ERE Assessment of the Day-Ahead Market Readiness in Albania (draft)

Executive Summary

This document sets out the findings of the first readiness assessment of the Albanian Power Exchange Day Ahead Market.

The transitory provisions of Albanian Law no 24/2023 on the Promotion of the Use of Energy from Renewable Sources (RES Law) foresee regular assessments of the Day-Ahead Market (DAM) by Enti Rregullator i Energjisë (ERE).[1] The ERE approved the methodology for the market readiness assessment of the Albanian Power Exchange (ALPEX) DAM in November 2025.[2]

In the methodology, the ERE defines the principles and indicators we will use to assess the readiness of the ALPEX DAM. The DAM is "ready" when it is liquid and competitive enough to deliver a sufficiently frequent and sound reference price for Contracts-for-Differences (CfDs) in Albania. This document sets out the ERE's findings in the first market readiness assessment.

The ERE calculates the indicators in ALPEX and compares them to values in DAMs in selected EU comparators at the time of introducing CfD schemes.

In the methodology, the ERE commits to analysis of four market readiness indicators:

- **Availability of day-ahead price**: this indicator shows if the ALPEX DAM has produced a market price for every hour over at least a 10 month period.
- **Churn factor**: the churn factor is expressed as the ratio of volumes traded on the DAM and total volumes consumed, i.e. trading volume compared to the physical size of the market.
- **Bid-ask spread**: the bid-ask spread is defined as the difference between the minimum unsuccessful ask (selling) price and the maximum unsuccessful bid (buying) price. It provides a measure of liquidity in terms of the market participants' ability to trade marginal incremental volumes of energy without significantly moving the price.
- **Depth**: the market depth describes the volume of new zero-cost supply that buyers in the ALPEX DAM would be willing to buy at a positive price. In other words, it is the size of the positive price demand, less the non-negative part of the supply curve.

To complement the selected indicators, the ERE studies two other indicators:

- **Competitiveness**: a competitive environment can contribute to liquidity in the market as there are more available counterparties for trade. More competitive markets also decrease the degree of any participants' ability to set prices. The ERE measures the competitiveness of the market through the Herfindal-Hirschman index (HHI) and number of participants.
- **Market coupling**: the ERE considers the coupling of the Albanian and Kosovan sides of the ALPEX DAM. If the markets are coupled and the interconnector between Albania and Kosovo is not congested, the ERE uses data in the coupled market to conduct the assessment.

To contextualise the values of the indicators of the ALPEX DAM, the ERE compare them to values of the same indicators in comparator DAMs. The ERE selects the comparator DAMs based on a

1 RES Law, Article 30 Transitory provisions, para 4.

2 ERE (2025), Methodology on the assessment of the electricity day-ahead market readiness.

review of churn factors ACER publishes and analyses the liquidity of the DAMs at the time the comparator countries introduced CfDs themselves.

The ERE selects three comparator countries: Poland in 2016, Hungary in 2019, and Croatia in 2020. Therefore, the relevant comparator DAMs are the Polish Power Exchange (TGE), the Hungarian Power Exchange (HUPX), and the Croatian Power Exchange (CROPEX).

The ERE calculates the value of the liquidity indicators in the coupled ALPEX DAM over 12 months from 1 November 2024 to 31 October 2025. We also calculate the churn factor in all comparator markets, and the comparator bid-ask spread in HUPX, in the relevant calendar years.

In the analysed period, the churn factor in ALPEX is lower than in all comparator markets in the relevant years, and the bid-ask spreads in ALPEX are higher than those in HUPX in 2019. Furthermore, the market depth analysis of the coupled ALPEX DAM shows that in 25 percent of hours in the analysed period, the market would not have been able to absorb more than 146 MW of new zero price supply and maintain a positive market clearing price.

However, the ALPEX DAM shows positive development towards liquidity. It has produced a continuous price signal for more than 10 months, and the number of participants is in line with EU comparators. The HHI indicator also suggests that the coupled market is competitive on the sell-side and moderately concentrated on the buy-side. The market clearing point also exhausts the supply or demand in the market in only c. 2.5 per cent of hours. Put differently, a bid-ask spread exists in 97.5 per cent of hours. Table 1 and Table 2 summarise the indicators the ERE calculates.

Table 1: Summary of Indicators in ALPEX and Comparator DAMs

Indicator	ALPEX	HUPX (2019)	CROPEX (2020)	TGE (2016)
10 months of continuous prices	✓			
Churn Factor[3]	0.102	0.511	0.359	0.168
Share of hours in which bid-ask spread is defined	97.5%	100%		
HHI, Sell-side	853; Competitive			
HHI, Buy-side	1,220; Moderately Concentrated			
Number of participants	32 sellers, 33 buyers		21 sellers; 20 buyers	39 sellers, 39 buyers

Source: NERA Analysis of power exchange data.

[3] As ACER's churn factor estimates also include over-the-counter trades, NERA has calculated the churn factors for the comparators using the DAM data only.

Table 2: Bid-Ask Spread and Depth Distribution Summary Statistics

Indicator	5th pctl.	25th pctl.	Median	Mean	75th pctl.	95th pctl.
ALPEX, Bid-Ask Spread, per cent of mean market clearing price	0.6%	4.0%	9.7%	17.4%	19.2%	51.7%
HUPX Bid-Ask Spread, per cent of mean market clearing price	0.2%	0.4%	1.2%	3.7%	3.0%	11.3%
ALPEX Depth (MW)	93	146	192	211	258	386

Source: NERA Analysis of power exchange data.

On the basis of this analysis the ERE concludes that ALPEX DAM is not yet ready to be used as a reference price for the support contracts in Albania.

1. Introduction and Background

The transitory provisions of Albanian Law no 24/2023 on the Promotion of the Use of Energy from Renewable Sources (RES Law) foresee regular assessments of the Day-Ahead Market (DAM) functioning by Enti Rregullator i Energjisë (ERE).[4] A positive market readiness assessment by the ERE, which establishes sufficient functioning of the market and its ability to deliver a frequent and sound reference price, will trigger the conversion of existing renewables support agreements from Power Purchase Agreements (PPAs) to Contracts-for-Differences (CfDs).[5]

The ERE consulted on its methodology for the market assessment and approved it on 6 November 2025.[6] In the methodology, the ERE defines the principles and indicators we will use to assess the readiness of the Albanian Power Exchange (ALPEX) DAM.[7] In economic terms, the ALPEX DAM is "ready" when it can deliver a sufficiently frequent and sound reference price for the CfDs for supported RES generation in Albania. To this end, a market is ready when it is sufficiently liquid and competitive.

Although regulators and policymakers internationally aspire to liquid electricity markets, liquidity itself does not have a standard definition or measurement. In this market readiness assessment, the ERE will study indicators that describe market participants' ability to buy or sell electricity in the DAM without causing major price changes.

A competitive market is one in which buyers and sellers can exchange goods, and no single firm has a dominant position with which it can affect the market price. Like liquidity, there are many measures of competitiveness. For instance, Ireland's SEMC relates the idea of a competitive market to that of market power and the Croatian Power Exchange (CROPEX) relates it to concentration in the market.[8]

In the absence of a generally accepted definition for liquidity, the ERE will consider several market readiness indicators, which we have set out in the approved methodology.[9] The ERE chooses the indicators based on the RES Law, existing renewables support contracts, and international best practices. To determine the readiness of the market, the ERE calculates the values of the selected indicators and compares them to the levels in other European Union (EU) countries at the time they introduced CfDs.

The remainder of this document proceeds as follows:

- Section 2 sets out the indicators the ERE uses in the market readiness assessment;

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4 RES Law, Article 30 Transitory provisions, para 4.

5 Ministry of Infrastructure and Energy, "Bidding procedure documents for the selection of solar PV projects that will receive support measures, at locations identified by developers", p. 8.

6 ERE (2025), Methodology on the assessment of the electricity day-ahead market readiness.

7 This document references the ALPEX DAM. The assessment is based on the coupled Albania-Kosovo market during the periods in which the markets are coupled and have produced results. The market was first coupled in February 2024.

8 SEM Committee (8 May 2015), "Integrated Single Electricity Market (I-SEM) Market Power Mitigation Discussion Paper SEM-15-031", p.3-4. Croatian Power Exchange, 2023 Annual Report, p. 8.

9 ERE (2025), Methodology on the assessment of the electricity day-ahead market readiness, Article 5.

- Section 3 describes the comparators for the ALPEX DAM;
- Section 4 sets out the results of the analysis; and
- Section 5 concludes.

2. Market Readiness Indicators

In determining the methodology, the ERE consulted on the indicators we will use for the market readiness assessment. The indicators in the approved methodology reflect the requirements in the RES Law and supplement them with best practices that are set out in renewables support agreements or used in other EU countries that are appropriate for comparison with ALPEX.

2.1. Required Indicators

Article 5, para 1 of the approved methodology states that the ERE must take into account two factors in the market readiness assessment:

- The uninterrupted availability of a day-ahead market price; and
- Market liquidity as measured using the churn factor, or the amount of electricity traded in the market compared to the total consumption.[10]

In the methodology, the ERE committed to a review of the methodology used by the EU Agency for the Coordination of Energy Regulators (ACER). To allow comparison of the ALPEX DAM churn factor with the churn factors ACER publishes, the ERE uses the same approach as ACER.[11] That is, the ERE calculates the churn factor as:

$$Churn_Y = \frac{\sum_{h=1}^{n} Volume\ of\ DAM\ Trades\ in\ hour\ h}{\sum_{h=1}^{n} Consumption\ in\ hour\ h}$$

where n is the number of hours in year Y.

2.2. Supplementary Indicators

Article 5, para 3 of the approved methodology states the ERE may consider two further indicators. The applicability of these indicators depends on the availability of data in other EU markets for comparative analysis:

- Bid-ask spread, which describes the difference between the minimum unsuccessful ask (selling) price and the maximum unsuccessful bid (buying) price; and
- Market depth, which measures whether the market can accommodate new renewable supply in the merit order curve.

2.2.1. Bid-Ask Spread

The bid-ask spread provides a direct measure of liquidity in terms of the market participant's ability to trade marginal incremental volumes of energy without significantly moving the price. The value of a bid-ask spread does not describe the supply and demand curves in detail nor

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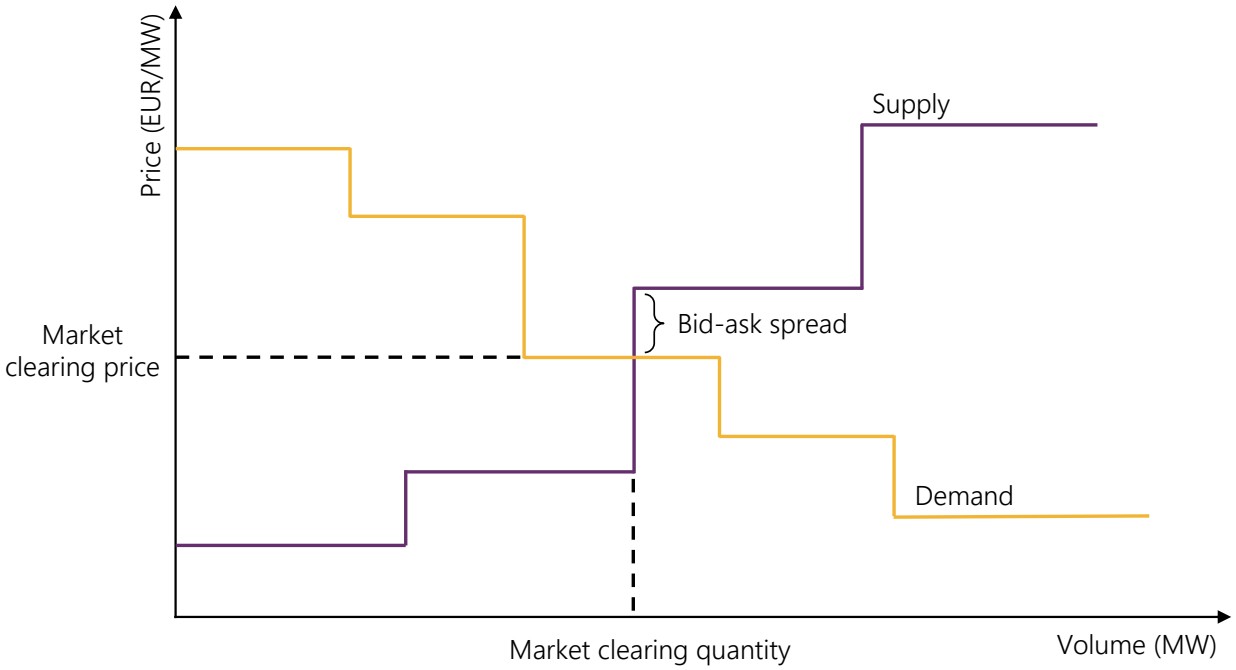
10 The RES Law also requires that the ERE studies if the market has implemented principles and rules for the integrity and transparency of the sale of electricity. RES Law, Article 30 Transitory provisions, para 4.

11 The ERE has clarified the formula ACER uses to calculate the churn factor in correspondence with ACER. As ACER uses both over-the-counter trades and DAM trades to calculate the churn factor, the ERE consultant also calculates the churn factors for comparators markets with DAM data only.

capture the effects of trading different volumes on the market. Figure 2.1 shows an illustration of the bid-ask spread.

Figure 2.1: Illustration of the Bid-Ask Spread



Note: The supply and demand curves are for illustration only.

Calculating the bid-ask spread requires detailed order book data for the DAM and coupled markets. The ERE received such data for the ALPEX DAM and Hungarian Power Exchange (HUPX) DAM. The data is not available for other comparators.[12]

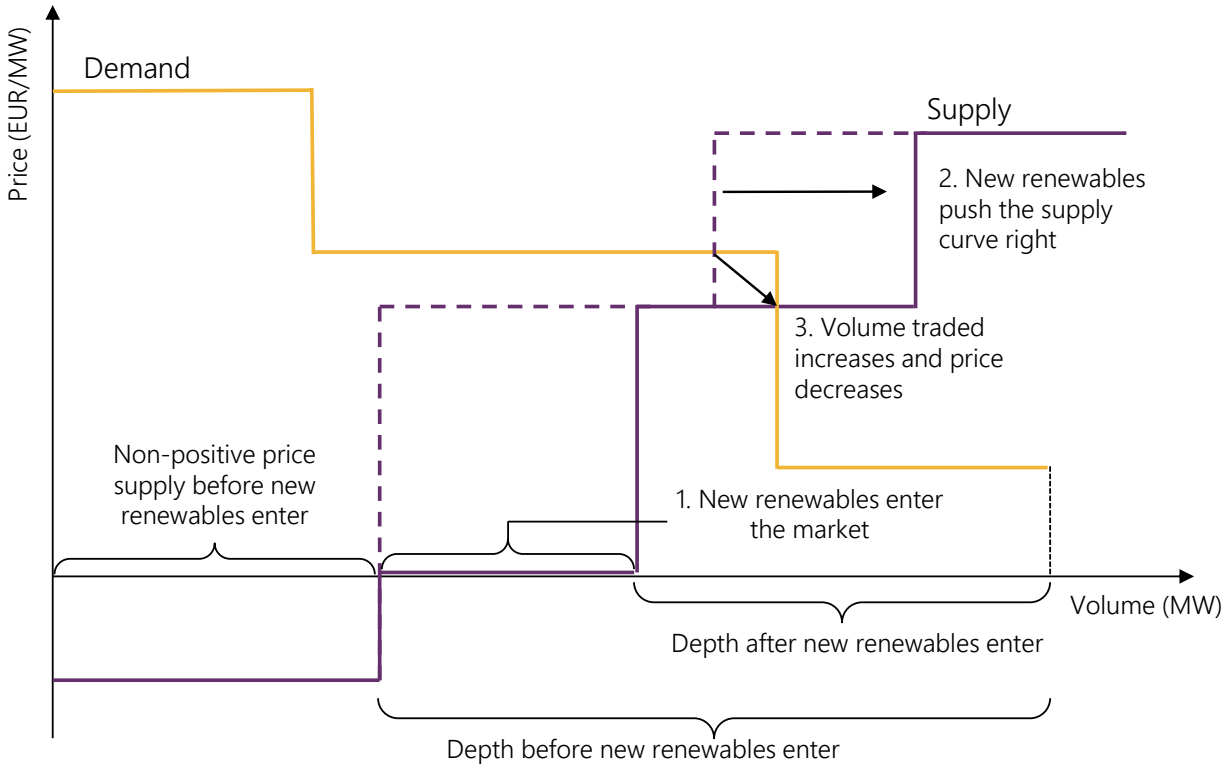
2.2.2. Depth

In the context of the market readiness analysis, the ERE uses market depth to assess if the renewable supply that would enter the ALPEX DAM following a positive market readiness assessment meets the demand curve in its *non-negative* portion.[13] This ensures that a) the CfD reference price is not negative, which would constitute an additional policy cost, and b) in economic terms, renewable supply intersects the demand curve in a portion where market participants have a non-negative willingness to pay for electricity. Figure 2.2 illustrates the effects of introducing new renewables on supply, market price, and traded volumes.

[12] See Section 3 for the selection of comparator markets and Appendix B.2 for details on data collection.

[13] The DAM market design allows negative prices. In the ALPEX context, the floor price is €-500/MWh.

Figure 2.2: Illustration of Price, Traded Volume, and Depth Changes When Renewables Enter the DAM



Note: The supply and demand curves are for illustration only. The Figure assumes that renewables entering the DAM have zero marginal cost, which is why they enter the supply curve after non-positive price supply.

Estimating the market depth requires detailed order book data. As market depth relates to the expected increases in capacity sold in the DAM, the ERE estimates the market depth for ALPEX DAM only.

2.3. Other Indicators Used by EU Comparators

In addition to the indicators listed in Article 5 of the final methodology, the ERE studies two competitiveness indicators of the ALPEX DAM. These include the number of market participants in the DAM and the Herfindal-Hirschman index (HHI).

The HHI measures market concentration and is commonly used in the assessment of mergers and it is used in the EU comparators to estimate the concentration of the electricity markets.[14] The ERE compares its estimates to commonly used thresholds for competitiveness.

The HHI is the sum of the squared market shares of all market participants. That is, the ERE uses the following formula to calculate the HHI, for the supply and demand side separately:

$$HHI = \sum_n (MS_n)^2$$

where n is the individual firm and MS represents its market share.

[14] For instance, see ACER/CEER (2025), 2025 Poland National Market Monitoring Report, p.51.

3. Choice of Comparator Markets and Time Periods

As the ERE sets out in the methodology, we compare the values of the selected indicators to values observed in EU comparators.[15] As the ERE undertakes the market readiness assessment to allow the conversion of PPAs to CfDs, we select comparators from countries that have already introduced CfDs themselves.

3.1. Most Relevant Comparators for Albania

To date, two-sided CfDs have been used in twelve EU member states.[16] These member states are France, Spain, Denmark, Greece, Hungary, Ireland, Italy, Poland, Croatia, Portugal, Lithuania, and Romania.[17]

The EU comparators that have introduced CfD schemes have determined that their DAMs are sufficiently liquid to support the CfD scheme. Therefore, evidence that the ALPEX DAM is as liquid and competitive as the DAMs that are relevant to the comparator countries would support a positive market readiness assessment.

The ERE assesses the liquidity of the ALPEX DAM against liquidity indicators of the relevant DAMs at the time each member state introduced the CfD. The current liquidity of the comparator DAMs may be higher than the liquidity at the time of introduction of the CfD scheme as the introduction of the CfDs may have increased the liquidity of the DAMs. Some comparators have also operated CfDs for more than five years and the DAMs may have become more liquid over time.

Further, the ERE focuses on EU comparators with the *lowest* value of liquidity indicators, which nonetheless operate CfD schemes for renewables. Comparison with these markets gives the ERE an indication of the *minimum* level of liquidity in European DAMs needed to introduce CfDs.

To shortlist the comparators, we reviewed the churn factors calculated by the ACER at the time of or in the year preceding the introduction of the CfD support in the relevant DAM. Table 3.1 below lists the timing of the first auction and the churn factor calculated by ACER.

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15 ERE (2025), Methodology on the assessment of the electricity day-ahead market readiness, Article 7.

16 A plant that is supported by a two-sided CfD either receives or pays back the difference between the reference market price and a strike price.

17 Florence School of Regulation (2024), "Contracts-for-Difference to support renewable energy technologies: Considerations for design and implementation"; AURES II (2022), "Auctions for the support of renewable energy in Croatia"; European Bank for Reconstruction and Development (EBRD) (2025), "With EBRD support, Romania delivers second successful renewable energy auction"; European Commission (2023), State aid: Commission approves €193 million Lithuanian scheme to support offshore wind farms to foster the transition to a net-zero economy.

Table 3.1: First CfD Auction and Churn Factors in EU Comparators

Country	First CfD auction	Churn factor prior to first auction
France	2016	0.225 (2015)
Spain	2021	0.810 (Iberia, 2020)
Denmark[18]	2005	NA
Greece	2016	1.028 (2015)
Hungary	November 2019	0.533 (2019)
Ireland	2020	1.068 (2019)
Italy	2019	0.702 (2018)
Poland	December 2016	0.169 (2016)
Croatia	December 2020	0.385 (2020)
Portugal	2019	0.795 (Iberia, 2018)
Romania	2024	0.32 (2023)
Lithuania	2023	0.95 (2022)

Source: ACER, Florence School of Regulation, AURES II.[19]
Notes: ACER has published churn factors up to 2022. Spain and Portugal operate a joint regional Iberian electricity market.

The churn factors suggest that the ERE should consider Croatia, Hungary, Romania, and Poland as comparators for the ALPEX DAM. Despite its low churn factor, France is not a suitable comparator as ACER states the French churn factor is lower due to a significant share of electricity sourced through bilateral contracts or through specific national arrangements.[20] Besides, France had coupled its DAM with Belgium and the Netherlands for nearly ten years by the time of its first CfD auction.[21] The churn factor in France alone is therefore not a good measure of the market liquidity in the long-standing coupled market. The actual level of market activity in France is higher than the value reflected in ACER's churn factor calculation.

Other member states with higher churn factors are not as relevant as comparators. The liquidity of their DAMs, measured using the churn factor, is greater than the minimum liquidity required to introduce CfDs. Further, some jurisdictions including Greece and Ireland present very high churn factors for a DAM context (i.e. above 1), because participation in the DAM is mandatory or highly favourable for producers. In Greece, producers are obligated to participate in the DAM by submitting sell orders for the available capacity of their generating units.[22] Although participation in the DAM is not mandatory for producers in Ireland, it is recognised as the only way of achieving

18 Denmark has allocated CfD support only for offshore wind. Denmark arranged a technology neutral auction in 2021, but received no bids. (Danish Energy Agency (2021) "Technology neutral tender 2021 completed").

19 ACER Market Monitoring Report 2020, 2021, and 2023; ACER data dashboard, available at https://www.acer.europa.eu/monitoring/MMR/electricity_gas_key_developments_2025. Accessed 2.12.2025. Florence School of Regulation (2024), "Contracts-for-Difference to support renewable energy technologies: Considerations for design and implementation"; AURES II (2022), "Auctions for the support of renewable energy in Croatia"; AURES II (2020), "Auctions for the support of renewable energy in Hungary".

20 ACER (2023) "Progress of EU electricity wholesale market integration" para 55.

21 EPEX Spot website, link: https://www.epexspot.com/en/marketcoupling. Accessed 2.12.2025.

22 Hellenic Energy Exchange (14 October 2021), Day-Ahead & Intra-Day Markets Trading Rulebook, Section 4.1.4 para 1.

a day-ahead position in the wholesale electricity market that will minimise the producer's exposure in the balancing market.[23] Due to their market arrangements, these DAMs do not constitute relevant comparators for Albania.

The ERE also considers the coupling of the comparator markets. If a smaller DAM with lower churn is coupled with a larger DAM, the low churn may not be indicative of lower liquidity within the comparator DAM (as the larger DAM can contribute to liquidity within the coupled pool).

All potential comparator markets are currently coupled with their neighbours. Hungary coupled its DAM with Czechia and Slovakia in 2012, and Romania joined the coupled market in 2014.[24] The coupled market, 4M MC, joined the European Single Day-Ahead Coupling (SDAC) along with the Polish DAM in June 2021.[25] The Croatian DAM also coupled with the SDAC in 2018 through the Croatian-Slovenian border, and in June 2022 via the Croatian-Hungarian border as well.[26] In addition to the SDAC, the Polish DAM coupled with the Nordics through Sweden in 2010.[27]

For the market readiness assessment, the ERE focuses on **Croatia, Hungary and Poland** as potential comparators. While Romania has a relatively low churn factor, Romania has been coupled with other jurisdictions since 2014, which may provide liquidity above the level shown in Table 3.1. Therefore, the relevant DAMs used as comparators in this study are CROPEX in 2020 for Croatia, HUPX in 2019 for Hungary, and the Polish Power Exchange (TGE) in 2016 for Poland.[28]

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23 The Single Electricity Market Committee Website, How the SEM works, Day ahead market, link: https://www.semcommittee.com/how-sem-works. Accessed 27.8.2024.

24 Hungarian Power Exchange website, link: https://hupx.hu/en/about-us/10-year-anniversary, Accessed 15.8.2024.

25 Polskie Sieci Elektroenergetyczne website, link: https://raport2021.pse.pl/en/economic-and-market-impact/integration-of-the-polish-market-with-european-markets, Accessed 16.8.2024.

26 Croatian Power Exchange (2024), Annual Report 2023, p. 10.

27 Nord Pool (2010), No. 74/2010 NPS - Successful launch of the price coupling between the Nordic region and Poland.

28 The Polish Power Exchange is called Towarowa Giełda Energii in Polish.

4. Calculation of Indicators

4.1. Summary of indicators

To conduct the market readiness assessment of the ALPEX DAM, the ERE calculates the indicators set out in Section 2. For ALPEX, we use data for 12 months from 1 November 2024 to 31 October 2025 to estimate the values of the indicators.[29] For the comparator markets, we study one calendar year of data in the year in which the countries introduced CfDs. That is, we study HUPX data from 1 January to 31 December in 2019, CROPEX data from 1 January to 31 December 2020, and TGE data from 1 January to 31 December 2016.

Table 4.1 and Table 4.2 summarise the values of the indicators. As can be seen from the first Table, the ALPEX DAM has a lower churn factor than the selected comparators. However, the number of participants in the coupled ALPEX market is in line with the comparators, and the sell-side of the day-ahead market is competitive. The second Table shows that ALPEX DAM has higher bid-ask spreads than the HUPX DAM in 2019. We show the result in percentiles (pctl.). For example, 25 per cent of the bid-ask spreads in the ALPEX DAM are less than 4.0 per cent of the average market clearing price.

Table 4.1: Summary of Indicators in ALPEX and Comparator DAMs

Indicator	ALPEX	HUPX (2019)	CROPEX (2020)	TGE (2016)
10 months of continuous prices	✓			
Churn Factor[30]	0.102	0.511	0.359	0.168
Share of hours in which bid-ask spread is defined	97.5%	100%		
HHI, Sell-side	853; Competitive			
HHI, Buy-side	1,220; Moderately Concentrated			
Number of participants	32 sellers, 33 buyers		21 sellers; 20 buyers	39 sellers, 39 buyers

Source: NERA Analysis of power exchange data.

[29] For the availability of prices, it is sufficient that prices are available in each trading period over 10 months.

[30] As ACER's churn factor estimates also include over-the-counter trades, NERA has calculated the churn factors for the comparators using the DAM data only.

Table 4.2: Bid-Ask Spread and Depth Distribution Summary Statistics

Indicator	5th pctl.	25th pctl.	Median	Mean	75th pctl.	95th pctl.
ALPEX, Bid-Ask Spread, per cent of mean market clearing price	0.6%	4.0%	9.7%	17.4%	19.2%	51.7%
HUPX Bid-Ask Spread, per cent of mean market clearing price	0.2%	0.4%	1.2%	3.7%	3.0%	11.3%
ALPEX Depth (MW)	93	146	192	211	258	386

Source: NERA Analysis of power exchange data.

4.2. Availability of Prices

Converting the existing renewable generator support agreements from PPAs to CfDs requires that the reference price is available in each trading period. The ERE's final methodology sets out that the reference prices must have been available for at least 10 months.

Over the period from 1 November 2024 to 31 October 2025, the ERE finds that ALPEX has provided a market clearing price for Albania and Kosovo in all hours over the 12 month period. Therefore, the ALPEX DAM has provided a continuous CfD reference price over a 10 month period and meets this particular criterion set out in the ERE's final methodology.

4.3. Market Coupling

ALPEX coupled the Albanian DAM and the Kosovan DAM in February 2024. In a coupled market, market participants bid for electricity in the market without individually receiving cross-border capacity allocations. ALPEX takes into account the available cross-border capacity in the price calculation process to minimise the price differences across the Albanian and Kosovan markets.

If the interconnector between Albania and Kosovo is not flowing at full capacity, the prices in the coupled market converge. In these hours, the buy- and sell-orders on both sides of the market contribute to price formation in a single market and the bid-ask spread and depth in the coupled market is consistent with the bid-ask spreads in individual markets. However, if the interconnection constraints are binding, the prices in the markets will not converge and combining the supply and demand curves of the two markets no longer accurately describes the markets on both sides of the interconnector.

The market prices in Albania and Kosovo differ in 57 of the 8760 hours in the analysis period. Put differently, the market prices in Albania and Kosovo are the same in more than 99 per cent of the hours in the analysis period. Therefore, for the market readiness assessment, the ERE will consider the DAMs in Albania and Kosovo coupled and will calculate the values of liquidity and competitiveness indicators accordingly.[31]

[31] We take the trades and demand in the coupled market into account to calculate the churn and competitiveness indicators in all hours of the year. For the analysis of depth and bid-ask spread, the ERE excludes the hours in which the interconnector is congested. As there are only 57 hours with congestion on the interconnector, including these hours would not alter the conclusions of the assessment. See Appendix B.2 for more information about the hours that we exclude from the analysis.

4.4. Churn Factor

As set out in the approved methodology, the ERE calculates the churn factor in the ALPEX DAM and compares it to churn factors in comparator markets. The churn factor is defined as the amount of electricity traded in the DAM, divided by the total consumption in the area.

We calculate the churn factor of the coupled ALPEX DAM. That is, we study the sum of traded volumes in the coupled market in all hours of the analysis period and divide it by the sum of system demands in Albania and Kosovo in the analysis period.

For the comparators, ACER's churn factor estimates take into account over-the-counter trades. To accurately compare the churn factors, the ERE also calculates the churn factors of the comparator DAMs using the market clearing volumes in the DAM alone.[32]

Table 4.3 shows the churn factors in ALPEX and comparator DAMs. As can be seen in the Table, the ERE finds that the ALPEX churn factor is lower than churn factors in the comparator markets.

Table 4.3: Churn Factors in ALPEX and Comparators

	ALPEX	HUPX (2019)	CROPEX (2020)	TGE (2016)
Churn Factor	0.102	0.511	0.359	0.168

Source: NERA Analysis of power exchange data.

4.5. Bid-Ask Spread

The ERE estimates the bid-ask spread in the ALPEX DAM to supplement our analysis of the churn factor. Estimating the bid-ask spread requires detailed order book data in the ALPEX DAM. As the market clearing point and volumes are determined by the supply and demand curves in Albania and Kosovo, and the trades on the interconnector, the ERE analyses the coupled ALPEX DAM.[33]

The bid-ask spread can be defined if and only if an unfulfilled order exists on both the buy- and sell-side of the DAM. That is, a bid-ask spread exists if the market clearing quantity does not exhaust the supply or demand in the coupled market. The ERE finds that the bid-ask spread can be defined and calculated in 97.5 per cent of hours in the sample.[34] That is, the bid-ask spread is not defined in 2.5 per cent of hours, e.g in the hours where all demand orders are fulfilled or all supply order are fulfilled. The ERE excludes these hours from the summary statistics.

Figure 4.1 shows the distribution of the bid-ask spread. As the Figure shows, the bid-ask spread reaches up to EUR 720/MWh in individual hours. However, most bid-ask spreads are lower, with 75 per cent of bid-ask spreads below EUR 24.25/MWh. The highest bid-ask spreads occur early in the analysis period, in November 2024.

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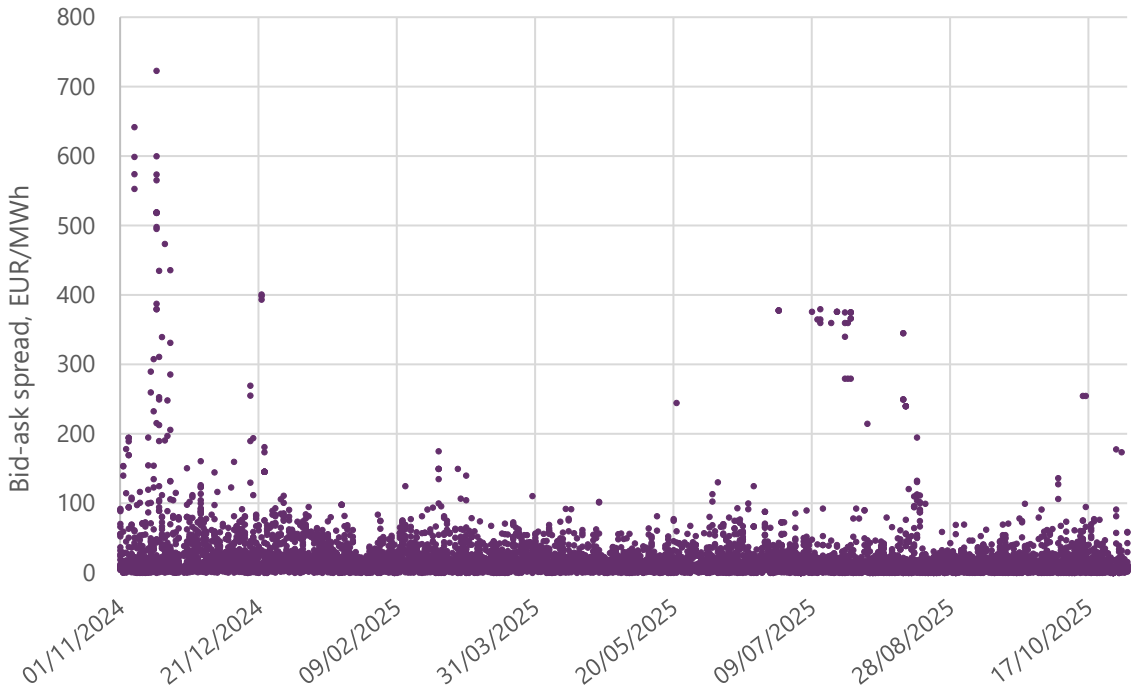
32 The churn factors without the over-the-counter trades are similar to churn factors ACER publishes.

33 The ERE excludes the 57 hours where the interconnector is congested from the analysis.

34 The ERE removes hours from the sample in which the market results and supply and demand curves ALPEX publishes are not consistent or the market cannot be considered coupled. See Appendix B.2.

Figure 4.1: ALPEX DAM Bid-Ask Spread



Source: NERA Analysis of ALPEX data.

Table 4.4 shows the summary statistics of the bid-ask spread in both EUR/MWh terms and as a percentage of the average price in ALPEX over the analysis period. The Table shows that half of the bid-ask spreads are below 9.7 per cent of the average DAM price. However, in 25 per cent of hours, the bid-ask spread is more than 19.2 per cent of the average DAM price. Due to these high bid-ask spreads, the mean bid-ask spread is greater than the median bid-ask spread.

Table 4.4: ALPEX Bid-Ask Spread Summary Statistics

	Formula	5th pctl.	25th pctl.	Median	Mean	75th pctl.	95th pctl.
Bid-ask spread, €/MWh	A	0.82	5.00	12.27	22.02	24.25	65.43
Market price, €/MWh	B				126.54		
Bid-ask spread, per cent of mean price	A/Mean (B)	0.6%	4.0%	9.7%	17.4%	19.2%	51.7%

Source: NERA Analysis of ALPEX data.

In addition to ALPEX, HUPX provided the ERE supply and demand curves that are sufficient to determine the market clearing point and bid-ask spread in 2019.[35] Like ALPEX, HUPX has individual hours with high bid-ask spreads. As a result, the mean bid-ask spread is greater than the median bid-ask spread. However, the bid-ask spread in HUPX in 2019 is consistently lower

[35] In 2019, there are three days between 28 November and 1 December where the market clearing volumes are not consistent with supply and demand curves. We exclude these hours from the sample.

than in ALPEX over the analysis period as a percentage of the average DAM price. Table 4.5 shows summary statistics of the ALPEX and HUPX DAM bid-ask spreads.

Table 4.5: ALPEX and HUPX Bid-Ask Spread as Percentage of Average DAM Price

	5th pctl.	25th pctl.	Median	Mean	75th pctl.	95th pctl.
Bid-ask spread, ALPEX	0.6%	4.0%	9.7%	17.4%	19.2%	51.7%
Bid-ask spread, HUPX	0.2%	0.4%	1.2%	3.7%	3.0%	11.3%

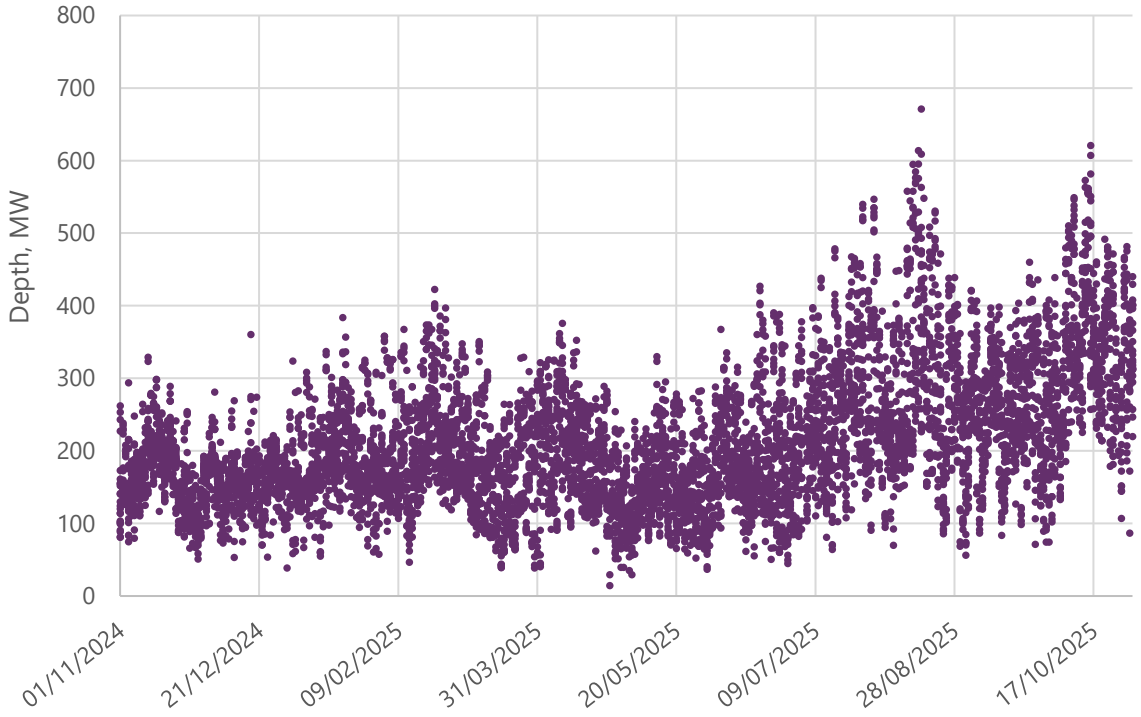
Source: NERA Analysis of ALPEX and HUPX data.

4.6. Depth

The ERE studies the depth of ALPEX, measured as the maximum (positive price) demand, less the non-positive price supply in the market, to assess how much renewable supply could enter the ALPEX DAM and meet the demand curve in its *non-negative* portion. This depth measures how much new zero marginal cost supply the market participants are willing to pay for.

Figure 4.2 shows the market depth in ALPEX throughout the analysis period.[36] As the Figure shows, the market depth is positive in all hours and appears to increase over the analysis period. The minimum depth in the market was 14.5 MW, which it reached in late April 2025.

Figure 4.2: ALPEX Market Depth



Source: NERA Analysis of ALPEX data.

Table 4.6 shows the summary statistics of the depth over the analysis period. As can be seen in the Table, in 25 per cent of the hours the market depth is less than 145.9 MW, which means that the

[36] The ERE and its consultant exclude the same set of hours for the study of depth as bid-ask spread. See Appendix B.

ALPEX DAM would not have been able to absorb 145.9 MW of new capacity at a positive price 25 per cent of the time over the 12 months between November 2024 and October 2025.

Table 4.6: ALPEX Depth Summary Statistics

	5th pctl.	25th pctl.	Median	Mean	75th pctl.	95th pctl.
Depth, MW	93.0	145.9	191.6	210.8	257.9	385.7

Source: NERA Analysis of ALPEX data.

4.7. Competitiveness

The ERE studies the competitiveness of the ALPEX DAM through the number of market participants and market concentration. To measure the market concentration, the ERE calculates the HHI on both sell- and buy-sides of the coupled market.

There are no universal HHI thresholds for competitive and concentrated markets. For example, the EU Guidelines on assessment of horizontal mergers state that markets with HHI below 1,000 are likely to be competitive.[37] The guidelines also assign stricter criteria for a change in HHI due to a merger if the market has a post-merger HHI of at least 2,000. The United States Department of Justice (DOJ) and Federal Trade Commission (FTC) guidelines consider markets with HHI below 1,000 competitive and with HHI above 1,800 highly concentrated.[38]

The ERE uses the HHI thresholds set out in the EU Guidelines. For the DAM readiness assessment, the coupled ALPEX DAM is competitive if it has an HHI of 1,000 or below, moderately concentrated if it has an HHI between 1,000 and 2,000, and concentrated if its HHI is 2,000 or more.

Table 4.7 shows the market share of the largest participant, the HHI, and the classification of the coupled ALPEX DAM. As the Table shows, the DAM is moderately concentrated on the buy-side, and competitive on the sell-side.[39] The market participant with the greatest market share on the buy-side has a 22 per cent market share, whereas the largest market participant on the sell-side has a 20 per cent market share. Additionally, there are more buy-side participants with market shares of at least 10 per cent than sell-side participants.

37 Official Journal of the European Union (2004/C 31/03), Guidelines on the assessment of horizontal mergers under the Council Regulation on the control of concentrations between undertakings.

38 US Department of Justice and the Federal Trade Commission (2023), 2023 Merger Guidelines. Previous versions of the DOJ and FTC guidelines have considered markets with HHI below 1,500 unconcentrated, and markets with HHI between 1,500 and 2,500 moderately concentrated. US Department of Justice and the Federal Trade Commission (2010), Horizontal Merger Guidelines.

39 The same classification would also apply if the ERE used the current DOJ and FTC guidelines.

Table 4.7: ALPEX Market Concentration

	Buy-side	Sell-side
Market share of largest participant	22%	20%
HHI	1,220	853
Classification	Moderately Concentrated	Competitive

Source: NERA Analysis of ALPEX data.

The ERE also studies the number of market participants in ALPEX and comparator markets. Table 4.8 shows the number of market participants in each market, on sell-side and buy-side separately. As the Table shows, the ALPEX DAM has more participants than CROPEX in 2020 but fewer market participants than TGE in 2016.

Table 4.8: Number of Market Participants in ALPEX and Comparator DAMs

	ALPEX	HUPX (2019)	CROPEX (2020)	TGE (2016)
Sellers	32		21	39
Buyers	33		20	39

Source: NERA Analysis, Power exchanges.

5. Conclusion

The ERE has conducted the first readiness assessment for the ALPEX DAM and has calculated the values of the liquidity indicators it outlines in its 2025 Methodology on the assessment of the electricity day-ahead market readiness. In the assessment, the ERE studies the coupled Albanian and Kosovan DAMs.

At this point in time, the ERE finds that the ALPEX DAM is not as liquid as the comparator markets were at the time of introducing the CfD contracts. The ALPEX churn factor in the coupled market is lower than in the comparator markets in the relevant years, the bid-ask spreads in the coupled market are higher than in HUPX in 2019, and the market cannot absorb 146 MW of new supply at a positive price in 25 per cent of hours. Therefore, the market readiness assessment does not provide evidence that the ALPEX DAM is ready to support the conversion of PPAs of supported renewables to CfDs.

However, there is positive development towards liquidity. The ALPEX DAM has produced a continuous price signal for more than 10 months, and the number of participants is in line with EU comparators. Furthermore, the HHI indicator suggests that the sell-side of the coupled market is competitive, and the buy-side is moderately concentrated. The market clearing point also exhausts supply or demand in only c. 2.5 per cent of hours.

As the ERE envisages in its approved DAM readiness assessment methodology, the ERE will repeat the market readiness assessment next year to review if the ALPEX DAM will be ready to support the conversion of PPAs to CfDs.

Appendix A. Data Sources and Data Retrieval Process

As we set out in the main body of this document, the ERE requires detailed data market clearing prices and volumes, supply and demand curves, and completed trades to conduct the market readiness assessment. This Appendix describes the data sources we have used, and the data retrieval process.

A.1. ALPEX

To conduct its analysis, the ERE required the following hourly data in the coupled Albania-Kosovo DAM that covers the duration of the analysis period:

- Market clearing prices and volumes in Albania and Kosovo;
- Supply and demand curves in Albania and Kosovo;
- Completed trades by market participant in Albania and Kosovo.

To obtain the DAM data, the ERE engaged ALPEX to obtain the information on completed trades. ALPEX provided data on completed trades to the ERE and its consultant throughout the analysis period. In addition, the ERE used data that ALPEX makes publicly available on supply and demand curves, and market clearing prices and volumes. As discussed in the main body of this document, the ERE's assessment takes into account both the Albanian and Kosovan DAM in the periods where the two markets are coupled, i.e. there is no inter-zonal congestion, and the coupled market operates as one.

A.2. Data from Other Power Exchanges

The ERE also engaged with the power exchanges it selected as comparators. It procured data on market clearing prices and volumes in each market, and supply and demand curves if these were sufficient to determine price formation.

A.3. ACER

To appropriately compare the churn factors the ERE estimates with those that ACER estimates and publishes annually, the ERE engaged with ACER to understand the methodology ACER uses. ACER confirmed its approach to calculating the churn factor in email correspondence with the ERE.

ACER also confirmed it takes into account over-the-counter trades in estimating the churn factors for comparators. To allow a more direct comparison of ALPEX with the comparator EU countries, the ERE therefore calculated the churn factors for each comparator using the published data on the market clearing volumes.

A.4. ENTSO-E

To calculate the churn factors, the ERE required load data in Albania, Kosovo, and each comparator market in the appropriate years. The ERE has used load data published by ENTSO-E on its

transparency platform to calculate the monthly and annual churn factors we show in this document.

Appendix B. Details on Calculation of Indicators

B.1. Churn Factor

B.1.1. ALPEX

Due to the low number of hours with diverging electricity prices, the ERE treats the market as coupled when we calculate the churn factor. That is, in the 12 months from 1 November 2024 to 31 October 2025, the ERE considers the sum of volumes traded on both the Albanian and Kosovan sides of the market and divides the volume with the demand in both regions to calculate the churn factor.[40]

In Section 4.4, we report the churn factors over the 12 month analysis period. The ERE also calculates the churn factor in each month of the year to study possible seasonality and changes in the churn factor. That is, we adapt the formula to calculate churn factor such that:

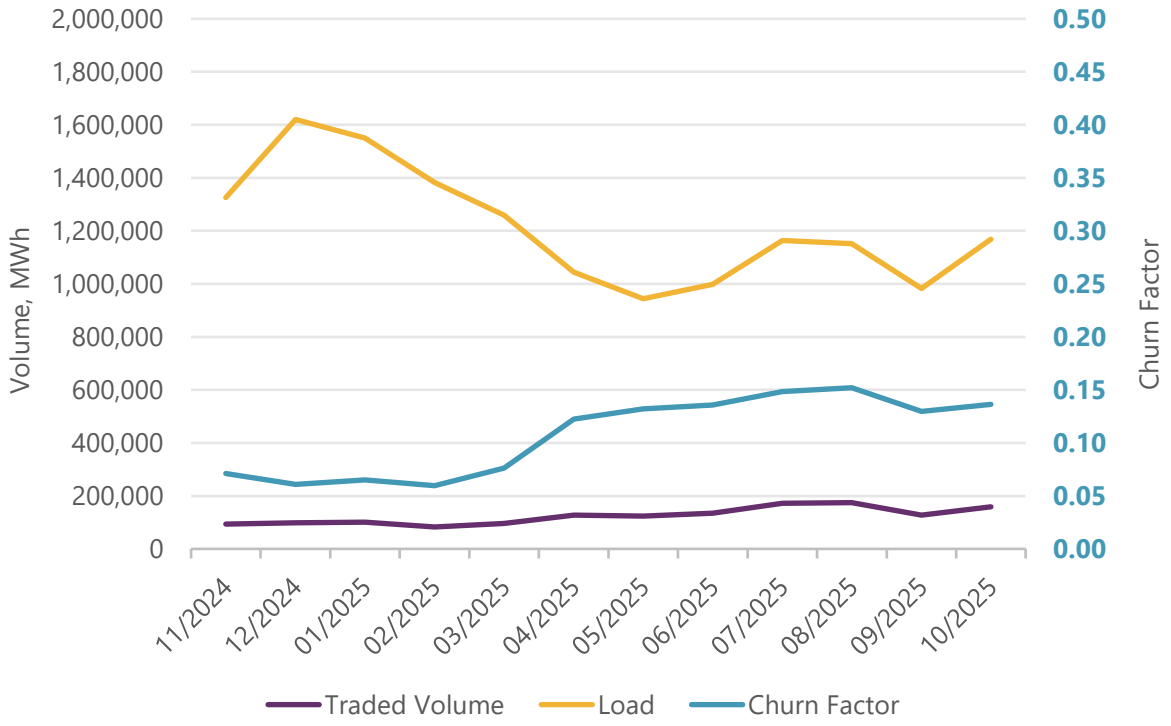
$$Churn_M = \frac{\sum_{h=1}^{k} Volume\ of\ DAM\ Trades\ in\ hour\ h}{\sum_{h=1}^{k} Consumption\ in\ hour\ h}$$

where k is the number of hours in month M.

Figure B.1 below shows the monthly market clearing volumes, monthly system demand, and the monthly churn factor. As the Figure shows, the traded volumes and churn factor have increased over the measurement period. The churn factor also appears to exhibit some seasonality, which is largely caused by changes in system load. Over the analysis period, the churn factor has ranged from 0.060 to 0.152, and the churn factor is 0.102 over the full analysis period.

[40] The ERE subtracts the trades on the interconnector from the market clearing volumes. ALPEX reports the interconnector trades on both sides of the coupled market.

Figure B.1: Monthly ALPEX Traded Volume, Load, and Churn Factor



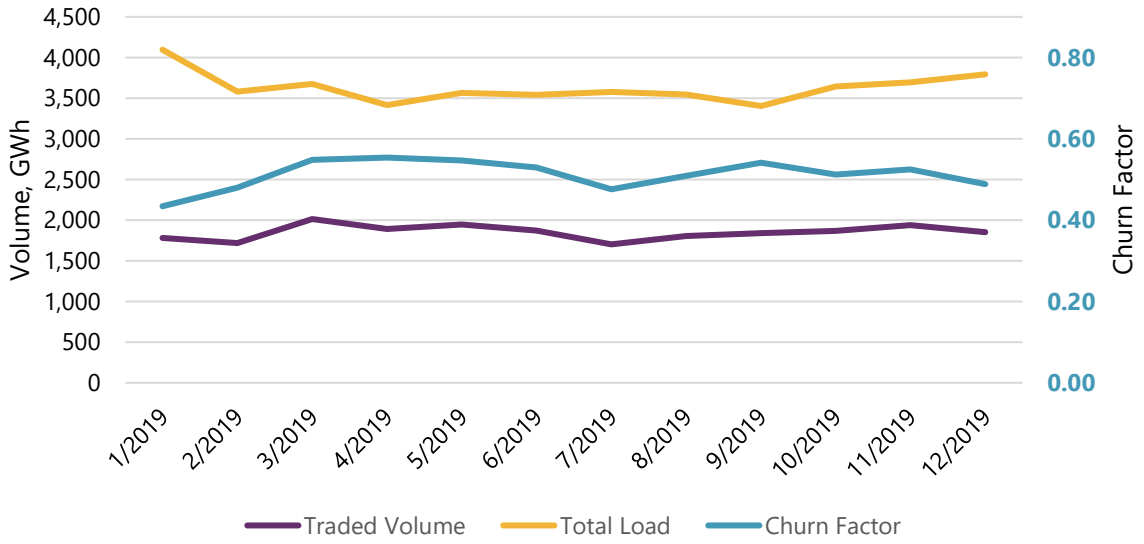
Source: NERA Analysis of ALPEX data.

B.1.2. HUPX

The ERE also studies the monthly churn factor in comparator markets. Like the churn factor of ALPEX, the churn factors in comparator markets vary month to month. The changes are due to both seasonality of the traded volumes and the total system load.

Figure B.2 shows the monthly churn factors in HUPX in 2019. As can be seen in the Figure, the monthly churn factor ranges from 0.43 in January 2019 to 0.55 in March, April, and May. The churn factor in the full year of 2019 is 0.511.

Figure B.2: Monthly HUPX Churn Factor, 2019

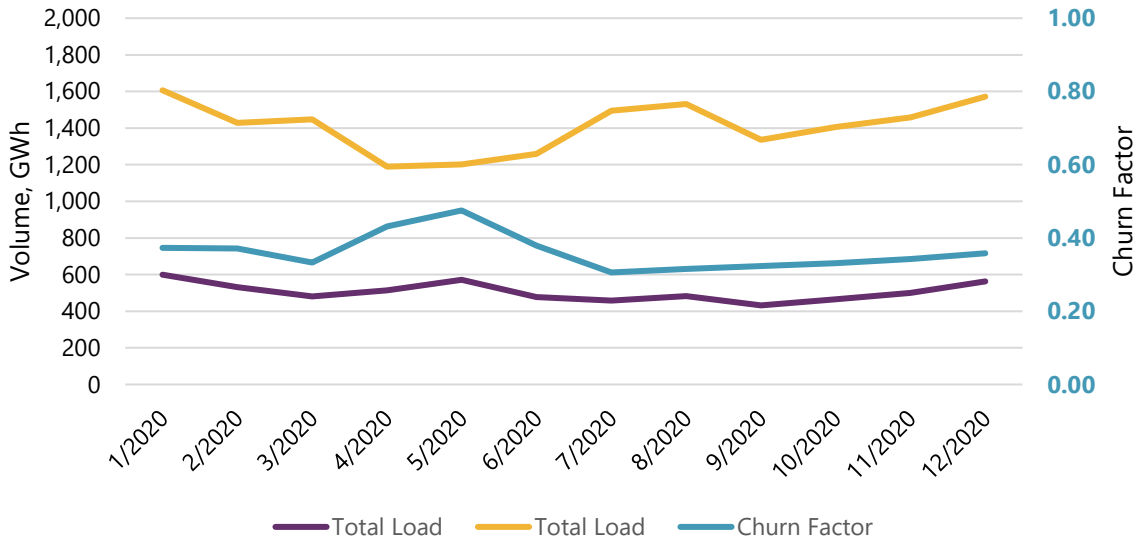


Source: NERA Analysis of HUPX data.

B.1.3. CROPEX

Figure B.3 shows the monthly churn factors in CROPEX in 2020. As the Figure shows, the monthly churn factor is at its lowest level, 0.31, in July and at its highest level, 0.48 in May. The churn factor in all of 2020 is 0.359. The traded volumes in CROPEX seem to exhibit some seasonality, with higher traded volumes and total demand in the winter months.

Figure B.3: Monthly CROPEX Churn Factor, 2020

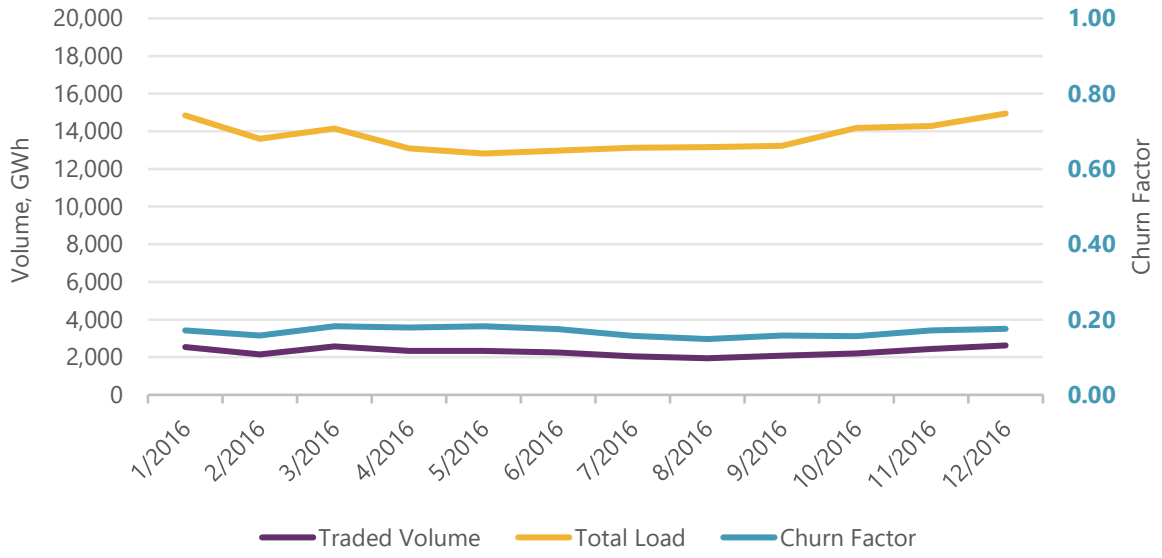


Source: NERA Analysis of CROPEX data.

B.1.4. TGE

Figure B.4 below shows the monthly churn factors in TGE in 2016. The churn factor in TGE varies somewhat less than in the other markets we study, from 0.16 to 0.18. This is because the traded volumes in TGE and total load in Poland follow a similar pattern. An increase in total load corresponds to an increase in traded volume and vice versa.

Figure B.4: Monthly TGE Churn Factor, 2016



Source: NERA Analysis of TGE data.

B.2. Bid-Ask Spread

B.2.1. ALPEX

The ERE has analysed the bid-ask spread in the coupled ALPEX DAM. As part of the analysis, we construct the full supply and demand curves in the coupled market using data on the buy and sell orders in Albania and Kosovo.

As Section 4.3 states, we exclude from the analysis the 57 hours where the prices in Albania and Kosovo do not converge.

Additionally, there are 47 hours where the supply and demand curves in the coupled market are not consistent with market clearing results or the data is missing. We remove these hours from the sample, too. These hours are:

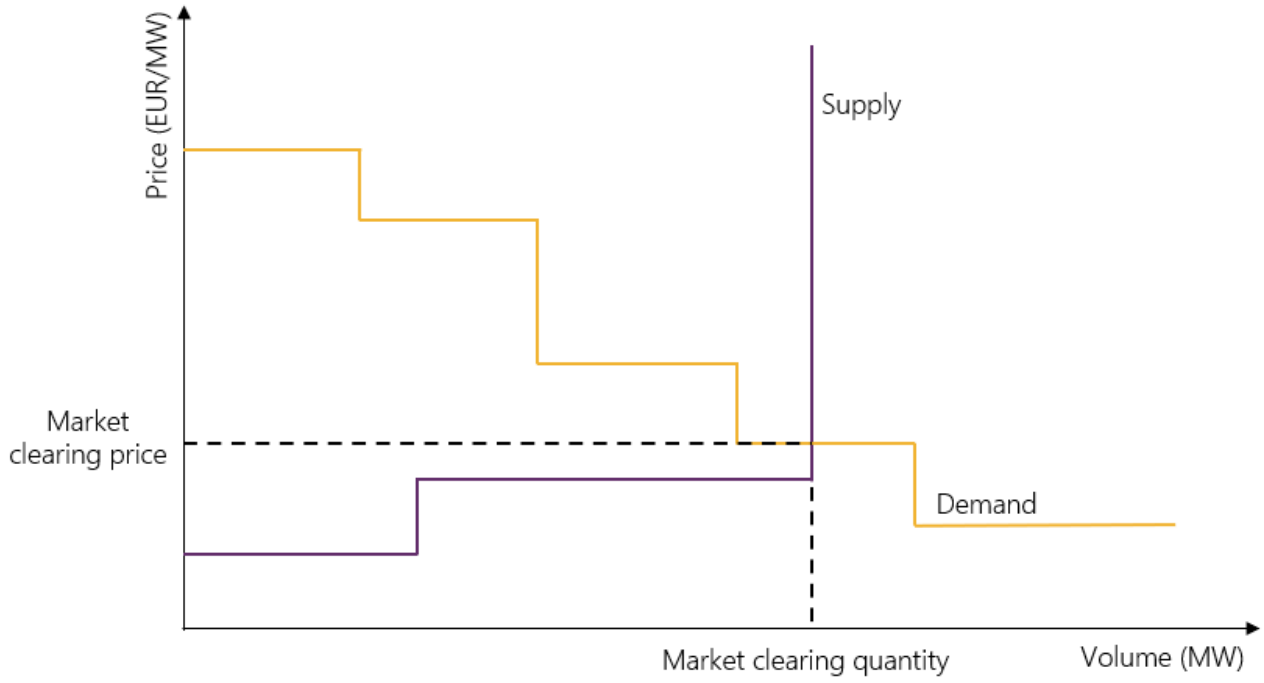
- On 30 March 2025, there is one hour with no data due to the change in daylight savings time. As there is no data and this hour does not exist in practice, we remove it from the sample.
- On 5 July 2025, the published ALPEX market results in Albania and Kosovo have identical market clearing quantities. This appears to be a data error, and the quantities are inconsistent with the coupled market supply and demand curves. We remove these hours from the sample.

- On 26 October, the market clearing results ALPEX makes publicly available and the quantities in the trade data are not consistent after the clock change at 2 AM. As this appears to be a data error, we remove these hours from the sample.

The ERE's analysis of the bid-ask spread includes the remaining hours. However, the bid-ask spread cannot be defined in 2.5 per cent of these hours. As Section 4.5 sets out, the bid-ask spread is defined if and only if a next unfulfilled order exists on both sides of the market.

Figure B.5 below illustrates a case where the bid-ask spread is not well defined. The market clearing quantity is equal to the maximum quantity supplied in the market. Therefore, the next unsuccessful sell (ask) order does not exist, and the bid-ask spread is not well-defined in this illustrative hour. This is the case whether all demand clears or not. Conversely, if all demand in the market clears, there is no unsuccessful buy (bid) order, and the bid-ask spread is not well-defined even if there are unsuccessful sell orders in the market.[41]

Figure B.5: Bid-Ask Spread is Undefined As All Supply Clears



Source: NERA illustration.

B.2.2. HUPX

HUPX provided the ERE's consultant with supply and demand curves that are sufficient for determining the market clearing prices and quantities in the HUPX DAM. As these supply and demand curves are consistent with the HUPX DAM clearing prices and volumes, they allow the ERE to estimate the hourly bid-ask spreads in the HUPX DAM in 2019.

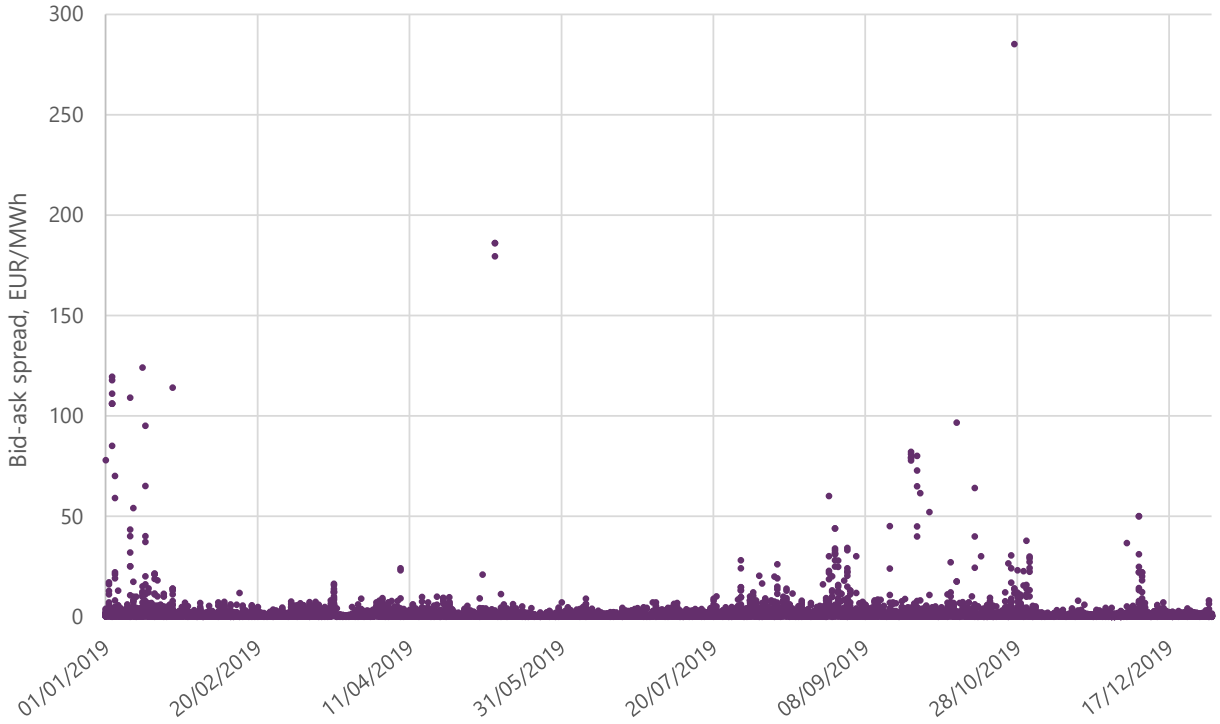
Like in ALPEX, the data includes hours where the supply and demand curves appear inconsistent with the market clearing prices and volumes. In 2019, there are 46 such hours.

[41] Over the analysis period, there are no hours in which both all demand and all supply in the coupled market clear.

Almost all, 45, hours with inconsistencies take place between 28 November and 1 December 2019. The final hour with data inconsistency occurs on 23 December. The ERE does not have the data to establish why the inconsistencies take place and it cannot determine which data should take precedent. Therefore, we remove these hours from the sample. The bid-ask spread is well-defined in all remaining hours in the sample.

Figure B.6 shows the hourly bid-ask spreads in 2019, and Table B.1 reports summary statistics of the distribution of the bid-ask spreads. As can be seen in the Figure and Table, three quarters of bid-ask spreads are EUR 1.50/MWh or below. This corresponds to less than 3.0 per cent of the annual average market price. However, there are individual bid-ask spreads that reach up to EUR 285/MWh.

Figure B.6: HUPX DAM Bid-Ask Spread in 2019



Source: NERA Analysis of HUPX data.

Table B.1: Summary Statistics of HUPX DAM Bid-Ask Spreads

	Formula	5th pctl.	25th pctl.	Median	Mean	75th pctl.	95th pctl.
Bid-ask spread (€/MWh)	A	0.10	0.20	0.60	1.86	1.50	5.70
Market price (€/MWh)	B				50.36		
Bid-ask spread (per cent)	A/mean(B)	0.20%	0.40%	1.19%	3.70%	2.98%	11.32%

Source: NERA Analysis of HUPX data.

B.2.3. CROPEX

CROPEX's representatives communicated to the ERE that CROPEX cannot provide supply and demand curves that are sufficient to determine the price formation in the CROPEX DAM. CROPEX does not have access to the buy and sell orders in the coupled power exchanges that contribute to the market clearing price and quantity in the CROPEX DAM. Therefore, the ERE cannot calculate the bid-ask spread for CROPEX.

B.2.4. TGE

TGE's representatives communicated to the ERE that TGE cannot provide supply and demand curves for each hour in 2016. Therefore, the ERE cannot calculate the bid-ask spread for TGE.

B.3. Depth

The ERE has analysed the market depth of the coupled ALPEX DAM. That is, the ERE constructs the full supply and demand curves in the coupled market using the buy and sell orders in Albania and Kosovo.

As we set out in Appendix B.2, the supply and demand curves in the coupled market are not consistent with the market clearing results when the prices in Albania and Kosovo do not converge. Furthermore, there are hours where the market clearing results appear inconsistent with the supply and demand curves, possibly due to data errors.

The ERE removes the same set of hours for the analysis of market depth as bid-ask spread. That is, we remove the 57 hours where the prices in Albania and Kosovo differ, and the 47 hours where the supply and demand curves in the coupled market are not consistent with market clearing results or the data is missing.

B.4. Competitiveness

The ERE studies the market concentration of the coupled market throughout the analysis period. That is, the ERE uses the trade data on both the Albanian and Kosovan sides of the market to estimate the number of participants, their market shares, and the HHI indicator.

As we report in Section 4.7, the ERE finds that the buy-side of the market is moderately concentrated, whereas the sell-side of the market is competitive. The difference in HHI is c. 360 despite the similar market shares of the largest market participants. The largest market share on the buy-side is 22 per cent and on the sell-side 20 per cent.

The difference in HHI is caused by more buyers with higher market shares. Table B.2 below shows the five highest market shares on both sides of the market. As the Table shows, the five highest market shares on the buy-side are higher than the market shares of the respective sellers.

Table B.2: 5 Market Shares of Participants

	Buy-Side	Sell-Side
Highest	22.1%	20.0%
2nd Highest	15.0%	10.2%
3rd Highest	11.9%	9.2%
4th Highest	10.3%	7.6%
5th Highest	9.8%	7.1%

Source: NERA Analysis of ALPEX Data.