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## Quarterly summary: Svenska kraftnät's auctioning of EPAD contracts to improve hedging opportunities

**Q3 2023**

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# Svenska kraftnät

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Svenska kraftnät is a state owned enterprise with the task of maintaining Sweden's electricity transmission grid, which consists of about 16,000 kilometres of 400 kV and 220 kV transmission lines with substations and interconnectors. Svenska kraftnät is also the system operator for electricity in Sweden.

Svenska kraftnät is developing the transmission grid and the electricity market to meet society's need for a secure, sustainable and cost-effective supply of electricity. In this, Svenska kraftnät plays an important role in implementing national climate policies.

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## Background

The FCA Guideline (EU) 2016/1719 establishing a guideline on forward capacity allocation, aims to improve and ensure sufficient hedging possibilities in the forward markets. The regulatory framework mainly concerns transmission system operators (TSOs), regulatory authorities, Member States and market participants. The long-term hedging (forward) market shall ensure that it is possible to mitigate risks related to the price volatility in the Day-Ahead market in bidding zones across the EU. TSOs are identified as one party that can be legally obliged to support the functioning of the market. Until now, the most common way of providing support has been for the TSOs to offer Long Term Transmission Rights.

Svenska kraftnät's pilot project with auctioning of the financial contracts used for hedging specific bidding zone price risk in the Nordic market, Electricity Price Area Differentials (EPADs), aims to empirically test an optional way for the TSO to increase liquidity in the forward market. If proven successful, this model could potentially serve as an example of alternatives to the measures currently described in the FCA GL.

In the pilot's auctions, Svenska kraftnät offers to both buy and sell EPADs in the bidding zones SE2, SE3 and SE4. The auctions on either side of a bidding zone border (buy on one side and sell on the other) are matched with each other and the transactions only go through if Svenska kraftnät's buy transaction is made at the same or a lower price than Svenska kraftnät's sell transaction in the adjacent bidding zone.

For the implementation of the auctions, Svenska kraftnät has procured Svensk kraftmäkling AB (SKM), which arranges the auctions. All transactions are cleared with Nasdaq Clearing.



During the pilot project, Svenska kraftnät has limited the volume of outstanding contracts to approximately 10 percent of the expected available physical capacity on each bidding zone border.<sup>1</sup>

In order to simplify follow-up and analysis of the pilot project, Svenska kraftnät compiles the results of the auctions and presents a number of metrics that also illustrate the development of the continuous market for EPADs in the affected bidding zones. The summaries are published quarterly in the form of short reports, of which this is the third one and refers to the third quarter of 2023.

Please note that Svenska kraftnät has decided not to include the appendix with the compilation of the auction results published by SKM in connection with each auction that has been conducted. For these, please refer to SKM's website.

## Introduction

### Bidding zones and hedging

The spot price of electricity varies between bidding zones and depends for example on the transmission capacity of the power grid. Price developments in the forward market provide an indication of how market participants view future price developments and future differences in electricity prices between bidding zones. At the same time, the forward market gives an indication of the market's expectations of the size of the future congestion income that arises from price differences between bidding zones and accrues to Svenska kraftnät.

So-called system price contracts enable hedging of large parts of the fundamental price risk that exists in the Nordic electricity market because of varying availability of, for example, hydro and nuclear power and variations in fuel prices. The system price serves as a broader reference price<sup>2</sup> for different types of contracts in the Nordic/Baltic market area.

The remaining price risk, i.e. the difference between the price in a specific bidding zone and the system price, indeed cannot be managed with system price contracts. EPAD contracts allow hedging against the basis risk represented by the difference between a specific bidding zone's price and the system price.

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<sup>1</sup> For more detailed information on how the auctions are set up and concluded, please refer to [www.svk.se](http://www.svk.se) and [www.skm.se](http://www.skm.se).

<sup>2</sup> A virtual hub that pools all bids and offers on forward electricity contracts in the Nordics, boosting liquidity and creating a single reference price for several bidding zones.

By design, the combination of system price contracts and EPAD contracts provides effective hedging for the price risk that exists in the system as a whole and for the specific bidding zone against which the EPAD contract is settled.

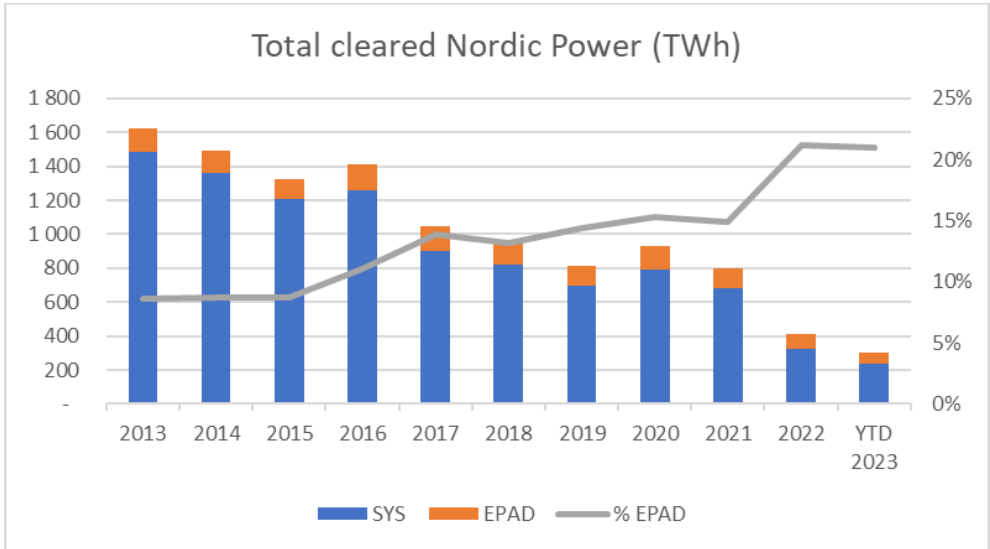
Although an EPAD contract, by design, hedges the risk of deviations between a bidding zone's price and the system price, EPAD contracts can also be combined in pairs to hedge the price difference between two bidding zones or more. Thus, the combination of buying an EPAD in one bidding zone and selling it in an adjacent bidding zone corresponds to a financial instrument for hedging between two bidding zones. This is a type of hedging that for most market participants has limited uses, but the design can be used to manage the financial exposure that a transmission system operator (TSO) obtains when engaging in the financial market. This is because the contract combination acts as an effective hedge of congestion income.

## Turnover and liquidity

Svenska kraftnät's pilot project with EPAD auctions aims, as mentioned above, to test a new way for a TSO to support improved hedging opportunities and contribute to increasing liquidity in the financial electricity market. The follow-up presented in this report only covers the current calendar year, with a focus on the third quarter. It was therefore considered reasonable to complement the monitoring of short-term developments with a longer-term perspective.

The Nordic financial market for electricity has struggled with declining liquidity for many years. In 2022, the challenges increased further as a result of higher margin requirements, which mean that participants have to allocate a lot of capital to clearing, as well as increasing spot price differences and lower price correlation between bidding zones. The latter, in turn, has led to reduced relevance of the system price as a reference price for market participants' hedging.

**Figure 1** below shows the total cleared volume of system and EPAD contracts at Nasdaq since 2013. As can be seen in the figure, system contracts account for the majority of the turnover in the Nordic market and it is these that have lost the most in volume (TWh), in both absolute and relative terms. Furthermore, the EPAD contracts' relative share of total turnover has actually increased from just below 10% to just above 20%.



**Figure 1.** Total cleared volumes at Nasdaq Clearing (2013-September 2023).

# Summary of auction results

After discussions with market participants it was decided to take a summer brake during July until mid-August. In total, Svenska kraftnät conducted auctions on four occasions during the third quarter of 2023, starting August 15, where monthly, quarterly and annual contracts was allocated in separate auctions. The fourth and last auction occasion of the quarter was September 26. The total number of participants per auction occasion averaged just over 22, which is an increase from the previous auction period (19).

The participation rate has remained relatively constant during the period. The number of individual transactions (deals) varied between 137 and 160 per auction and amounted to 152 on average. The total volume, here expressed in energy terms (GWh), was evenly distributed between the auctions.

**Table 1** summarizes the auctions in terms of participation, number of trades and volumes.

**Table 1** Auction date, number of participants, number of trades and total volume (GWh).

Auction date	Number of participants	Number of trades	Total volume (GWh)
2023-08-15	22	159	1 186
2023-08-29	22	153	1 186
2023-09-12	22	160	1 114
2023-09-26	22	137	1 114



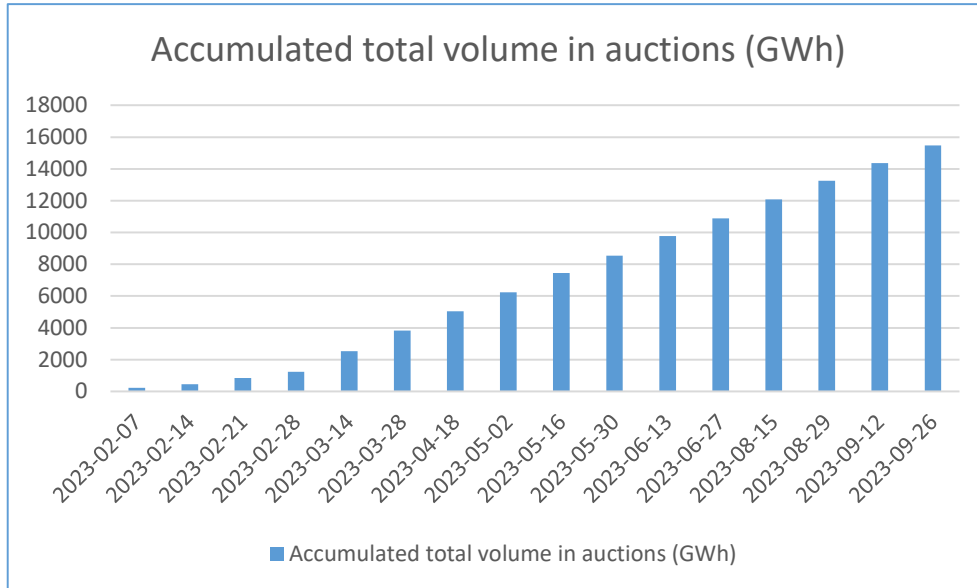
## Total allocated volumes in the auctions

**Table 2** below shows a summary of volumes for each contract in the auctions conducted during the period covered by this report.

**Table 2** Allocated volumes in the auctions held between August 15 and September 26 2023.

Bidding Zone	Contract	Volume (MW)	Svk BUY	Svk SELL
SE2	23-SEP	100	BUY	
SE2	23-OCT	100	BUY	
SE2	23-NOV	50	BUY	
SE2	Q4-23	200	BUY	
SE2	Q1-24	80	BUY	
SE2	YR-24	40	BUY	
SE3	23-SEP	100 + 100	BUY	SELL
SE3	23-OCT	100 + 100	BUY	SELL
SE3	23-SEP	50 + 50	BUY	SELL
SE3	Q4-23	80 + 80	BUY	SELL
SE3	Q1-24	180 + 180	BUY	SELL
SE3	YR-24	40 + 40	BUY	SELL
SE4	23-SEP	100		SELL
SE4	23-OCT	100		SELL
SE4	23-NOV	50		SELL
SE4	Q4-23	200		SELL
SE4	Q1-24	80		SELL
SE4	YR-24	40		SELL

**Figure 2** (below) illustrates the total accumulated volumes offered to the market through the auctions since the auctions started in February 2023. On September 26 2023 total volumes summed up to 15,486 GWh.



**Figure 2.** Total accumulated volume in auctions during 2023 YTD (GWh).

## How to interpret auction results

When allocating the coupled EPADs the symmetrical volume offered by Svenska kraftnät for purchase and sale is distributed to market participants based on the marginal price for their bids and offers for the individual EPAD contract, i.e. market participants submit orders for discrete products for each side of the bidding zone border. Where Svenska kraftnät offer to purchase EPADs, the offers from sellers will be accepted beginning with the lowest price and increasing to the price level of the offer that fulfils Svenska kraftnät's volume to purchase (marginal price).

Where Svenska kraftnät offer to sell EPADs, the bids from buyers will be accepted beginning with the highest price and decreasing to the price level of the bid that fulfils Svenska kraftnät's volume to sell (marginal price).

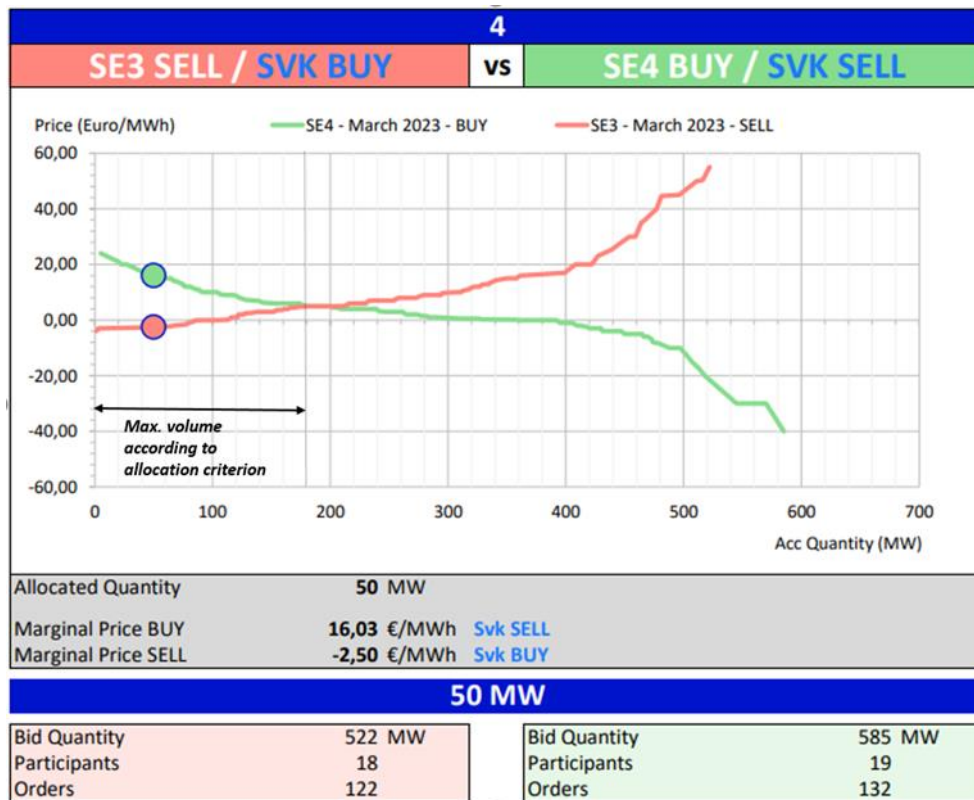
The results of each auction opportunity are published just after 13:00 CET on the day of the auction.<sup>3</sup> The auction results are presented in the form of bid curves.

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<sup>3</sup> Auction results are published on SKM's website, [Link to Auction Results](#)

**Figure 3** (below) shows the first auction conducted on February 7, this is one example of how to illustrate price formation with the bid curves.

- The green bid curve illustrates the prices at which market participants are prepared to buy the March contract in the SE4 bidding zone, these are ranked from highest to lowest bid.
- The red curve illustrates the prices at which market participants are prepared to sell corresponding contracts in the SE3 bidding zone.
- The points on each bid curve represent the marginal price at which the transactions are concluded. On the x-axis, these are placed at the offered volume (50 MW) and the marginal prices (16.03 EUR/MWh and -2.5 EUR/MWh, respectively) can be read off the y-axis.



**Figure 3.** Example of auction result showing order curves, price for each contract, allocated volume, number of participants, number of orders and the total order quantity.

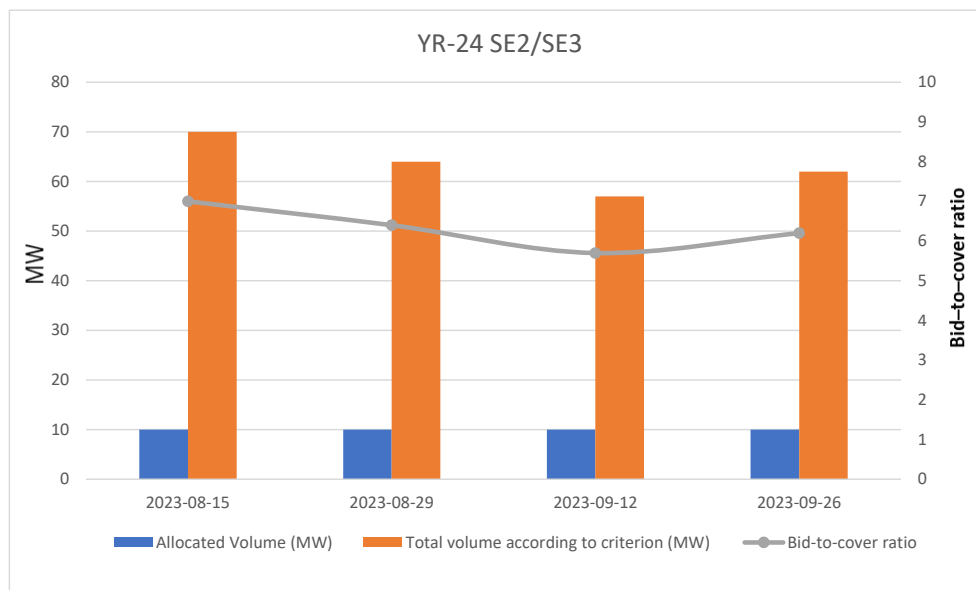
Figure 3 also illustrates the distance that corresponds to the volume that could have been allocated given Svenska kraftnät's allocation criteria. (The price which Svenska kraftnät purchase for must always be lower than or equal to the price at which Svenska kraftnät sell for in each coupled transaction.) In the figure just above, this corresponds to a volume of 188 MW, i.e. where the two curves intersect. The total bid volume, number of participants and total number of orders can be found in the information boxes at the bottom.

## Bid-to-cover ratio

The bid-to-cover ratio is the quantity of orders (buy or sell) for an EPAD-contract divided by the quantity accepted by Svenska kraftnät. A high bid-to-cover ratio indicates a strong demand for the contracts.

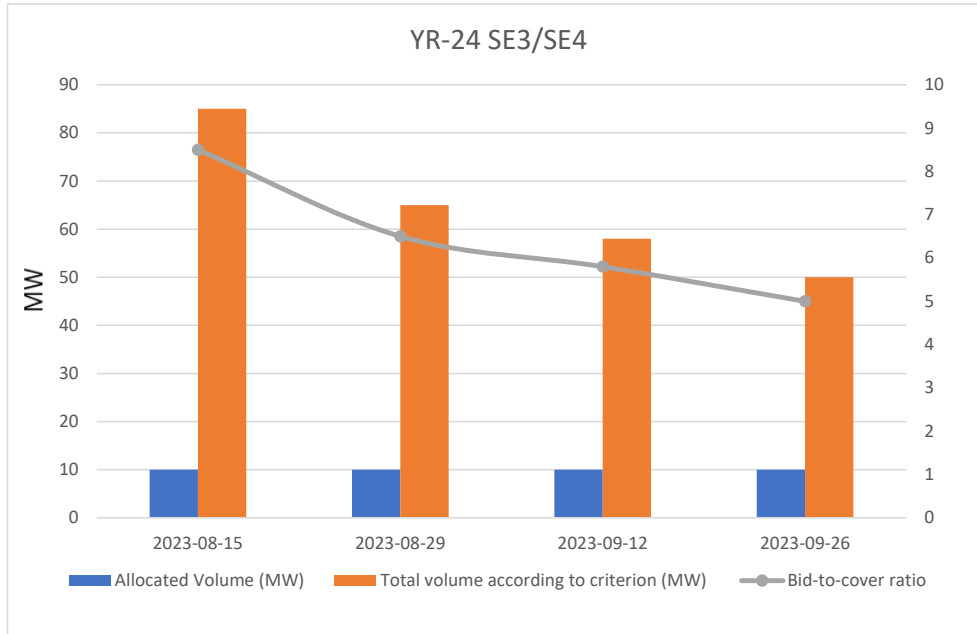
As mentioned earlier, the price at which Svenska kraftnät purchase must always be lower than or equal to the price at which Svenska kraftnät sell in each coupled transaction. The bid-to-cover ratio presented below is adjusted to reflect this condition, i.e. calculated as the volume accepted by Svenska kraftnät divided by the total volume of orders where the respective purchase and sales price would meet the above criterion. This means that the bid-to-cover ratio is not calculated and based on the total (gross) volume of orders.

During the third quarter, the bid-to-cover ratio was highest for the yearly contracts and amounted to approximately six times the volume offered. Demand has been stable over the period. **Figure 4** illustrates the bid-to-cover ratio for the offered yearly contracts that link to the northern bidding zone border SE2-SE3. On average, the order volumes continued to be more than six times greater than the volume offered by Svenska kraftnät.



**Figure 4.** Volumes for SE2/SE3 yearly contracts, shown per auction occasion.

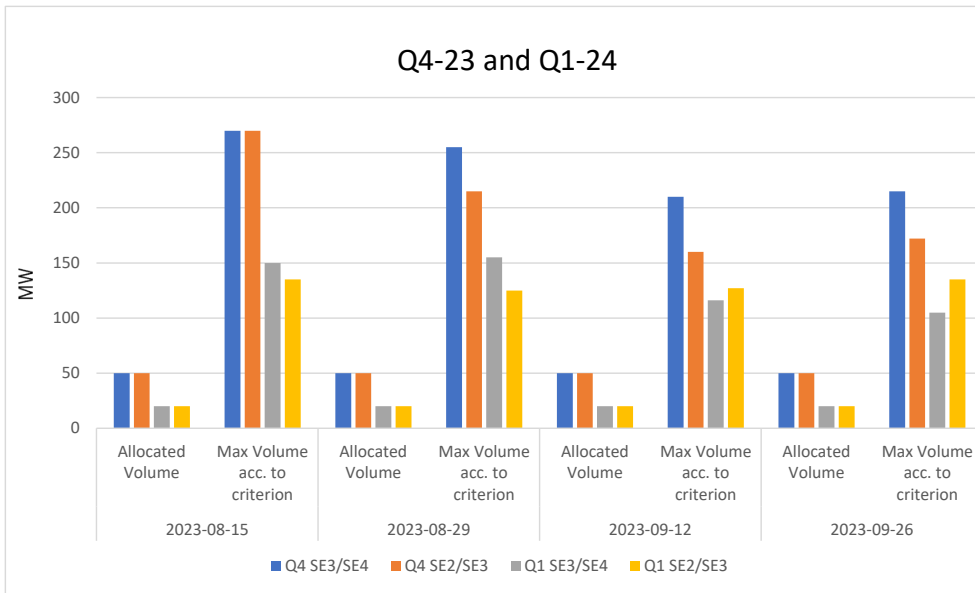
**Figure 5** (below) shows the same relationship for the contracts in auctions for the southern bidding zone border between SE3 and SE4. On average, the total volume that met the criterion has been almost seven times greater than the volume offered, even though the ratio decreases over the auction period.



**Figure 5.** Volumes for SE3/SE4 yearly contracts, shown per auction occasion.

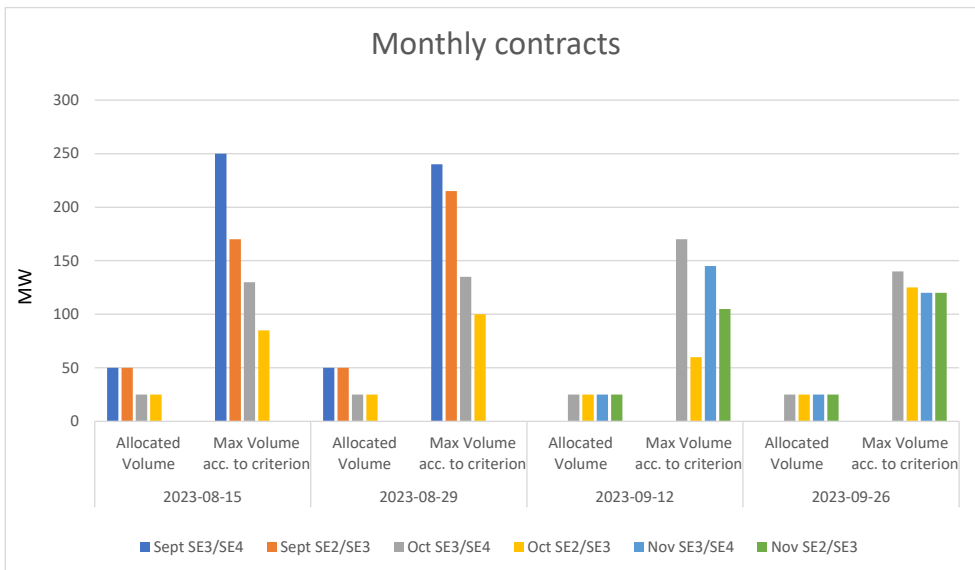
Quarterly contracts had a slightly lower bid-to-cover ratio than the yearly contracts, which follows the same pattern as the auctions in the second quarter. **Figure 6** below shows that the southern border (SE3-SE4) continued to attract greater interest than the northern border (SE2-SE3), even though the differences were significantly smaller than during the second quarter.

Q3 2024 contracts exhibits an average bid-to-cover ratio of 4.7 for the southern border and 3.8 for the northern border. For the Q1 2024 contracts the relationship was similar, with a bid to cover ratio of close to 6.5 for both borders.



**Figure 6.** Volumes for quarterly contracts, shown per auction occasion.

The monthly contracts in **Figure 7** below exhibits a similar pattern as the quarterly contracts. In this case the bid-to-cover ratio for the northern border is 25 percent lower than for the southern border.

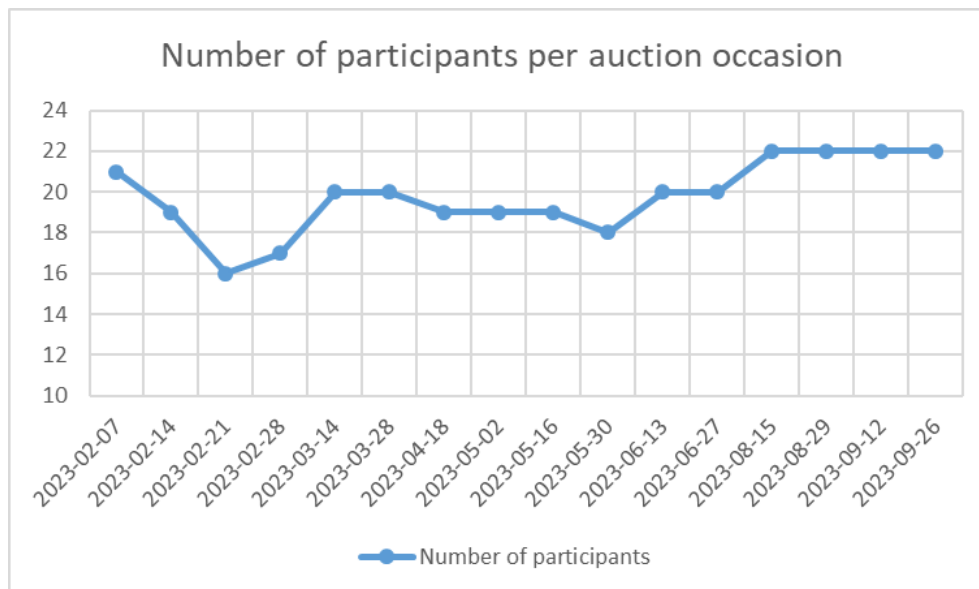


**Figure 7.** Volumes for quarterly contracts, shown per auction occasion.

## Participation in auctions

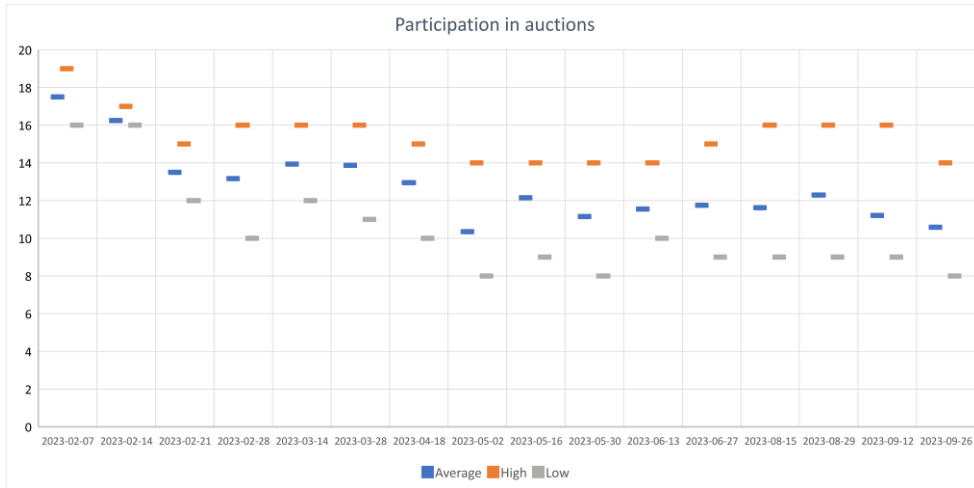
Participation has been relatively stable during the third quarter. During Q3, the average number of market participants has amounted to approximately 11.5 per individual auction, a marginal decrease when compared with the previous quarter (12.0). However, the total number of participants at each auction has been higher than 11.5 because a participant does not have to submit bids for contracts in all bidding zones or on all bidding zone borders offered by Svenska kraftnät.

**Figure 8** below summarises the total number of participants in the 16 auctions that have taken place since the start of the pilot. In a quarterly comparison, it can be stated that the auctions attracted 22 market participants on all four occasions during Q3.



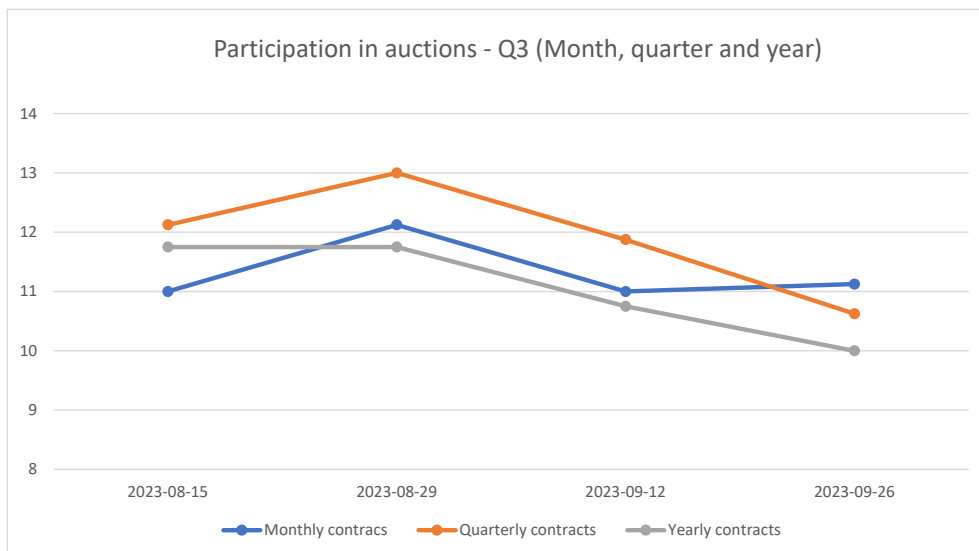
**Figure 8.** Number of participants per auction occasion (February – September 2023).

The illustration in **Figure 9** below summarizes the maximum, minimum and average number of participants for the different individual auctions since the start of the pilot (presented per auction occasion).



**Figure 9.** Average, high and low participation in auctions (per auction occasion).

**Figure 10** (below), shows the auction participation in the third quarter broken down into monthly, quarterly and yearly contracts. As stated above, the yearly contracts have consistently shown a high bid-to-cover ratio, but at the same time attracted the lowest average number of participants. Furthermore, the quarterly contracts have shown the greatest participation interest on average, which follows the same trend as in the second quarter.



**Figure 10.** Average number of participants during quarter 3 per auction occasion split by maturity.



## Price development in continuous market

In general, auction marginal prices have tended to end up relatively close to the previous trading day's closing prices and usually within the (unofficial) indicative price difference between the best buyer and the best seller (the so-called bid-ask spread).

Low liquidity in EPAD contracts means not only that turnover is low, but also that the closing prices are also likely to be subject to some uncertainty as a reference price for the auctions. As can be seen in some of the figures below, with special regard to SE4, market prices have remained close to the price levels set in the auctions during the trading days following the auctions. This indicates that the auctions have a price-forming function in the market (price discovery).

During the third quarter, Svenska kraftnät conducted four auctions in bidding zone SE3 for yearly contracts. In **Figure 11**, the auction occasions have been plotted in relation to the historical price development of the front-year contract (YR-24) during 2023. It can be noted that the SE3 contract has been trading below the system price since mid-March. The average marginal price in the auctions was approximately -2.5 EUR/MWh. Svenska kraftnät both buys and sells SE3 contracts in the linked auctions vis-à-vis SE4 and SE2 respectively and therefore normally does not receive any net positions in SE3.



**Figure 11.** Closing prices for each day (first nine months, 2023) in the continuous market plotted together with the auction occasions (August - September) for SE3 YR-24 contracts.

The corresponding contract for bidding zone SE4 showed a marked decline during the first quarter and the expected price difference relative to the system price fell sharply. The following quarters was instead characterized by a sideways movement with a slight upturn in the third quarter. Svenska kraftnät conducted four auctions during the third quarter and the marginal price in the auctions ended up at approximately 21 EUR/MWh.

See **Figure 12** below for closing prices in the continuous market plotted along with auction occasions.



**Figure 12.** Closing prices for each day (first nine months, 2023) in the continuous market plotted together with the auction days (August to September) for SE4 YR-24 contracts.

The price for the corresponding SE2 contract showed a sideways movement within the range of approximately -35 EUR/MWh – approximately -20 EUR/MWh during the first nine months of 2023. The marginal price in the auctions ended up at the level of -23 EUR/MWh. Closing prices and auctions are shown in **Figure 13**.



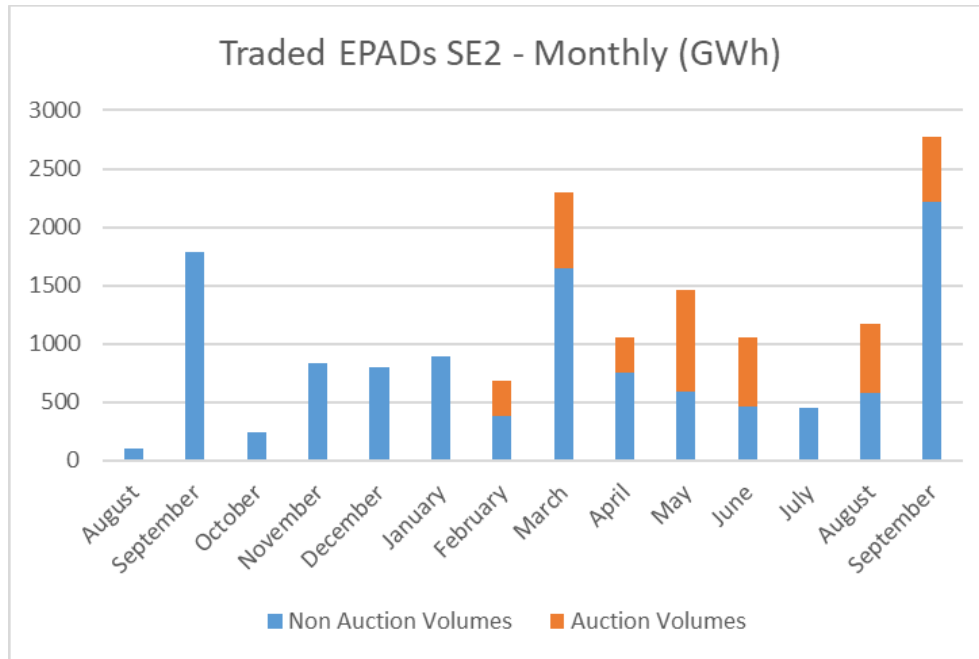
**Figure 13.** Closing prices for each day (first nine months, 2023) in the continuous market plotted together with the auction occasions (August to September) for SE3 YR-24 contracts.

## Activity and trading in the continuous EPAD market

The model used by Svenska kraftnät in the pilot is primarily designed to add liquidity to the existing market, not to establish a parallel market or trading venue to the existing. Therefore, one of the most important long-term effects of the pilot to study and evaluate will be its' impact on the continuous market.

**Figure 14** (below) presents a summary of the total turnover of EPAD contracts for SE2 broken down by auction volumes and continuous trading. Turnover is presented as the total amount of energy (GWh) and thus take into account both power and time. The look back period extends from August 2022 to September 2023.

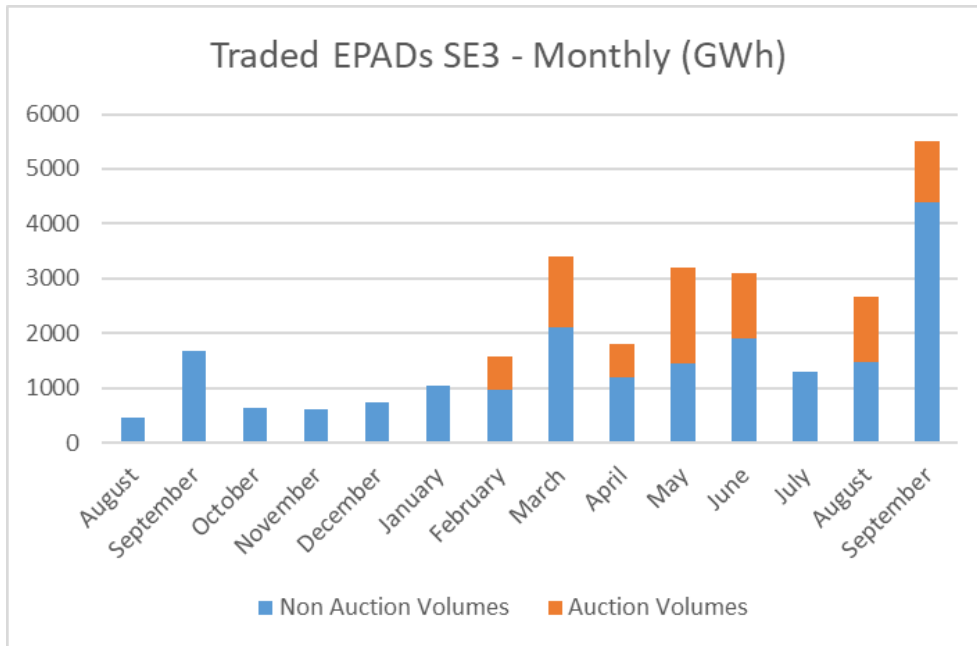
From the picture below, it can be seen that the total turnover in SE2 has increased since the auctions started in February. However, turnover does not show a clear trend if auction volumes are excluded, but it should be noted that September 2023 was a very good month.



**Figure 14.** Turnover (GWh) of EPADs for SE2 per month, 2022-2023.

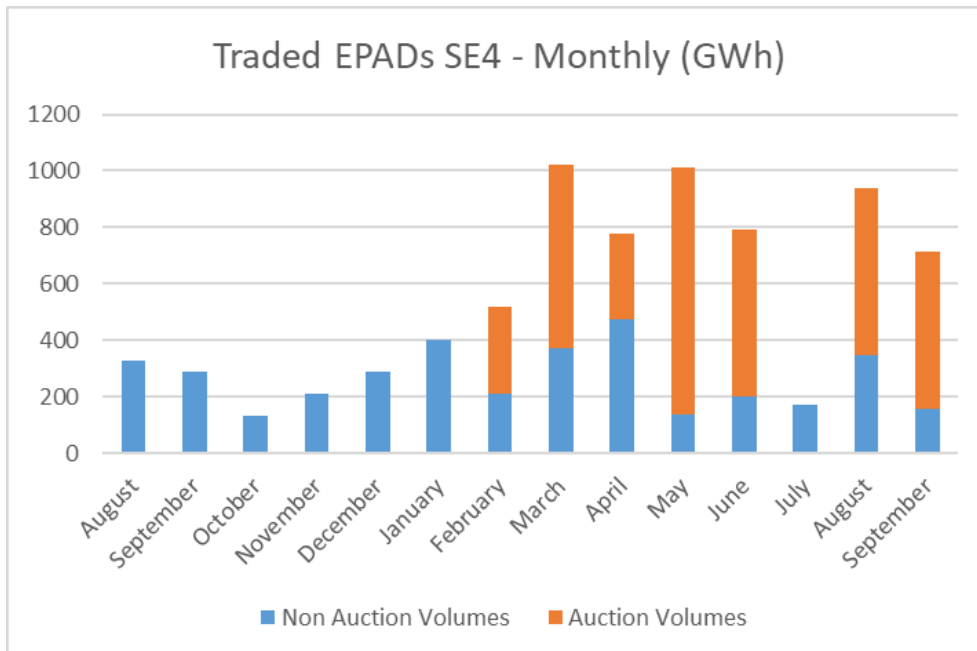
As mentioned earlier, trading in EPADs has been fairly limited for many years. This market situation was reinforced in 2022 (and also applies to 2023) when sharply increased margin requirements made it more capital-intensive to trade EPAD contracts than before. Nasdaq Clearing's total collateral requirement increased tenfold from the beginning of 2021 to the end of August 2022 when the price of electricity was at its highest. Furthermore, the margin requirements for positions in SE2 contracts were significantly higher during the period than for corresponding contracts in SE4.

In the case of SE3 as illustrated in **Figure 15**, which is the bidding zone that during the period showed the highest liquidity and the highest turnover in continuous trading, a slightly positive trend can be seen, even though auction volumes also accounted for a large proportion of the increase. Note that the scale on the y-axis in the figures varies for the different bidding zones and that the turnover in SE3 was significantly higher than for SE2 and SE4.



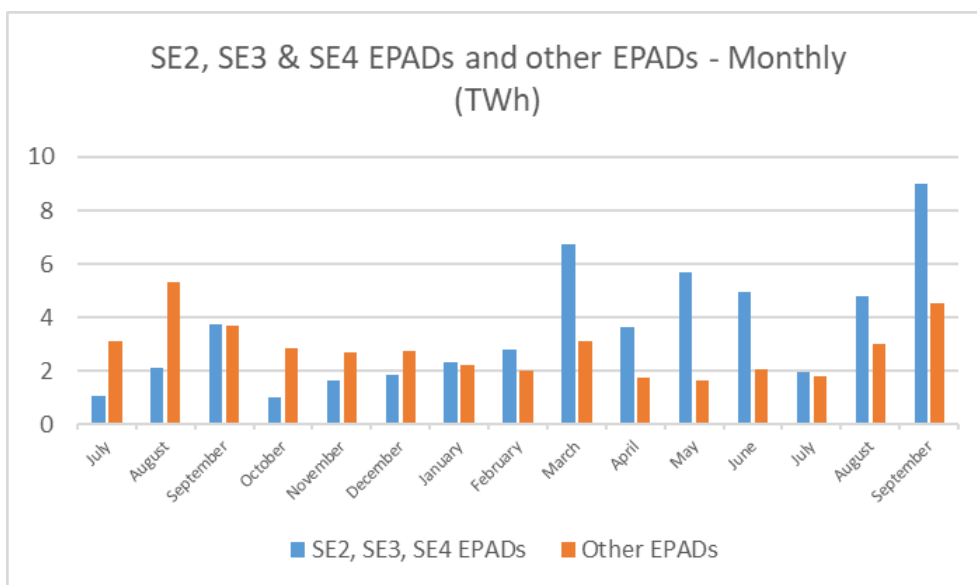
**Figure 15.** Turnover (GWh) of EPADs for SE3 per month, 2022-2023.

Regarding SE4, from **Figure 16**, it can be noted that auction volumes account for the lion's share of the total increased trading volumes and that turnover in continuous trading has varied, but remained at a low level, both in relative and absolute terms.



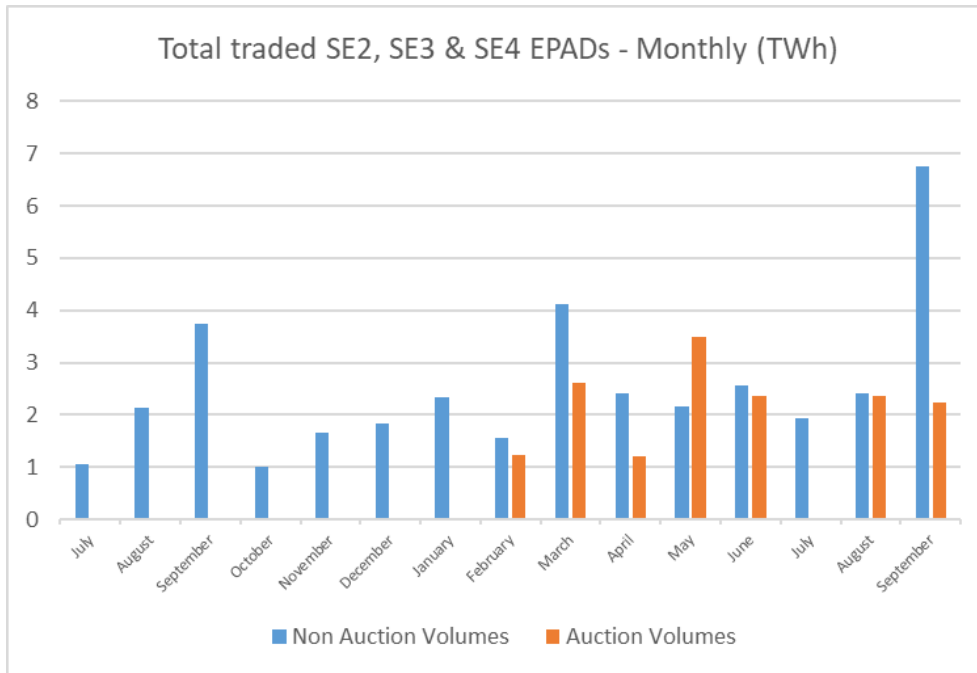
**Figure 16.** Turnover (GWh) of EPADs for SE4 per month, 2022-2023.

**Figure 17** (below) shows how the total turnover (TWh) in the contracts included in Svenska kraftnät's pilot (SE2, SE3 and SE4) has developed over the past year in relation to other EPAD contracts. This comparison presents a significant increase in turnover, both in absolute and relative terms, for the bidding zones where EPADs have been auctioned, clearly illustrated via the blue bars. Other EPADs also showed a slight increase during the third quarter.



**Figure 17.** Total trading for SE2, SE3 and SE4 compared to other EPAD contracts (July 2022–September 2023).

If the total turnover (TWh) for the contracts included in the pilot is split into continuous trading volumes and auction volumes, **Figure 18** below illustrates that the share of auction volumes in total turnover was high in August. In September 2023, however, a markedly higher share of continuous trading can be observed.

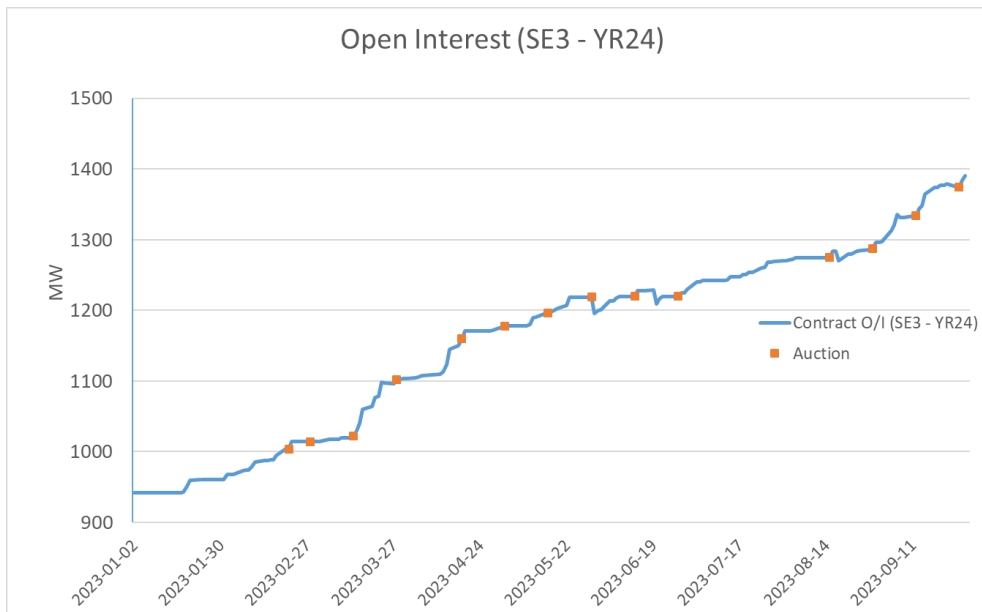


**Figure 18.** Total trading for SE2, SE3 and SE4 split into non auction volumes and auction volumes (July 2022-September 2023).

## Open Interest

Open interest is often used as an indicator of liquidity and market activity in continuous trading. Open interest is the total number of derivative contracts (e.g. EPAD-futures) held by market participants at the end of the trading day. Open interest is calculated by adding all the contracts from opened trades and subtracting the contracts when a trade is closed by a market participant. Open interest is thus not the same as traded volume, as traded volume increases by both entries and exits while open interest increases by entries and decreases by exits.

**Figure 19** (below) shows the development in the continuous market of the SE3 yearly front contract. The figure illustrates that open positions have increased throughout the period. The line in the graph shows the open interest for SE3 YR24 contracts, and the auction occasions are plotted with orange marks in the graph.



**Figure 19.** Open interest in SE3 YR-24 EPAD contract (January–September, 2023).

Open interest is commonly used as an indicator of liquidity and market activity in the continuous trading. An assessment of causality between the EPAD auctions and open position will have to wait until future reports. The strength of this metric is that it enables a follow-up of the development in the volumes that are actually hedged.

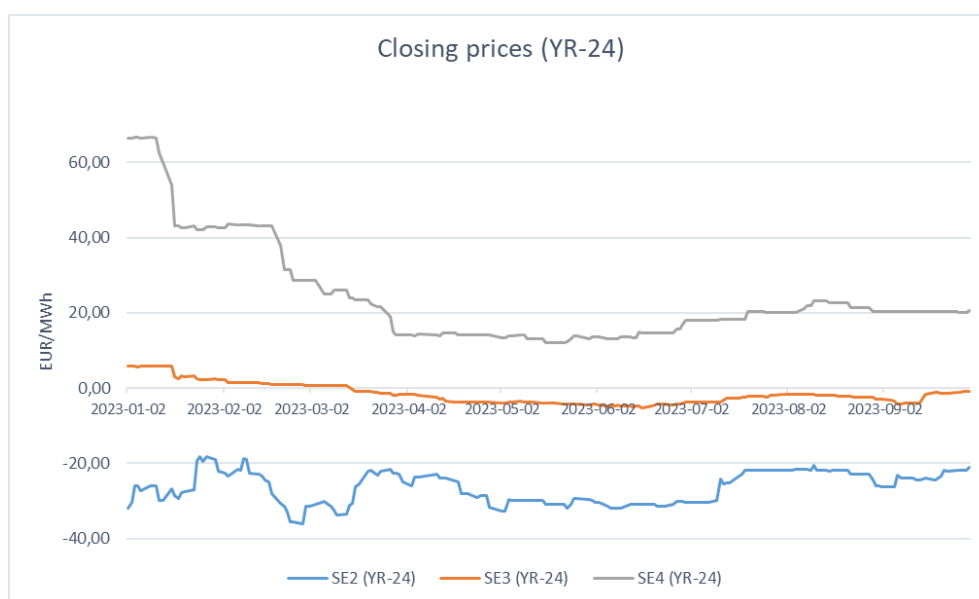
As mentioned above, Svenska kraftnät does not have any open positions in SE3. In addition, Svenska kraftnät has only auctioned a limited volume in yearly (YR-24) contracts during February to September in SE3.



# In-depth section

## Svenska kraftnät's own role and exposure

From the figure below, which covers the entire pilot period, it can be seen that the first quarter was characterized by a belief in reduced future bidding zone differences, primarily manifested by gradually decreasing prices for the SE4 contract. Instead, the second and third quarters were characterised by market expectations of relatively stable future differences.



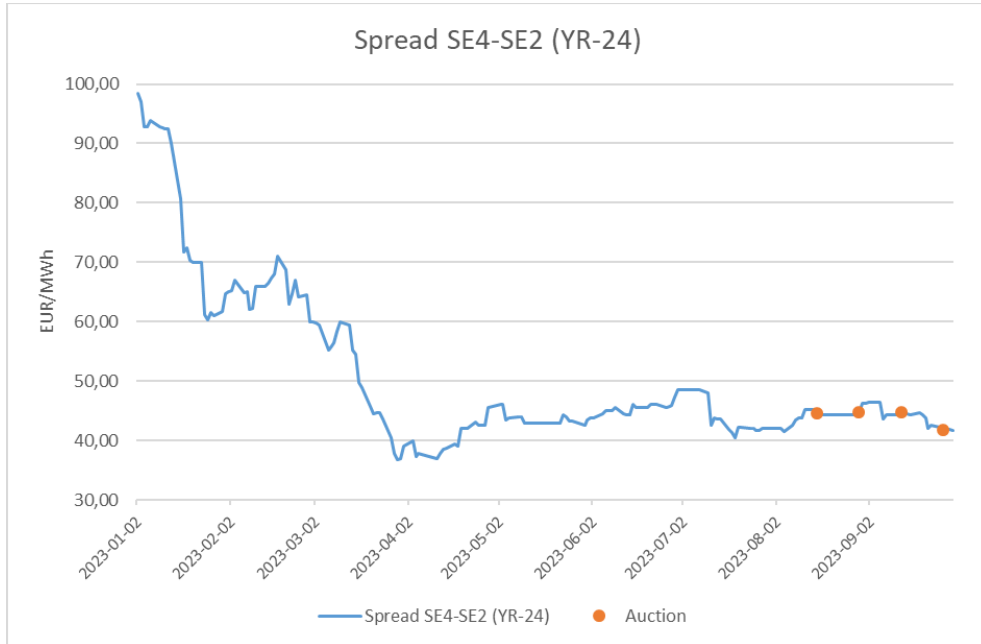
**Figure 20.** Closing prices YR-24 contracts (January–September, 2023).

Svenska kraftnät has the opportunity to offer market participants these trading opportunities via auctions, since congestion income attributable to each bidding zone border constitutes an inherent financial exposure.

Conceptually, the auctions can therefore also be described as Svenska kraftnät partially hedging expected future congestion income generated through price differences between different bidding zones in the day-ahead market.

Normally, Svenska kraftnät buys EPADs in the surplus area SE2 and sells EPADs in the deficit area SE4. The net position after auctions thus means that Svenska kraftnät obtains a long SE2 position (a neutral SE3 position) and a short SE4 position.

**Figure 21** below shows the price difference between SE2 and SE4, this spread gives an indication of the level of hedged congestion income. The locked-in margin for the annual contracts averaged 44 EUR/MWh in the third quarter.



**Figure 21.** Price difference between SE2 and SE4 for YR-24 contracts (January – September, 2023).

# Conclusions

The purpose of the EPAD pilot is to support market participants by providing transmission capacity in the forward market. By adding trading volumes, the long-term goal is to contribute to increased hedging opportunities and higher liquidity in continuous trading.

Overall, Svenska kraftnät notes that the auctions have continued to function well and that the high bid-to-cover ratio shows great interest from market participants. The participants in the auctions believe that the auction process, both when allocating in auctions and when bids do not result in allotment, has worked well.<sup>4</sup>

This report covers only the first eight months of the pilot. Although positive developments can be observed, we still consider it too early to draw firm conclusions about the effects of the auctions on the overall EPAD- market. The report primarily aims to continue to identify various initial indications, which in the future can be analyzed more thoroughly.

Finally, the auctions are deemed to support increased transparency and better price formation in the EPAD market. In addition, Svenska kraftnät can conclude that the auctions fulfill an important need during a period of continued decreasing market liquidity. Further, Svenska kraftnät's role as a "natural" buyer and seller in the surplus respective deficit areas SE2 and SE4 is also considered to contribute to better opportunities for market participants to deal with the underlying structural market asymmetry in Swedish bidding zones.

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<sup>4</sup>Svenska kraftnät has conducted a consultation on existing arrangements for EPAD auctions as well as future development of arrangements for auctions of hedging products.

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Svenska kraftnät is a state owned enterprise with the task of maintaining Sweden's electricity transmission grid, which consists of about 16,000 kilometres of 400 kV and 220 kV transmission lines with substations and interconnectors. Svenska kraftnät is also the system operator for electricity in Sweden. Svenska kraftnät is developing the transmission grid and the electricity market to meet society's need for a secure, sustainable and cost-effective supply of electricity. In this, Svenska kraftnät plays an important role in implementing national climate policies.

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