

Nordic Market Design Forum – Feasibility study

Executive summary

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EXECUTIVE SUMMARY

Background to the study

The Nordic power market is the world's oldest and most successful international power market. The market design was far-sighted and has lasted for two decades with limited change, while adapting to new zones. It has all the features of an effective market: liquidity, trust, diversity, transparency and growth; with a range of derivatives traded around the main spot market. The market covers four currencies, three synchronous electricity systems, and a broad range of technologies including reservoir hydro, nuclear, conventional thermal, biomass and wind generation; which brings shared welfare benefits. In recent years the market has expanded to include the Baltic region. Its success is recognised worldwide, and the underlying market design is the basis for the European Target Model, encompassing a day-ahead price coupling action, continuous intraday trading and a close-to-real-time balancing market.

Despite its success, the Nordic market design is showing signs of stress. Structural changes – including increasing wind generation, a growing energy surplus, the retirement of thermal capacity, and increasing interconnection with the continent – introduce complex, interlinked challenges.

Flat and low prices as well as a shortage of flexible generation assets put pressure on the Nordic market design and drive the need to refine it further. Finland and Sweden have a strategic reserve, which may be at odds with the stated philosophy of an 'energy only' market design. In view of the new challenges, the Nordic intraday market is underdeveloped and there are different detailed arrangements for reserve and balancing products in each Nordic country. Markets for non-frequency system services are generally immature.

The Nordic market has faced stress in recent years with low price levels, and needs to adapt to the changing circumstances, in particular replacing flexible thermal electricity generation with renewables and incorporating decentralised technologies. The Nordic region is expected to maintain an energy surplus into the future, implying that the markets for imports/exports to the Continent and Britain need to be improved. Furthermore, bringing more of the flexibility in demand side assets into the market and imperfections in Nordic market design that prevent the efficient flows of electricity in the region also need solving. The contribution of this report is to propose regional solutions to these regional challenges.

The work presented in this report has been sponsored by a group of 10 clients representing a broad coalition of Nordic market participants¹. The group has worked together to define the overall package of proposals in this report. From the perspective of the group, the market design concepts in this report are directionally correct both in terms of the plan and vision for Nordic market design and also in terms of priorities. The detailed market design proposals need to be clarified and further developed.

¹ Study participants included: Dansk Energi, DONG Energy, Energinet, Elering, Fingrid, Finnish Energy Industries, Fortum, Statkraft, Energi Norge, Vattenfall. Stakeholders present as observers at the workshops included OED (Olje- og energidepartementet) and Energistyrelsen.

Vision for the Nordic market design

Early discussion in the region revealed a strong desire among most stakeholders to continue with the principle of **energy-only market design**. The motivation for the proposals detailed in this report therefore centres upon maintaining these **principles**, and strengthening their **implementation**, evolving the design of the market to be better aligned to the challenges of today and the future. It is this route that we advocate as the vision for future electricity market design in the Nordics.

The Nordic market design should:

- § support system operation;
- § empower consumers;
- § send correct and reliable price signals for efficient resource allocation; and
- § support innovation and the incorporation of new technologies into the market.

The role of the market should also increase. The Nordic market design vision described in this report would give the Nordics an opportunity to be a **first mover in providing a high level of security of supply in a market-based and cost-efficient way**, and incentivises innovation and investment where needed. The role of the market in balancing timeframes would also increase. Overall, the vision will deliver **an efficient and competitive Nordic electricity market, thereby minimising the need for political and regulatory interference**.

Now is the right time to sharpen the core Nordic market design so it is fit to meet the coming challenges. The Nordic TSOs are finalising their solutions paper, and the report from Jorma Ollila's investigation calls for a renewed effort of Nordic co-operation in the Nordic energy sector. The proposals in this report support both initiatives and have been defined so that they are aligned with the vision for the Nordic market and implementable by 2020 with a visible impact by 2025.

Achieving the vision for the Nordic market design

A scoping study prioritised mutually reinforcing areas of market design to enable the Nordic market to adapt to meet the vision set out above.

The proposals start with pricing for balancing energy, which is the ultimate real-time market. Energy prices in all other timeframes should reflect the expectation of the real time energy price. The underlying philosophy is to ensure that balancing prices may be formed freely, reflecting scarcity where appropriate; and that this will drive expectations and forward contract values. Where the resolution of the imbalance settlement period requires additional services to be defined, these should be delivered and remunerated in a way which is as market-based as possible. Strategic reserve should be organised in a way which minimises market distortions. In all cases, our work is exploratory and qualitative, and any specific reform proposal merits a more formal assessment and cost benefit analysis before implementation.

The following pages summarise the market design proposals in the order below:

- § real time price signals that support system operation and market functioning;
- § an enhanced intraday market better equipped to facilitate the market functioning;
- § system services that are adequately rewarded and similarly compensated across the Nordic market;

- § a common Nordic market design and implementation of strategic reserve;
- § further considerations for market design development;
 - these were considered to be of potential relevance for the future but not a priority in the near term;
- § roadmap for implementation of the next steps of the market design proposals; and
- § the creation of an enduring market design forum to monitor progress and drive the change.

The proposals should be considered part of an overall consistent reform package. However, we consider that most elements are likely to be beneficial in their own right and may – if necessary – be implemented in isolation or as part of a more narrow reform programme.

Real time price signals that support system operation and market functioning

The proposals support the evolution of correct real time price signals, even in scarcity situations, to better support market functioning; robust real time price signals are a pre-requisite for better functioning markets in other timescales. Sharper price signals during times of scarcity are a key element of the energy-only market functioning properly. Increased transparency, shorter lead times and lower barriers for entry make it easier for market participants and allow a wider range of resources to support TSOs in system balancing.

Table 1 – Proposed changes for balancing and imbalance market design

Proposed change	Description
Single price for imbalance settlement	Move to single-price and single portfolio imbalance settlement
Adjust price caps in the balancing market to reflect Value of Lost Load	Raise the price cap in the Nordic Regulating Power Market from 5,000 EUR/MWh to better reflect Value of Lost Load (this price should be higher than the Intraday price cap)
Estimate any lost load in the imbalance position of the BRPs and the marginal imbalance price	In the event of involuntary load curtailments, any lost load should be estimated and included in the imbalance positions of individual BRPs and the calculation of the system imbalance volume and the marginal imbalance price
Remove direct link between balancing, imbalance prices and day-ahead prices	Remove the condition that the day-ahead price sets the floor for the up-regulation price and the cap for the down-regulation price, and consequently for imbalance prices (except as a backstop price in the event that there are no balancing trades, and if an intraday price cannot be used)
Include balancing energy exported outside the Nordics in balancing price formation	Whenever balancing energy is exported from one of the price zones in the Nordics to a price zone outside the Nordics, the exported energy should be included in the marginal price formation for balancing energy as is currently done with imported balancing energy (similarly as in day-ahead price coupling)
Remove obligation on BRPs to balance	Remove any balancing obligations at the day-ahead and any other stage, better allowing the market to support system balancing
Publish information on system imbalance and balancing and imbalance prices in real-time	Balancing activations and prices should be published as close to real-time as possible, which serves as an indication for imbalance prices to guide behaviour of market participants
Balancing market gate closure closer to real-time	The gate closure to submit bids to the Regulating Power Market should be moved as close to the operating hour as possible
Balancing market minimum bid size to 1 MW	Reduce the minimum bid size in the balancing market to 1 MW and take electronic activation into use

An enhanced intraday market better equipped to facilitate the market functioning

The proposals for the intraday market will give market participants a better platform to trade into balance closer to real time. Taken together, the changes support effective intraday markets, the valuing of flexibility in different market timeframes and forward trading of flexibility products. In the Nordic market, rapid load and flow changes between hourly day-ahead blocks create disturbances in system frequency. Today, this ramping challenge is solved through requirements placed on the generators and on maximum hourly flow changes on DC links. The ID market will have an important role in bridging hourly commitments to 15-minute imbalance settlement², enabling to solve the ramping challenge of cables and stabilising system frequency at hour changes within the market.

Table 2 – Proposed changes for the intraday market design

Proposed change	Description
Intraday auctions	<p>§ A single opening auction on day D-1 (no later than 3pm CET) for all market time units for the following day as close as practically possible to the setting of day-ahead prices and recalculation of available capacities. The auction should use 15-min products.</p> <p>§ Continuous trading from the resolution of the opening auction until the gate closure time of the ID market, which could be combined with a closing auction (subject to further consideration).</p>
Intraday gate closure time (GCT) as close to real-time as possible	<p>§ The regional cross-zone intraday GCT in the Nordics should be as close as to the operating hour as possible, using 30 min as a starting point.</p> <p>§ Shortening the GCT for ID trading should ideally be accompanied with change to the deadline for submitting production plans.</p>
Information transparency between market participants and TSOs	As market participants trade closer to real time, greater transparency is needed. Market participants should provide the TSO with detailed, up to date information. TSOs should provide up to date, consolidated data on the overall system position.
Price cap in the intraday market	In line with the change to the balancing market, the price cap in the intraday market should be set to better reflect the value of lost load (9999 EUR/MWh as outlined in the all NEMO proposal ³).
Allocation of cross-zone capacity across market timeframes through an explicit cross-zone capacity product	Start a process to find a method to allocate cross-zone capacity across market timeframes, opening up intraday trading between price zones. This report contains a proposal by Pöyry for a dynamic market based approach. There are alternative (less complex) solutions which may be workable, perhaps as transitional measures. We recommend this topic for further exploration.

² The day-ahead market is, for the time being, expected to remain with hourly time resolution, and balancing to move to 15-minute resolution.

³ All NEMO's proposal for harmonised maximum and minimum clearing prices for Single Intra Day Coupling in accordance with Article 54(2) of Commission Regulation (EU) 2015/1222 of July 2015 establishing a guideline on capacity allocation and congestion management. 14 February 2017.

System services that are adequately rewarded and similarly compensated across the Nordic market

The objective for market design around non-frequency system services is to move away from the 'obligation, no payment' approach which is currently in place for some of these services, and move towards a more market-based approach for all services, as far as this can be made workable.

As thermal capacity is operating fewer hours or is decommissioned, the supply of different system services reduces. This means that services, which were previously considered as 'automatic' by-products of electricity generation, might become scarce. New technologies with different performance parameters to incumbent technologies will enter the system – incentives to provide reserves and other system services will also need to be accessible for these sources.

Table 3 – Proposed changes for system services market design

Proposed change	Description
Remove requisitioning of services without remuneration through supply and grid connection conditions	Wherever generators are required to provide system services without remuneration or at below market rates, there should be a transparent needs assessment to establish whether there is a demand for the service in the system. If there is, a market-based procurement approach should be developed as far as possible. At minimum, there should be a regulated remuneration and equal requirements for all technologies.
Level playing field between TSOs and market participants providing the same services	Service providers should compete with any TSO assets providing system services on an equal footing. Minimum requirement is to increase transparency on the system, cost levels of TSO assets and market participant compensation when they are providing the same services as TSO assets.
Marginal pricing of availability fees of reserve products	Marginal pricing should be used for pricing the availability fees of all reserve products (FCR, aFRR and mFRR).

A more Nordic market design for strategic reserve that does not distort market price signals

If Nordic cooperation works well in tight supply situations, the market should be able to cope. Peak load constraints should also be manageable with the development of price signals, grid development and ordinary market operations. In the absence of effective demand side response, strategic reserve could be necessary as a transitional measure. Given that peak load reserves exist, regulators and TSOs should see these resources as together across national borders and use them in a way that distorts the market as little as possible. To ensure that the rules governing the activation and pricing of this strategic reserve do not have a distorting effect on energy market prices, we have identified a set of recommendations for the market design of strategic reserve in the Nordics, which stops short of recommending its abolition. Strategic reserve may have a role to play in minimising the impact of political intervention in the market which could be a result of involuntary scarcity arising from a market with poor demand side participation.

Table 4 – Proposed changes for strategic reserve

Proposed change	Description
Activation and pricing principles to better reflect the value of avoided scarcity	Activation of the strategic reserve should happen in the last market possible, the regulating power market, even if the capacity requires a longer warm-up time and the notification for a start-up is given earlier. If the strategic reserve is actually used to solve an energy shortfall, and not only warmed up, the activation should be reflected in imbalance prices at Value of Lost Load (e.g. balancing market price cap).
An explicit target level for power adequacy to define the dimensioning of strategic reserves	The size of strategic reserve should be defined, based on: <ul style="list-style-type: none"> § an explicit target level of power adequacy based on the Value of Lost Load (VOLL, EUR/MWh); § cost of capacity (EUR/MW per year); and § a probabilistic analysis on Expected Unserved Energy (EUE, MWh/a).
Regional cooperation to utilise strategic reserves more efficiently across countries and transparent protocols to handle scarcity situations	Adequacy assessments should be done on a regional basis and based on a common methodology. Strategic reserves in different countries should be seen together and considered as a common strategic reserve, including harmonised activation principles. The Nordic TSOs should have coordinated and transparent protocols to handle scarcity situations and how cross-zone flows are managed these situations.

Further considerations

In addition to the market design proposals mentioned above, the study also identified concepts deemed by the study members to be of potential relevance for the future but which were not considered to be a priority in the near term.

Table 5 – Further considerations

Balancing and imbalance arrangements	§	Scarcity adder and pricing;
	-	Inclusion of reservation costs in balancing and imbalance pricing; and/or
	-	Administered scarcity price function or adder;
	§	Combining aFRR and mFRR activation prices into a common merit order; and
	§	Increasing the role of market participants in reserve procurement and provision
System services	§	Granular reserve products;
	§	Inertia and/or the need for faster responding frequency containment reserves; and
	§	Nordic FCR-N market
Strategic reserve	§	Deeper Nordic cooperation to further reduce the size of strategic reserves and improve policies, criteria, and procedures for procurement
	§	Demand-side participation

There are additional areas to address that we consider important for the vision of future Nordic market design including forward trading timeframes and TSO incentives.

Implementation of proposals

Next steps to implement the market design concepts in this report

This study focuses on pragmatic changes to Nordic market design that can be implemented by 2020 with a visible impact by 2025. The next steps for implementation are outlined in the table below.

Figure 1 – Next steps to implementing the market design concepts

Topic area	Next steps	Comments
Proposals for balancing and imbalance	<p>Input to Nordic TSO projects on full cost balancing and reducing minimum bid size</p> <p>Input to balancing market co-operation between Nordic and Baltic markets</p>	Main dependency is on integration of balancing markets and settlement rules under Electricity Balancing Guideline and Nordic-Baltic markets
Proposals for intraday	<p>Start a Nordic process to implement ID market improvements</p> <p>Input to Nordic TSO finer time resolution project</p>	<p>Main dependencies: start of XBID in 2018 and ENTSO-E proposal on ID capacity pricing</p> <p>Transitional arrangements – pilots for ID auctions and or cross zone capacity allocation</p>
Proposals for system services	<p>Start a Nordic process among stakeholders to look at system services</p> <p>Input to further development of Nordic aFRR and other system products</p>	Main dependency is the implementation of the clean energy package; how services should remunerated and TSO ownership of assets
Proposals for strategic reserve	<p>Input to Nordic TSO project to harmonise activation rules</p> <p>Process to harmonise methodologies and principles of co-operation</p>	Main dependencies are ENTSO-E work on a common methodology for security of supply and Commission view on CRMs

A Nordic forum should be established to progress Nordic market design

In order to monitor progress and push forward the ideas presented in this report, a Nordic forum should be established with a remit to promote and drive forward Nordic market design

- § The forum should bring together ministries, market participants and financiers, regulators, power exchanges and TSOs as well as other appropriate entities such as the EU Commission. The forum should include representation from the Baltic markets.

- § The purpose of the forum should be to promote common discussion and implementation of solutions to regional market design challenges.
- § The remit of the forum should be to initiate regional discussion of market design issues and drive development of the regional electricity market.

We see the forum proposed here as complementary feeding into the policy-level forum proposed by Jorma Ollila⁴ on topics related to electricity market design as the vision also requires action from the political level i.e. complementary energy policy to enable the market design to work.

As a concrete task, the market design forum would monitor progress on implementation of the market design changes outlined in this report, alongside other topical market design issues. The forum would update the list of market design topics as new information came to light and proposals are made for investigation. The forum would also serve as a platform where different national initiatives could be brought together and discussed.

⁴ The Ollila report can be downloaded from: <https://tinyurl.com/y7cqjggl>.

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