Statnett

Norwegian EPAD pilot Q1 2025

Contents

Introduction

This is the quarterly report presenting results from the Norwegian EPAD auctions. The report provides insights into the auction outcomes, market trends and liquidity measures for Q1 2025, including the first and only auction in December 2024. Statnett will continue releasing these quarterly reports to provide ongoing transparency and insights into the progress of the EPAD market. After the first year of operation, Statnett plans to publish a more comprehensive report, offering a detailed analysis of the auction results and market developments over the initial year.

Background

The financial power market provides market participants with an opportunity to obtain standardized financial contracts to hedge their positions and reduce their financial risk. However, the liquidity in the Nordic financial power market has been declining over the last decade. This has caused increased price spreads between buyers and sellers, indicating low and decreasing efficiency in the financial power market.

The European Regulation (EU) 2016/1719, establishing a guideline on forward capacity allocation (FCA), has been adopted into Norwegian law and assigns a responsibility to TSOs to ensure the availability of sufficient price hedging opportunities for market participants. Accordingly, in February 2024, the Norwegian Energy Regulatory Authority (RME) issued a decision directing Statnett to explore alternative schemes to support price hedging in the Norwegian bidding zones. The decision was made under the authority of the Norwegian Energy Act § 10-1, and Article 30(5)(b) of the FCA regulation.

Separately, the Norwegian Ministry of Energy directed Statnett to conduct a pilot program for EPAD[1] auctions in Norway. An EPAD is a futures contract that provides a hedge between the price in the respective bidding zone and the Nordic system price.

The motivation behind the pilot program is to assess whether EPAD auctions can enhance liquidity and price formation in the financial power market. In these auctions, Statnett offers to buy and sell EPAD contracts across adjacent bidding zone borders based on price-independent volumes. Specifically, Statnett will buy a volume on one side of a border and sell a corresponding volume on the other side of the border.

In August 2024, it was announced that Nord Pool had won the tender to manage the Norwegian EPAD pilot on behalf of Statnett. As a result, Nord Pool is responsible for organizing the auctions, and the auction calendar, market rules, fee schedule and results are published on their website.[2] All transactions are cleared by Nasdaq Clearing. The pilot officially commenced on December 10, 2024, and shares many similarities with the ongoing Swedish pilot conducted by Svenska Kraftnät, which began in February 2023.

[1] Electricity Price Area Differential (EPAD)

[2] Nord Pool's EPAD portal: https://www.nordpoolgroup.com/en/trading/epad-auctions/

Figure 1: Map of the bidding zones and borders in the Norwegian EPAD pilot.

As illustrated in Figure 1, the following borders are included in the pilot: NO1-NO2, NO1-NO5 and NO3-NO4. The contract types include monthly, quarterly and annual contracts. Auctions, which are held every Tuesday in even weeks, will only be concluded if Statnett's buy price is equal to or lower than the sell price in the adjacent bidding zone.[3]

The transmission grid in Norway is heavily affected by bottlenecks, resulting in significantly lower available physical capacity compared to Sweden. To mitigate risk, Statnett offers volumes of approximately 10-20 percent (200-250 MW) of the transmission capacity for each bidding zone border, distributed across the three contract types.

The intention is to run the pilot for two years. Statnett will publish quarterly reports, and after the first year of operation, Statnett will release a more comprehensive report evaluating how the pilot has impacted the indicators related to liquidity and price formation in the financial power market.

[3] Matching criteria: https://www.nordpoolgroup.com/4ad1ed/globalassets/download-center/epad/statnett-epad-auction---market-rules.pdf

Results

There are several methods for measuring liquidity in auctions. Common methods include participation, volume and price formation. In addition to these, the report also examines the bid-to-cover ratio, implicit price tails and friction costs.

Participation

The first auction in the pilot was conducted on December 10, 2024. As shown in Figure 2 below, each auction has so far had between 18-21 participants, with an average of 20 participants per auction. The auction with the lowest number of participants was the second auction. The timing of this auction, being close to the Christmas holiday and a public holiday in Sweden, may have impacted participation.

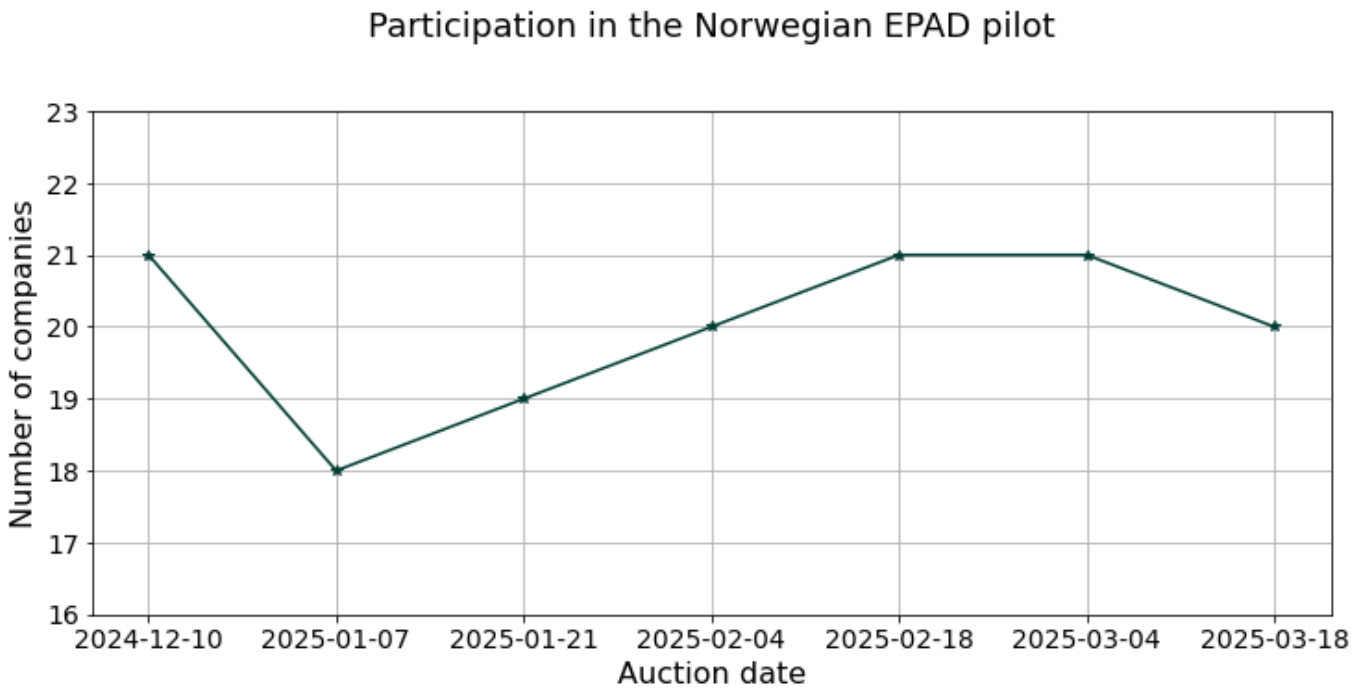

Figure 2: The number of individual companies placing orders in each auction. Data source: Nord Pool.

Accumulated volumes

So far, Statnett has offered a volume of 40 MW for the monthly contracts, 20 MW for the Q+1 contracts, 10 MW for the Q+2 contracts, and 5 MW for the annual contracts in each auction. With an increasing number of auctions, Statnett's positions will accumulate from the annual and quarterly contracts, while the offered volume for the monthly contracts will gradually decrease. More information about this can be found in the auction calendar.[4]

All the volumes offered in the annual and quarterly contracts have been sold. However, there have been two instances of unsold monthly contracts for NO1-NO2 and one instance for NO3-NO4.

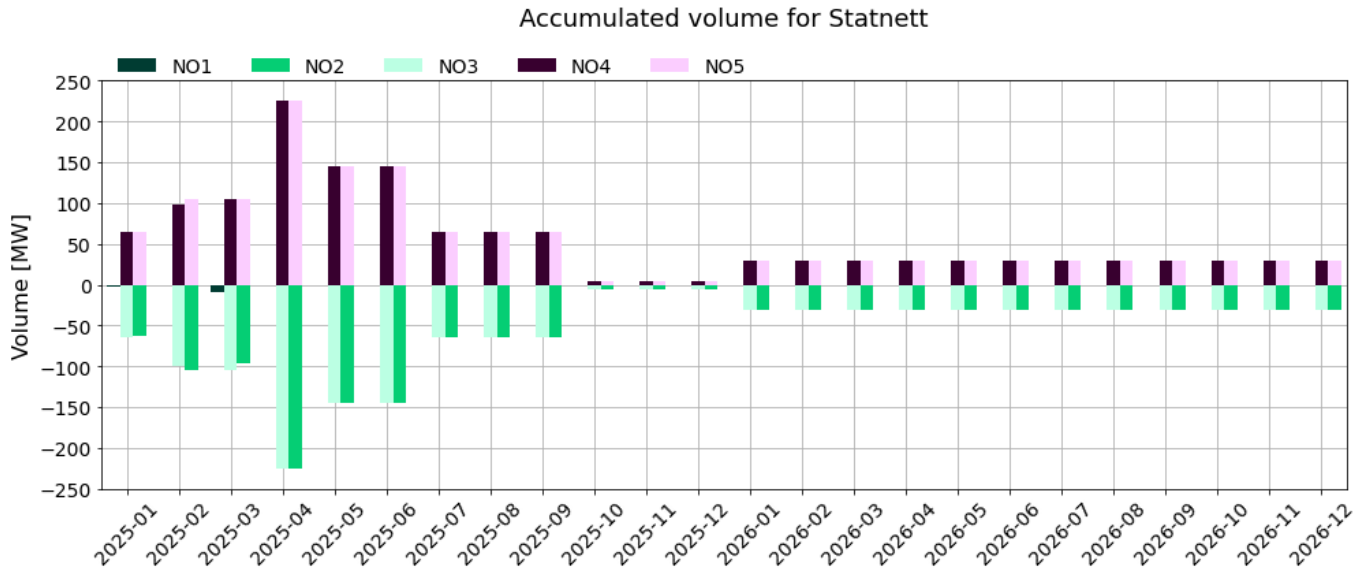

Figure 3: Accumulated volumes for Statnett per bidding zone per month. Data source: Statnett.

Figure 3 shows Statnett's current positions. From April 2025, Statnett reached the predefined volume of 200-250 MW for each border. With additional auctions, the accumulated position for every month will be 200 MW or more. So far, the position is only 5 MW for Q4 2025, from the annual 2025 contract offered in the first auction. This will increase to over 200 MW when the quarterly and monthly contracts are offered for this period.

NO1 is included in two of the auctioned borders: NO1-NO5 and NO1-NO2. In all auctions so far, Statnett has earned a buy position in NO5, and sell position in NO1 in the NO1-NO5 auction. In all auctions for the NO1-NO2 border, Statnett has so far gained a buy position in NO1 and a sell position in NO2. As such, the NO1 positions have been netted in most of the auctions. For the NO3-NO4 auction, the outcome has been a buy position in the surplus area NO4, and a sell position in NO3.

[4] Auction calendar: https://www.nordpoolgroup.com/49336b/globalassets/download-center/epad/statnett-epad-auction-calendar.pdf

Volumes in the auctions and continuous market

A common method of describing liquidity is by analyzing the traded volumes. This chapter examines the development of EPAD volumes since 2023 and how the auctions have impacted the total EPAD volumes.

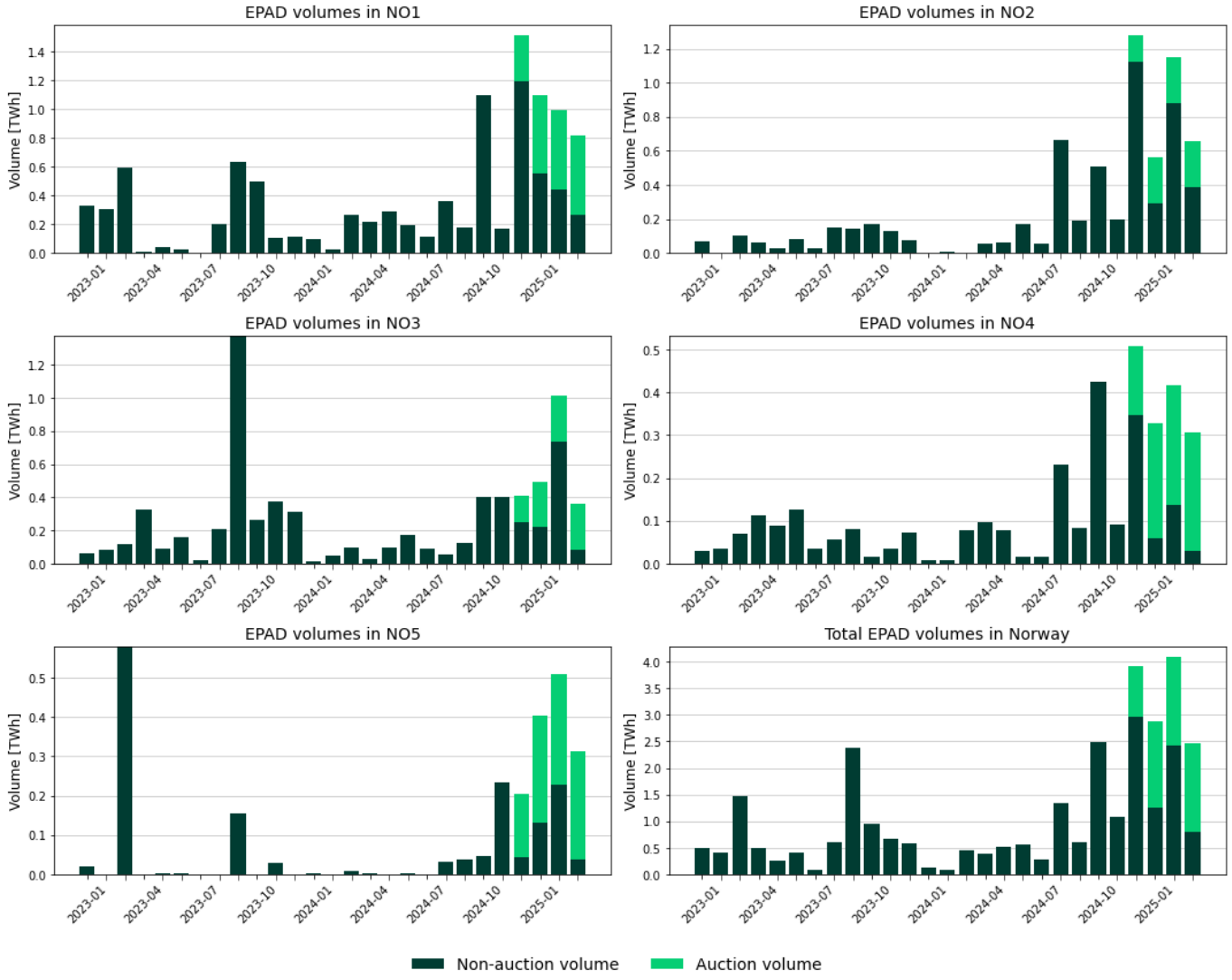

Figure 4: Monthly EPAD volumes in each Norwegian bidding zone, with the total EPAD volume for the bidding zones in the bottom-right plot. The timeframe ranges from 01.01.2023 to 31.03.2025. Data source: Nasdaq Commodities.

As shown in Figure 4, the volume remained low during the period. Nevertheless, an increase in volume in the continuous market was observed in the autumn of 2024, a few months before the first auction on 10 December. From the bottom-right plot in Figure 4, the three months with the highest volume during the pilot period are also the three months with the highest volume overall since the beginning of 2023. In Q1 2025, the EPAD auctions accounted for 52 percent of the total traded EPAD volumes. If December is included, the auctions accounts for a share of 44 percent. It is still too early to conclude whether the auctions contribute to increased volumes in the continuous EPAD market.

Bid-to-cover ratio

The bid-to-cover ratio is another approach to measure liquidity in auctions. It is a way to describe an "oversubscription" in an auction, where oversubscription is determined based on the *buy low-sell high* auction criterion. The bid-to-cover ratio is the maximum volume that can be matched in each auction fulfilling the criterion, divided by the volume offered by Statnett. A high bid-to-cover ratio indicates strong interest and, therefore, high liquidity for a contract. More information about the bid-to-cover ratio can be found in the Appendix. Figure 5 shows that the bid-to-cover ratio is significantly lower for the monthly contracts compared to the annual and quarterly contracts across all borders. One reason for this is that the offered volume for the monthly contracts has so far been higher than for the quarterly and annual contracts. A bid-to-cover ratio of less than 1 indicates that the border was not sold out. This occurred in the first and fifth auctions for NO1-NO2, and in the second auction for NO3-NO4.

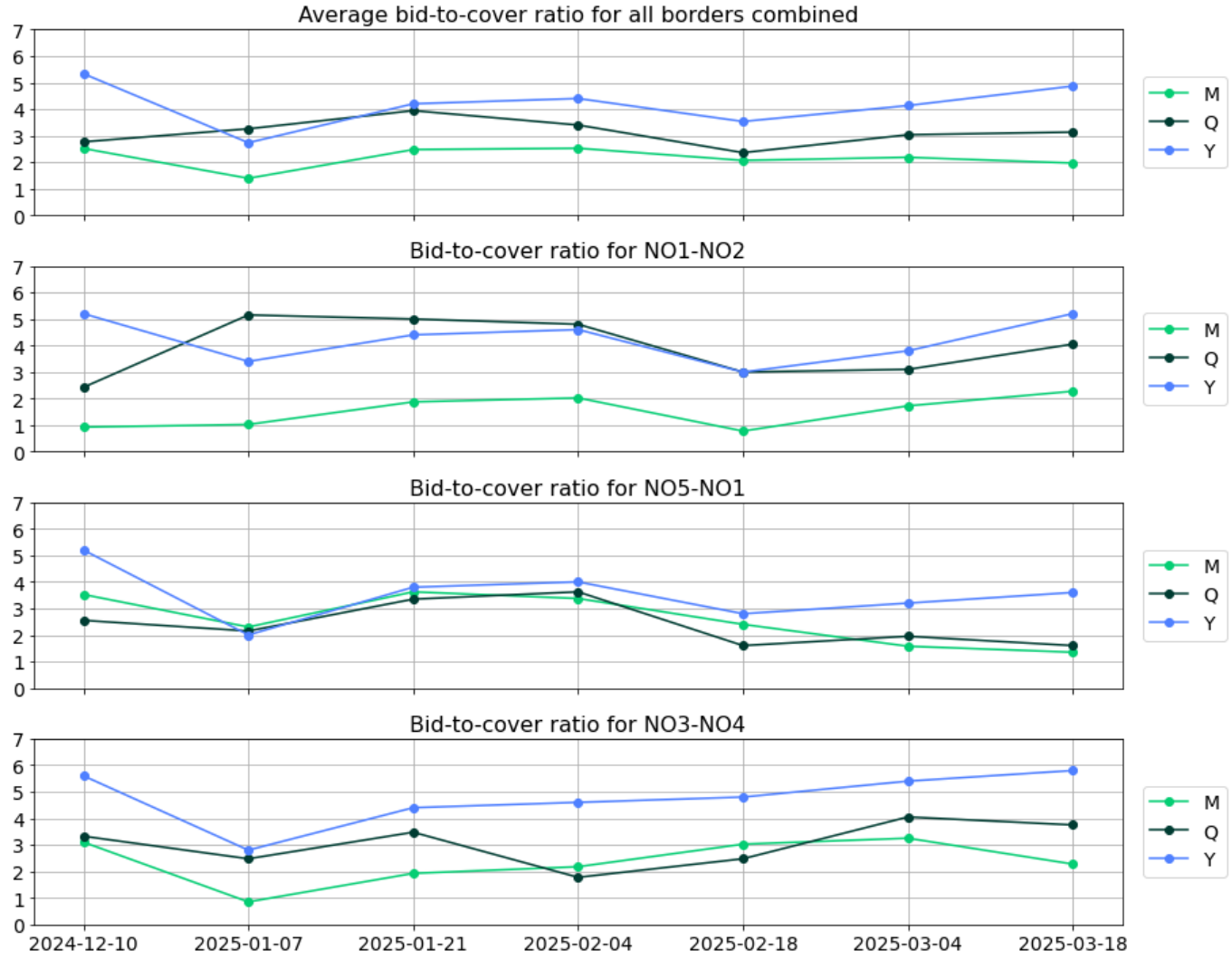

Figure 5: Bid-to-cover ratio per monthly (M), quarterly (Q) and annual (Y) contract for all borders, and the average for all borders combined. Since bid-to-cover ratio is a ratio, no unit is presented on the y-axis. Data source: Nord Pool.

Implicit price tails

Another way to describe liquidity and price formation in auctions, is the reference to "implicit price tails". While bid-to-cover describes the liquidity in terms of oversubscription of volumes, this approach focuses on price formation for the buy and sell curves. Specifically, implicit price tails look at the difference in price spread at the marked clearing point, and at some other reference point(s) on the bid and ask curves. A low implicit price tail indicates high liquidity in the auction.

There are two different types of implicit price tails presented in this report: Long implicit price tails and short implicit price tails. A long implicit price tail describes the absolute price difference between the highest or lowest price on the buy or sell curve and the marginal price at the market clearing point. For the short implicit price tail, the volume-weighted average price (VWAP) is used instead of the lowest or highest price. In the following reports from Statnett, the average of the two tails is presented for each boarder and contract. A detailed description of the implicit price tails can be found in the Appendix.

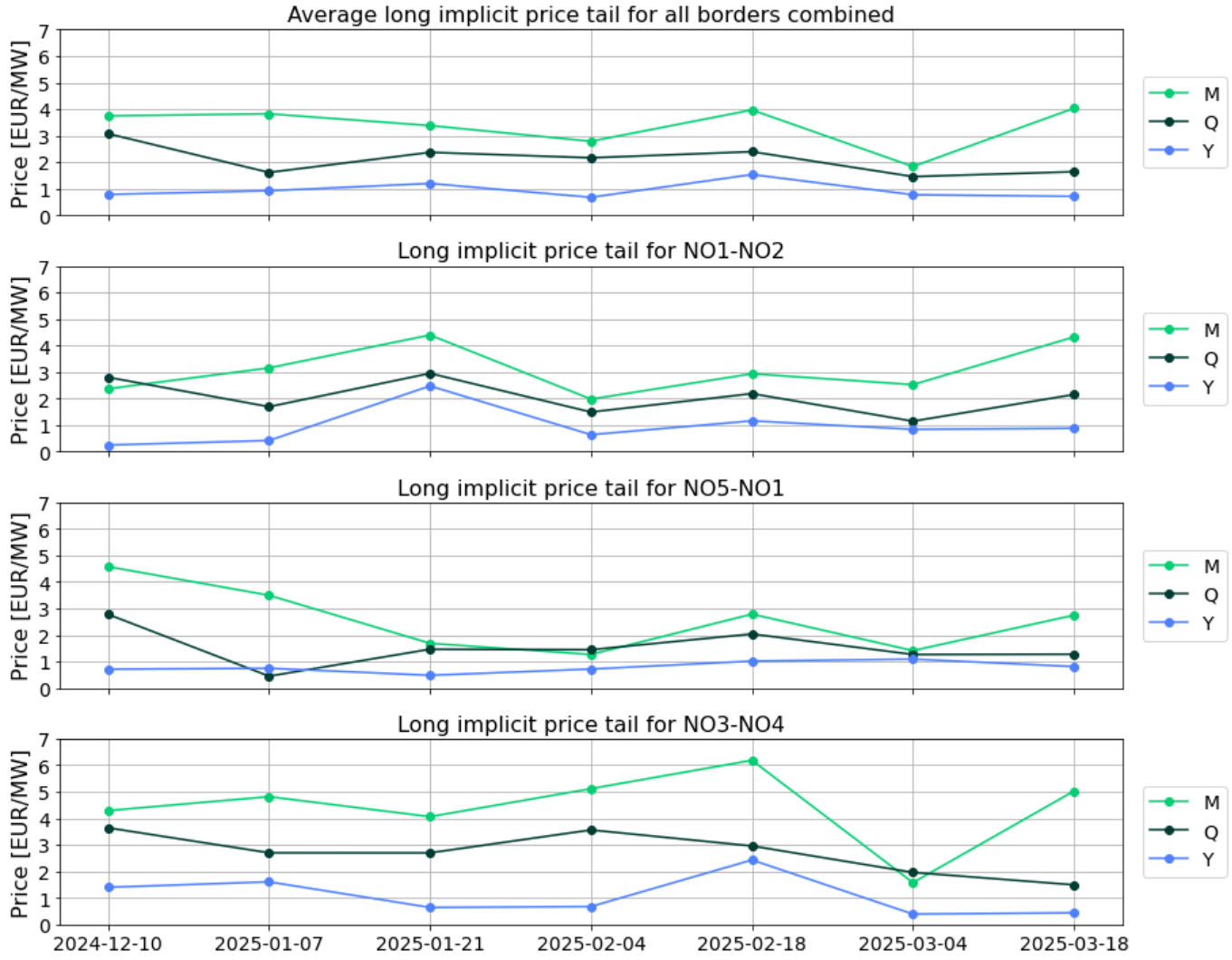

Figure 6: Long implicit price tail per monthly (M), quarterly (Q) and annual (Y) contract for all borders, and the average for all borders combined to the top of the plot. Data source: Nord Pool.

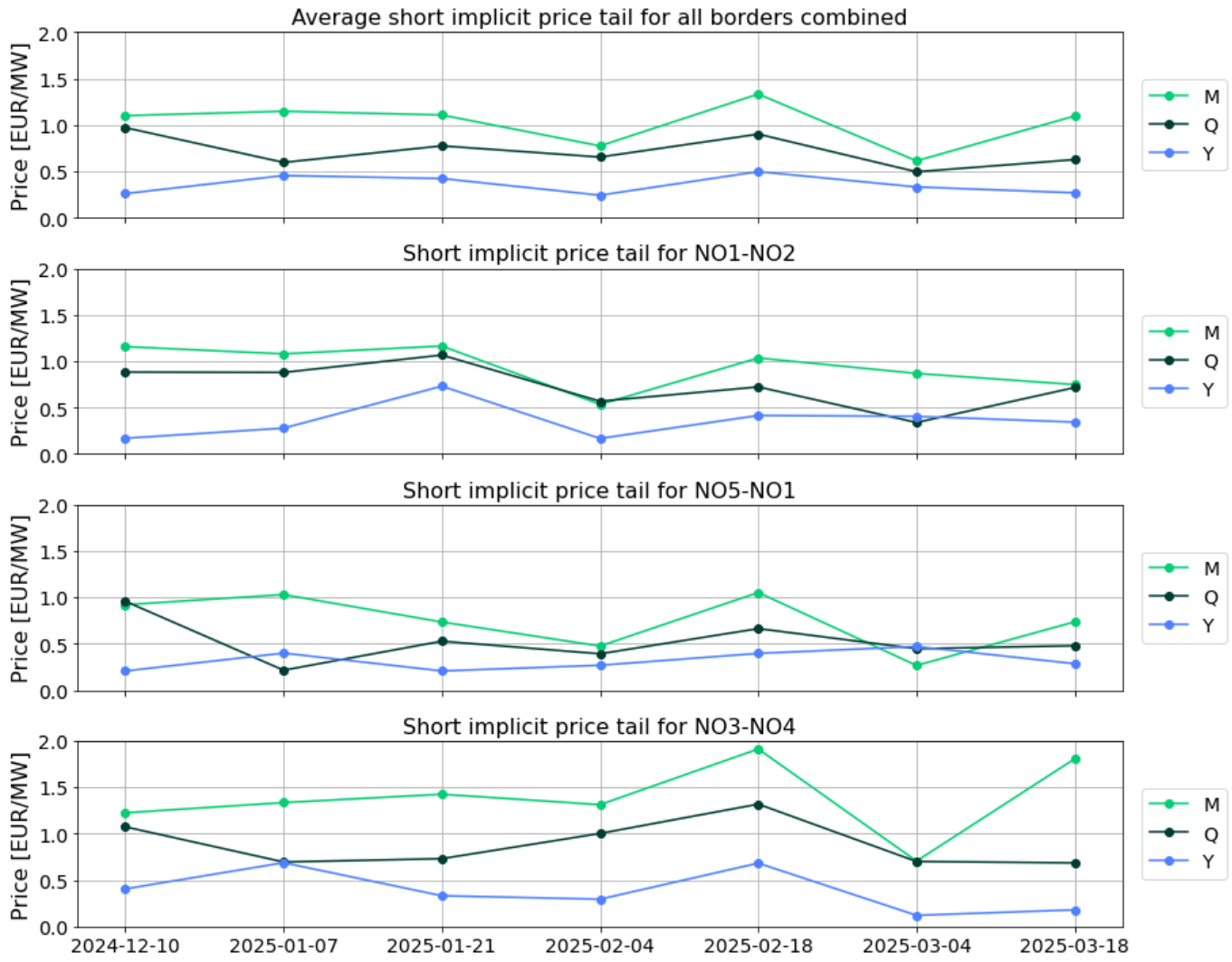

Figure 7: Short implicit tail per monthly (M), quarterly (Q) and annual (Y) contract for all borders, and the average for all borders combined. Data source: Nord Pool.

As shown in Figure 6 and Figure 7, the monthly contracts have the highest implicit price tails. Like the bid-to-cover ratio, this is partly a result of the higher offered volume for the monthly contracts. A decline in the long implicit price tails is observed for the monthly contract for the NO5-NO1 border. However, it is still too early to identify a clear trend for the different contracts and whether the implicit price tails are declining.

Friction costs

The participants submit separate orders for all borders and contracts. As a result, a price difference will often occur between the NO1 buy and NO1 sell contracts. This is referred to as a friction cost.

Friction costs can also be considered as a measure of liquidity. High friction costs indicate low liquidity and poor price formation. Ideally, friction costs should be as close to zero as possible. Even though the highest friction cost per auction occurred in the first one, it is still too early to conclude whether the friction costs have declined. As shown in Figure 7, friction costs declined from the first to the fourth auction but have risen since then.

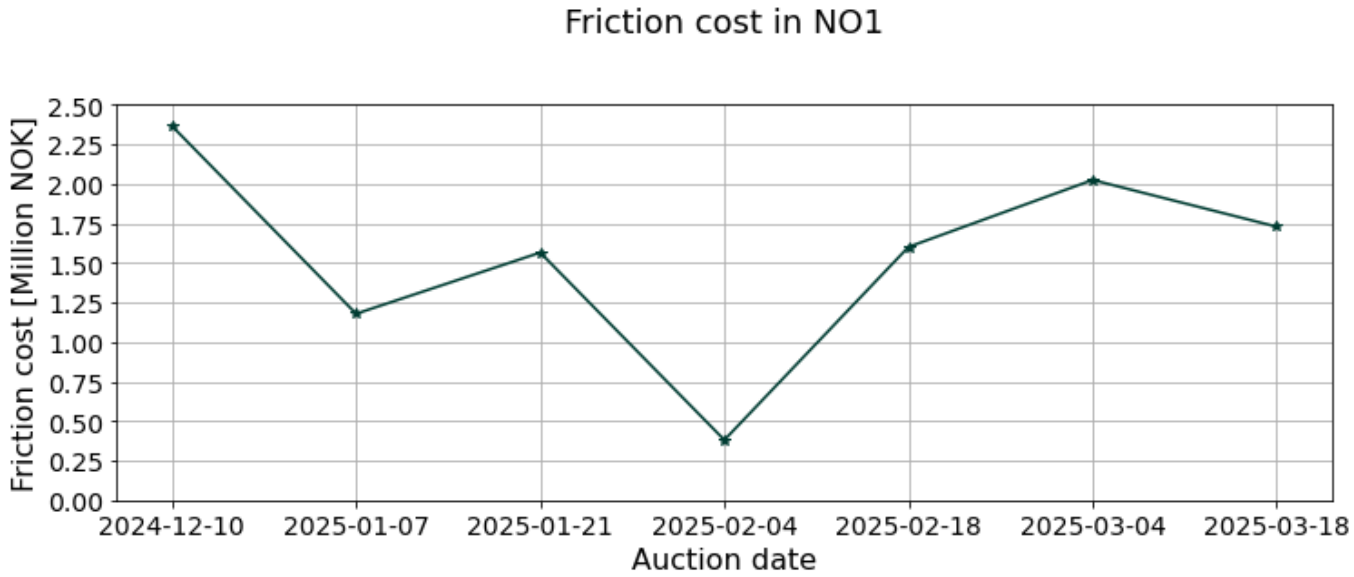

Figure 8: Friction costs in NO1 from the borders NO5-NO1 and NO1-NO2 for each action. Data source: Statnett.

Closing price and auction price

As mentioned previously, the liquidity in the continuous EPAD market has been low for many years, but an increase was observed in autumn 2024. As a result, the auction price usually sets the price in the continuous market. As observed in Figure 9, the prices in the EPAD auctions usually establish the price in the continuous market for the following trading days. This is particularly evident in the bidding areas for Southern Norway (NO1, NO2 and NO5). In the northern areas, the closing price in the continuous market changes more rapidly, particularly for NO3.

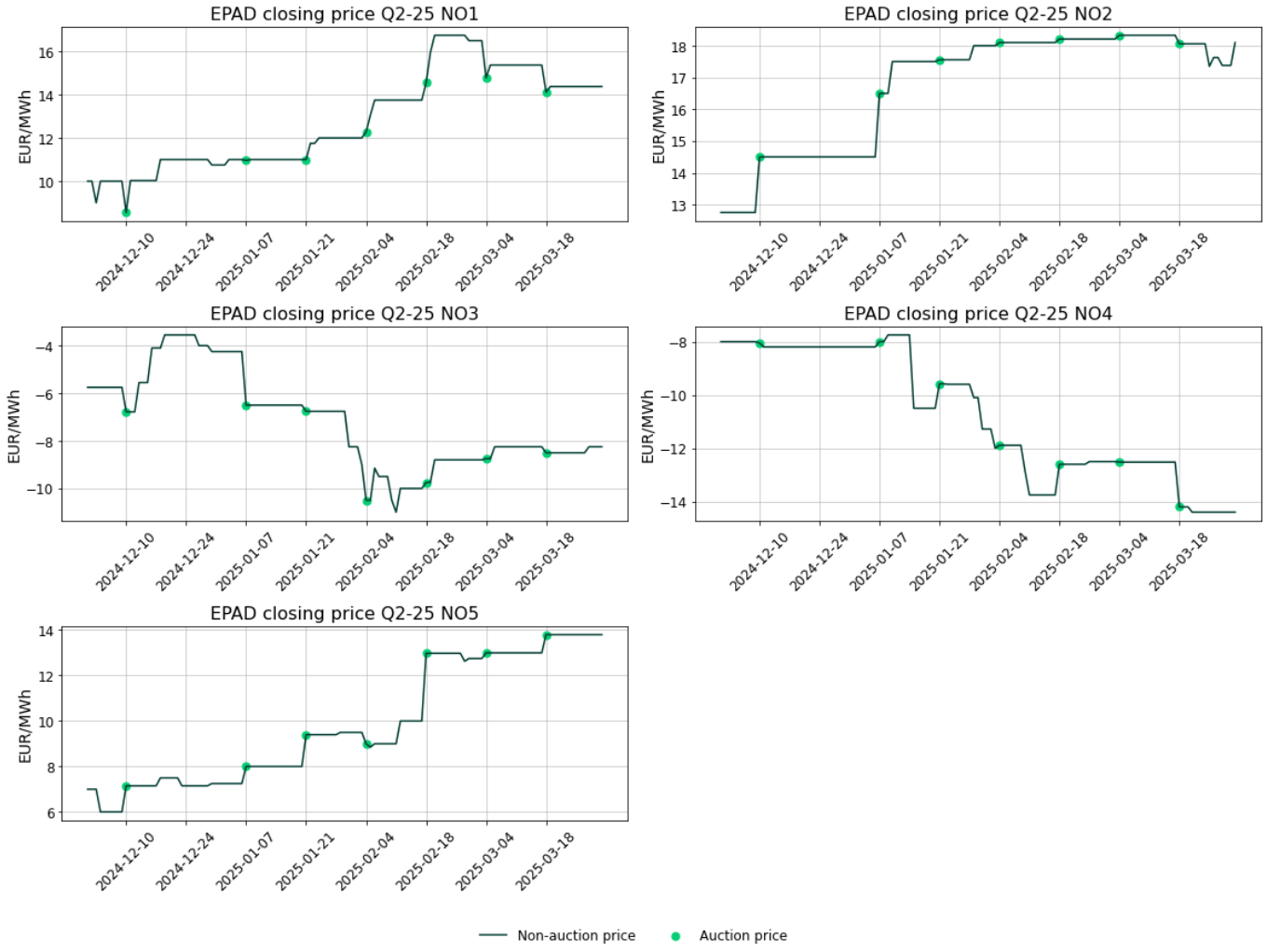

Figure 9: Closing price and auction price for EPAD Q2-25 contracts. Data source: Nasdaq Commodities, Nord Pool.

Appendix

Interpretation of the auction results

When participants submit their bids, the buy orders are sorted from the highest to the lowest bids, and the sell orders are sorted from the lowest to the highest bids. The highest price on the buy curve is referred to as the maximum buy price, and the lowest price on the sell curve is referred to as the minimum sell price, as shown in Figure 10. The volume at which the intersection occurs is referred to as the maximum volume. The intersection occurs at the last point where Statnett's buy price is equal to or lower than the sell price. In other words, it is the last point where the buy curve is higher than or equal to the sell curve. This is the maximum volume according to the auction criteria.

However, Statnett offers a specified volume for each contract and border, which can be found in the auction calendar.[5] If the maximum volume is higher than the offered volume, the marginal prices, i.e., the buy and sell prices for the contracts, will match the prices at the point for the offered volume. If the maximum volume is lower than the offered volume, the marginal prices will be the buy and sell prices at the point where the auction criteria are met.

Bid-to-cover ratio

As described in the Results section, the bid-to-cover ratio is a measure of oversubscription in the auctions and describes the relation between the accepted volume and the curves to the right of the marginal price. The bid-to-cover ratio is adjusted for the auction criteria, and is based on the maximum volume, not the last point on the curves. Hence, the bid-to-cover ratio is defined as:

$$bid - to - cover\ ratio = \frac{V_{max}}{V_{offered}}$$

Where V_{max} is the maximum volume according to the auction criteria, and $V_{offered}$ is the offered volume from Statnett.

From the example below in Figure 10, V_{max} is 135 MW, and $V_{offered}$ is 40 MW. Following the formula above, the bid-to-cover ratio is 3,375.

[5] Auction calendar: https://www.nordpoolgroup.com/49336b/globalassets/download-center/epad/statnett-epad-auction-calendar.pdf

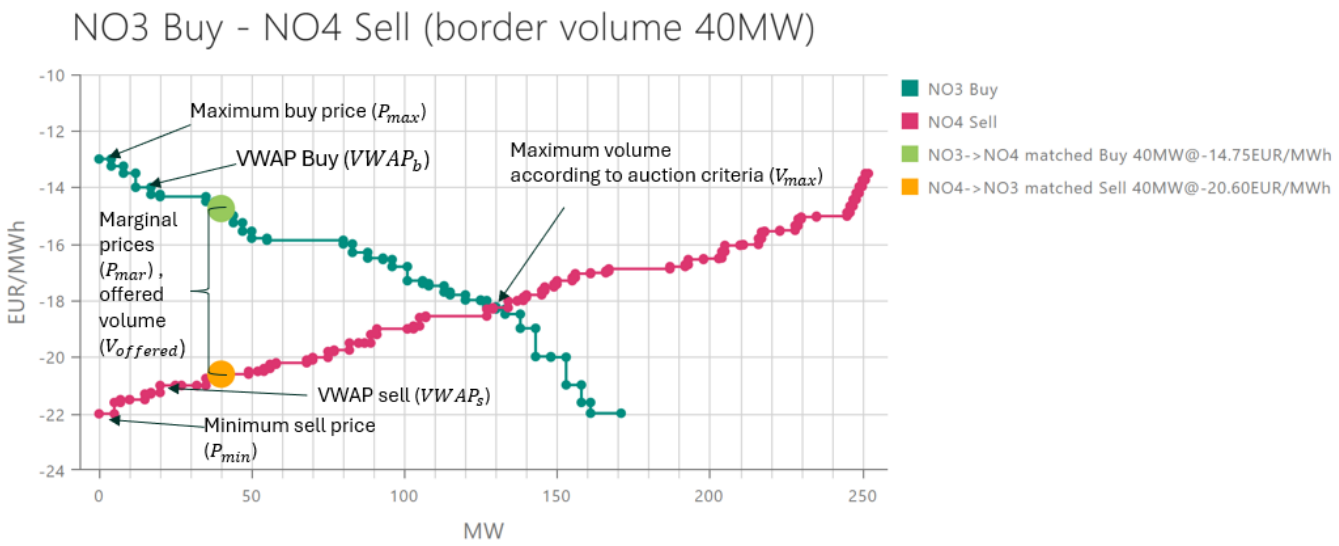

Figure 10: Illustration of result curves from the auction 03-04-2025 for the monthly NO3-NO4 contract. The curves can be found on Nord Pool's auction portal: https://data.nordpoolgroup.com/epad-auction/aggregated-bid-curves?auctionYear=2025&auctionDate=2025-03

Implicit price tails

As described in the Results section, implicit price tails describe the price formation to the left of the marginal price. As shown in Figure 10, the highest bid on the buy curve is referred to as the maximum buy price, P_{max}, and the lowest bid on the sell-curve is referred to as the Min sell price, P_{min}. One approach to describe the price formation is the difference between the maximum price on the buy curve and the marginal price.

Similarly, the same approach is used for the sell curve. However, here, the price formation to the left of the marginal price is described as the difference between the minimum price and the marginal price. To provide a more aggregated view of the price formation, the average long implicit price tail (LIPT) for the buy and sell curves for each contract and border is presented. Hence, the long implicit price tail is defined as:

$$\mathrm{LIPT} = \mathrm{mean}(\mathrm{abs}(\mathrm{P_{max}} - P_{mar_b}), \mathrm{abs}(\mathrm{P_{min}} - \mathrm{P_{mar\_s}}))$$

Where P_{max} is the maximum price on the buy curve, P_{mar_b} is the marginal price on the buy curve, P_{min} is the minimum price on the sell curve, and P_{mar_s} is the marginal price on the sell curve.

One disadvantage of the long implicit price tail is that some participants might submit a very high or low bid to increase their probability of getting a trade. This will result in a high implicit price tail, even if the majority of the orders are relatively close to the marginal price. An alternative approach is the short implicit price tail (SIPT). The short implicit price tail uses the volume-weighted average for the curve to the left of the marginal price and could be a better way to measure the price formation, since all points on the curve are taken into account, rather than just the total price difference.

The volume-weighted average price is the sum of the volume multiplied with the price, divided by the matched volume. Hence, the short implicit price tail is defined as:

$$SIPT = mean(abs(VWAP_b - P_{mar\_b}), abs(VWAP_s - P_{mar_s}))$$

Where $\mathrm{VWAP_b}$ is the volume-weighted average price for the buy curve, and $\mathrm{VWAP_s}$ is the volume-weighted average price for the sell curve.

Table 1: Matching rules in the auction algorithm.

Scenario	Rule
One border; A profitable direction exists (buy low/sell high condition is met)	Auction realized
One border; No profitable direction exists (buy low/sell high condition not met)	Auction not realized
One border; Initial sell/buy price is not fulfilling the buy low/sell high condition	A match is made at a lower volume by reducing the buy/sell side
One border; Insufficient volumes on one side	The volume is adjusted equal to the unfulfilled volume
One border; Both directions are profitable	The most profitable direction is realized
One border; Both directions are equally profitable but one has higher volume	The direction with the higher volume is realized
One border; Orders with the same prices are entered	The matched volume is proportionally split based on the respective bid volumes, accounted for maximum matchable volume
Multiple borders; Insufficient volume to fulfil all borders	The borders without profit are left out of the result
Multiple borders; Multiple profitable borders but insufficient volume to fulfil all	The most profitable border is prioritized, and the remaining volume is matched with the second most profitable border, etc.
Multiple borders; Orders with the same prices are entered	The matched volume is proportionally split based on the respective bid volumes, accounted for maximum matchable volume

Statnett

Statnett SF

Nydalen allé 33, Oslo

PB 4904 Nydalen, 0423 Oslo

Telephone: 23 90 30 00

E-mail: firmapost@statnett.no

www.statnett.no