COMMENTS ON THEMA CONSULTING REPORT

Effects of a more intraday driven market, Commissioned by NVE, dated January 2019

Summary

We welcome the report from Thema Consulting, commissioned by NVE. Pöyry Management Consulting (Pöyry) has been working on the topic of cross-zonal capacity allocation with various stakeholders since 2014. This paper provides comments from Pöyry on the topic of intraday markets and capacity allocation.

The Nordic market design has been the blueprint for Europe, introducing the concepts of bilateral trading, zonal markets and balance responsibility across a range of timeframes. These elements are now the basis of the pan-European electricity trading arrangements. Recently, with the growth in variable renewables, other European markets have moved the market design forward. Such adaptations include flow-based market coupling, shorter imbalance settlement intervals, and coordinated cross-border intraday and balancing markets; and intraday traded volumes have grown.

The Nordic (and specifically Norwegian) markets do not face such strong pressure to adapt, because of the inherent flexibility of the hydro fleet. However, the relative lack of attention to intraday timeframes means that the electricity market is unable to realise the full economic potential of the flexible capacity in trading with other parts of the Nordic region and on the interconnectors. Interconnector capacity may be (at times) committed early, limiting the potential for the hydro capacity to deliver high value flexibility to neighbouring markets, including continental Europe and soon also Great Britain.

The first part of this paper presents the need for capacity allocation between timeframes. In addition, the reworked case of the example presented in Thema's report is presented, with the opposite conclusion: allocation of capacity across timeframes – including both intraday and balancing – could have value for both market participants and the market as a whole. This illustrates that there can be economic value in enabling capacity allocation to intraday. Case examples are a powerful way of making a point, but transposing case examples into broad generalisations should be done with care.

Access to supply flexibility from other zones is gradually getting more important. Allowing more cross-zonal transmission capacity to be allocated to the intraday timeframe would help market participants balance their own portfolios within day and reduce the burden on the TSOs to resolve forecast changes. Furthermore, providing market participants with the opportunity to secure capacity at the day-ahead stage may open up for more valuable transactions later on. The next section recaps the potential mechanisms that can support the allocation of capacity across timeframes and constraining factors to be considered and studied further for the Nordic market.

Pöyry has previously proposed a mechanism for capacity allocation utilising explicit capacity rights. Recently, we have developed another potential solution for the allocation of capacity. The potential solution would achieve the desired objective of market based capacity allocation without changes in the day-ahead market, namely a regional Nordic auction with buy-back of cross-zonal capacity, and would also support the solution of other important issues faced by the Nordic market, such as 15-minute balancing periods and cable ramping. The auction concept would, as well, provide a market-based means to procure resources for balancing timeframes, as required in the balancing code. We acknowledge that introducing trading of cross-zonal capacity as a separate product

alongside energy products could be seen as a radical step and this further justifies the need for a thorough feasibility study and stakeholder process to investigate the options further.

Market design is a topic that benefits from open debate of ideas and concepts. We would be happy to discuss and present our views to both NVE and Thema Consulting, preferably also as part of a wider stakeholder debate.

The need for capacity allocation between timeframes

The use of cross-zonal transmission capacity is a crucial element the main European markets. Optimal dispatch must account for uncertainty and flexibility from other zones is gradually more important to accommodate this uncertainty. Provisions are being designed to allow more cross-zonal transmission capacity to be allocated to the balancing time-frame, but this blocks market participants from balancing their own portfolios within day and places additional burden on the TSOs to resolve intraday forecast changes. Furthermore, using capacity at the day-ahead stage may block far more valuable transactions later on. Capacity will have to be bought back to be available intraday, and at present there is no mechanism to do that.

Thema's report presents a worked example which appears to illustrate that in one case there is not economic value in passing capacity from day-ahead to intraday, but with a slight adaptation the same example can be used to illustrate a case where there is additional economic value in using the capacity intraday instead of day-ahead.

The Nordic market features a dominant 'spot' day-ahead market with high levels of liquidity, but its activity in subsequent timeframes is effectively limited to that of technical adjustment mechanisms with limited liquidity.

Since the early days of the Nordic market, the fundamentals of the electricity market have changed, with the growth of variable renewable generation reducing the quality of the input to and the relevance of the outcome from the day-ahead market. Market participants now have even greater imbalances that they have to manage. For Norway in particular, the impact of the weaknesses in the day-ahead market is not yet apparent, because of the inherent flexibility of its hydro fleet. Many other parts of Europe, including Finland and Denmark, face a need for access to flexible capacity from other areas after the day-ahead market, and the flexible Nordic hydropower generation is not able to exploit its full economic potential. Limiting the use of the intraday timeframe thus causes significant distortions to market efficiency.

The role of the intraday market is expected to be further enhanced in time, given the outlook for renewable penetration. The day-ahead market will most likely continue to have hourly resolution for the foreseeable future, and any 'within the hour rebalancing' will have to take place in the intraday market, given the choice of a 15-minute balancing settlement period. The need for market participants to balance their portfolios on a 15-minute basis must be recognised. If not, a slow, but certain erosion of the trust in the present market system will take place.

The need to consider valuation and efficient allocation of capacity across timeframes has been discussed in various parts of European legislation. The Target Model emphasises the need for effective allocation of network capacity between day-ahead, intraday and balancing markets. CACM Regulation requires, inter alia, "*optimising the calculation and allocation of cross-zonal capacity*" and "*providing non-discriminatory access to cross-zonal capacity*." The Electricity Regulation and the Balancing Code reflect similar views.

Precisely how to obtain the efficient resource allocation that everybody wants, is however not given in any of the documents.

In this context, the scope of the analysis given by NVE is too narrow. Such analyses should address market challenges in a wider European context, including changes in market design to comply with European legislation. Effects of expected changes should be analysed in context with the reasons for them, also looking at possible alternative solutions.

The intraday market will need to play an increasing role in the future. In order to improve the functioning of the intraday market, cross-zonal capacity allocation across timeframes will also need to be considered. This is addition to other topics such as gate closure time, auctions, price caps and information transparency.[1]

[1] See Pöyry Nordic Market design forum Table 10, page 45.

Figure 1 – Why capacity allocation is economically efficient – a different view using Thema's worked example as a starting point

Thema puts forward an example where the principle of ex-ante prices reflecting closer to real-time expectation collapses. They use this as a way to show that cross-zonal capacity 'reservation' only makes sense if the day-ahead and intraday markets are 'irrational', and there is consistent energy arbitrage between timeframes. We do not agree with this point of view (i.e. that cross-zonal capacity 'reservation' only makes sense if there is energy arbitrage potential between the timeframes) and have, therefore, adapted this worked example to follow this principle (ex-ante prices reflect expectation of closer to real-time prices).

The example on page 20 of the Thema report is then amended as follows: the day-ahead price is set to be equal to €55/MWh (rather than €50/MWh, reflecting the expected value of the intraday price; 80% probability of €45MWh and 20% probability of €95/MWh (We have thus removed the arbitrage potential within the high-priced zone, assuming that generators in that price zone bid up to reflect the potential of a price spike in the intraday).

This means that from a trader's perspective the expected pay off from trading at the day-ahead stage when compared to trading in the intraday is the same. Trading at the day-ahead stage implies an expected income of 10 EUR/MWh, and using the intraday timeframe yields the same result assuming a similar congestion pricing mechanism for intraday capacity is in place (this is 80%x(€45/MWh – €45/MWh) + 20% x(€95/MWh-€45/MWh = €10/MWh).

From a system dispatch and an overall economic surplus perspective however, there is a clear efficiency loss. Efficient dispatch and maximisation of economic welfare should be the key considerations. For the purposes of this analysis we will assume that the flexible unit in the low-priced, flexible zone has a 'cost' of €45/MWh. In the high-priced zone, the inflexible generator has a 'cost' of €50/MWh and the flexible unit a 'cost' of €95/MWh – in line with the Thema assumptions.

Case 1 – All cross-zonal capacity used at the day-ahead stage

a) In eight times out of ten (80%), the inflexible unit (given the system is long) can buy from the intraday market at a price of €45/MWh and avoid 'running' (i.e. all demand in the high-priced area ends up being met by partial flows from the low-priced zone).

b) In two times out of ten (20%), when the system is short and there is no cross-zonal capacity available the inflexible, expensive unit has to be scheduled in addition to the already scheduled generation (i.e. in this case there is no access to the flexible zone as no provision was made for such an eventuality).

Assuming the two zones as a single system and ignoring the change in system costs in the low priced zone (on the basis of unrestricted supply of flexibility at a given cost), the short-run system costs (assuming 1MWh of outturn demand for 80% of the time and 3MWh of outturn demand for 20% of the time for simplicity) now are 80% x €45/MWh x1MWh+20% x (€45/MWh x 1MWh+ €50/MWh x1MWh + €95/MWhx1MWh) = €74

Case 2 – Some cross-zonal capacity is 'reserved' for use intraday

a) In eight times out of ten times (80%), the system is balanced and there is no need to change position for the different generators (i.e. all demand in the high-priced area ends up being met by the partial flows from the low-priced zone).

b) In two times out of ten (20%), the cross-zonal 'reserved' capacity is used and there is no need for the expensive flexible unit in the high-pried area to be used.

Assuming the two zones as a single system and ignoring the change in system costs in the low-priced zone (on the basis of unrestricted supply of flexible resource at a given cost), the short-run system costs (assuming 1MWh of outturn demand for 80% of the time and 3MWh of outturn demand for 20% of the time for simplicity) now are 80% x€45/MWh x1MWh+20% x(€45/MWh x2MWh+ €50/MWh x1MWh)= €64

Therefore, system costs are lower in the Thema example when some cross-zonal capacity is 'reserved' for use later.

Thema then also suggests that a solution for avoiding high intraday costs arising from unexpected demand (and to complement this we would add unexpected drop in intermittent renewables) is for the system could be scheduled to be long from the day-ahead (i.e. schedule more resources than needed to account for a potential short position). This *may* or *may not* be a better outcome, and will depend on the potential access to flexibility and the relative costs.

Pöyry's solution – a market-based solution for allocating cross-zonal capacity between timeframes – does not block such an outcome, nor does it *pre-determine* that some cross-zonal capacity will be allocated to the intraday timeframe. It allows for the market to decide what the most efficient outcome is, in the same way that markets for energy allows market participants to choose the most efficient timeframes for trading energy.

Valuation and allocation of transmission capacity

Transmission capacity is akin to an option, and optionality, one of the main value components, depends on major, but very rare events. The absolute and the relative value of cross-zonal transmission capacity in the various markets (day-ahead, intraday and balancing) will vary dynamically through seasons and time-of-day depending on demand, meteorological parameters, major grid events etc. Allocating such capacity in fixed proportions between the different markets timeframes is thus unlikely to be optimal. 'Starving' the intraday market by using all of it day-ahead is definitely not a good idea.

Another option for allocating capacity between the day-ahead market and later markets is including transmission capacity between zones as explicit products in the day-ahead market. A third possibility would be buy-back of transmission capacity, either in the intraday market or in a new auction as outlined below.

The main options for capacity allocation across timeframes have been outlined and evaluated in Pöyry's flexibility market design report[2], Pöyry's response to the ENTSO-E Consultation on intraday pricing[3] and in Pöyry's Nordic market design forum[4]. The choice

[2] See Pöyry: Revealing the value of flexibility.

[3] See Pöyry ENTSO-E Intraday consultation pricing response.

of optimal capacity allocation method excluding ex-ante allocation requires a thorough technical feasibility study that should be started. The options include optimal allocation with new products in Euphemia, buy-back in an opening intraday auction and buy-back in continuous trading. A feasibility study should, amongst other things, assess compatibility of the capacity allocation mechanisms with both regulatory issues and practical elements such as Euphemia, day-ahead flow based market coupling, and XBID.

A pragmatic way forward for the Nordic market

Pöyry have been working on solutions to the allocation of capacity across timeframes for a number of years. During that time we have come up with a number of design alternatives that could achieve the objective. During our recent work in the Nordic market we have developed a new approach that should be considered alongside the established options as it could improve the situation significantly at reasonable cost. This design option should be considered alongside other allocation mechanisms in a feasibility study. Below we elaborate on two reform steps:

- introduce an auction between the day-ahead market and the continuous intraday trading; and
- include an explicit intraday cross-zonal capacity product.

New auction for portfolio rebalancing

Market functionality could to some extent be improved by changing the timing and granularity of the day-ahead auction, but such reforms would be complex and time consuming. With an hourly day-ahead market, introduction of 15-minute balancing (as is already decided) will increase intraday trading further. In a continuous market, both resource and cost could be questioned, in particular for the numerous, rather small and very similar transactions needed for reconfiguring all portfolios in the system.

To provide means for effective adjustment of day-ahead commitments, we suggest investigating the introduction of an auction with 15-minute products after day-ahead closure. This should preferably be a single auction each day, since repeating auctions for the same hours would increase the risk of market abuse and should be avoided. This auction will cover most of the new needs for rebalancing created by changing market structure without competing with the day-ahead market. We do not see any reason to fear that the trading in this auction will come at the expense of the pricing quality of the day-ahead market.

Such auction should be regional, covering the Nordic area and the interconnectors to neighbouring countries, and should if possible be coupled with similar auctions in those countries. It would however not only cover the need for rebalancing. In Norway, such market could be used as a market-related method for ramping of HVDC cables and countertrade related to congestion. Furthermore, as we will show below, introducing transmission capacity as a product would facilitate the release of transmission capacity from TSOs, give market-based allocation of transmission capacity between timeframes and integrate the procurement of balancing resources for TSOs and DSOs with other parts of the wholesale market.

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4 See Pöyry Nordic Market Design Forum report.

Transmission capacity as an explicit product

The THEMA Report 2014-32 (Reservation of cross-zonal capacity for balancing services), published by NVE in December 2014, discusses the crucial theme in in the context of market reform, and concludes as follows in the summary:

> "Exchange of balancing services is likely to reduce the cost of electricity market operation significantly. To fully reap the potential benefits, cross-border capacity must be reserved for exchange of balancing energy in real-time operation. The design of the reservation procedure is crucial for the efficiency of such reservation. The efficient solution implies simultaneous co-optimization based on real bids in the markets for day-ahead energy and balancing services, hourly reservation, harmonization of balancing product definitions, and flexibility to adjust the solution in the intra-day market. Co-optimization via explicit transmission capacity auction and market-based reservation are not likely to provide efficient solutions. The potential value of reservation cannot be based on historical balancing and day-ahead prices as both increases in cross-border capacity and exchange of balancing services are likely to affect prices in both markets. In addition, the electricity market transition is likely to increase the cost of balancing and the value of exchange of balancing services between markets."

We agree with the conclusion, in particular we support the notion that a simultaneous co-optimisation of energy and transmission products in all markets between day-ahead and balancing is necessary. We also agree with Thema that ex ante reservation of a certain share of the capacity for the intraday market is not a particularly good idea. The value of transmission capacity varies dynamically, and a market-based solution for such allocation is required. The 2014 Thema report mentions the need for adjustments in the intraday market. This seems to be lost in the 2019 report. We try to bring the discussion one step further by providing a concrete proposal on how to do it.

At present, TSOs are allowed to reserve cross-zonal capacity at no cost to make sure that there is enough balancing capacity for supply security, whereas market participants (BRPs) have no way of securing cross-zonal capacity. Optimal resource allocation will only be possible if there is fair competition between BRPs and TSOs for this capacity. To establish market-based allocation of transmission capacity between timeframes we are thus looking for a mechanism that exposes BRPs and TSOs to the same cost of cross-zonal transmission capacity in all relevant markets. Furthermore, such capacity has to be defined as a single composite product that can be traded and held between timeframes by both TSOs and BRPs and then used in subsequent markets. Only in this way will a market contribute to consistent valuation and allocation along the time axis.

Cross-zonal transmission capacity is by nature an option, with a value element (=optionality) on top of the value of the underlying (= the difference between zonal prices). The optionality element will be visible as a difference between the value of the composite product and the net value of its components. A generator of wind power in a zone with a general shortage of flexible power would be concerned that an unexpected reduction in wind would expose him to a high imbalance cost. He would be willing to pay an insurance premium to limit the upside of that cost. Similarly could a potential provider of up regulation resources be willing to pay something to get an option to supply in such eventuality.

Buying on one side and selling on the other side of a zonal border, paying the difference between zonal prices is a traditional countertrade used by TSOs to manage congestions. Defining countertrade as a composite product will make buy-back of capacity easier for all involved parties. Balancing resources are options that TSOs have to reduce or increase generation or consumption in specific zone. In the future, the procurement of manually

activated balancing resources will be integrated into the intraday market. With cross-zonal transmission capacity options, the market will be much more effective.

Hoarding of capacity could potentially be an issue. We therefore assume that a strict use-it-or-sell-it policy is implemented: All cross-zonal transmission capacity held by a party should be bid into the market and available for other parties at a price.

Next steps

Improving the market by introducing trading of cross-zonal capacity as a separate product alongside energy products could be seen as a radical step, and would require thorough processes: Investigating further if it is a good idea, formulating concrete proposals, involving market participants, performing market test, etc. Both Euphemia and XBID are to some extent prepared for explicit capacity products, and investigation has to be made.

A prime candidate for a market test would be one of the three main HVDC cables out of south-western Norway. A separate auction after day-ahead closure for transmission capacity to be used in the subsequent intraday market should be considered.

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