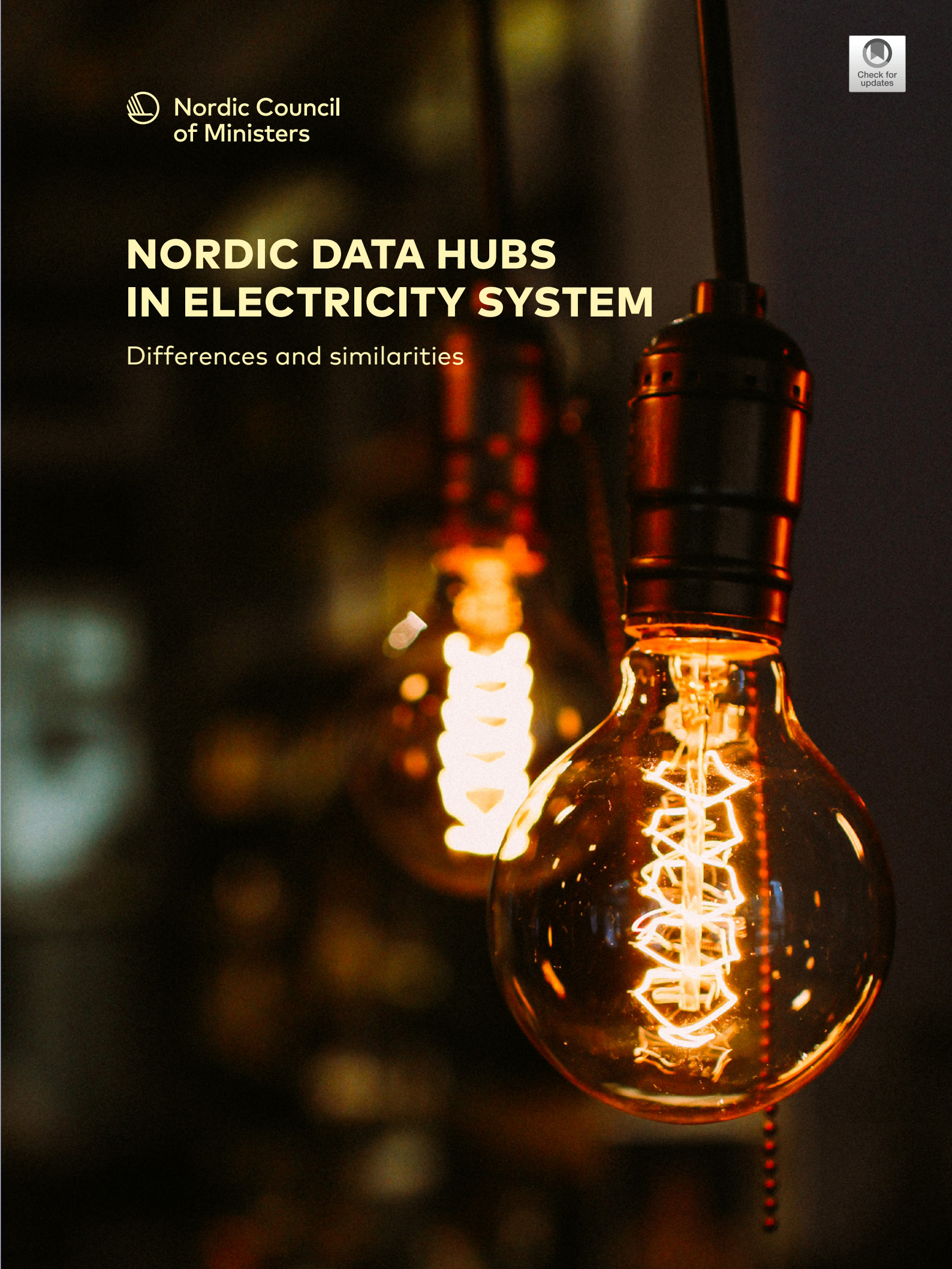
Nordic Council of Ministers

NORDIC DATA HUBS IN ELECTRICITY SYSTEM

Differences and similarities



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Executive Summary

Background and objectives

The Nordic[1] ministries and regulators aim to harmonise the electricity retail markets to reduce market entry barriers for retailers from the other Nordic countries, hence promoting competition and customer choice and reduced costs of operating in different national markets. Nordic Energy Research, on behalf of the Electricity Market Group, gave THEMA Consulting Group the task of analysing how the datahub projects can support the harmonisation process, and determine if there are recommendations regarding further adjustments of data exchange. More specifically, the study should meet the following objectives:

- Establish an understanding of the design and functionalities of existing and planned data hubs from a market, regulatory and technical perspective;
- Assess how data hubs can contribute towards more harmonised end-user markets from both a stakeholder perspective and a regulatory perspective;
- Give recommendations on the most appropriate steps to be taken regarding the role and functionalities of data hubs in order to facilitate harmonisation.

On the way to more harmonised Nordic retail markets

By proposing harmonised market rules, NordREG aims to make it easier for a retailer from one Nordic country to start operation in another Nordic country. The expectation is that these common market rules improve customer choice and reduce costs. The cost reductions can be achieved:

- By improving efficiency and economies of scale on data handling, business processes and IT systems. This includes the cost for IT systems, which should become cheaper if they are to be developed for all countries rather than being implemented specifically in each country;
- By increasing competition and further reducing margins. Reducing market entry barriers should lead to a larger number of suppliers in each country, and hence to more diverse choice for customers and more competition on price levels.

[1] For the sake of simplicity we use Nordic when we refer to Denmark, Finland, Norway and Sweden, as Iceland is not part of the scope of the study.

The NordREG recommendations cover combined billing, supplier-centric switching and customer moving, efficient information exchange, and customer interface requirements.

The datahubs currently operational (Denmark) or at the planning stage (Finland, Norway, Sweden) share many design characteristics and will all have the ability from a technical perspective to meet the requirements that have been set out by NordREG. The high-level recommendations should therefore largely be implemented as soon as the datahubs are in place. Some relevant legislation is proposed, but not yet ratified, e.g. in Sweden and Finland. Also, in Finland combined billing is not mandatory as of now.

High-level market rules are harmonised, but challenges remain

While the overall processes will be harmonised, there are differences in the detailed implementation. Some of these differences can be easily addressed, others depend on adjacent national regulation. For example, differences in supplier-of-last-resort rules affect the moving-out and supplier switch processes, and differences in the balancing settlement affect the exchange of master data. A general issue is roll-back or cancellation processes, which are not currently harmonised.

From the perspective of this study, it is sufficient if the hub processes are harmonised from a retailer perspective, because for them harmonisation is relevant if they decide to enter a new market. In a supplier-centric model, this will also harmonise the end-customer processes and lead to a more uniform end-customer experience.

To ensure compatibility, the underlying data model must be unified. That is, the data that is measured, stored and exchanged must be sufficiently similar, to allow the harmonisation of processes and data formats.

Even with full harmonisation of data exchange, other market entry barriers remain. These include the need to have a retail licence in each country, different local privacy and security laws that may apply, and local taxation rules. The datahubs do not have a natural role in removing such barriers.

It should also be noted that retail margins are already comparably small. Hence, the benefits of increased competition might be limited. This can however be different for the more immature energy services market, where the increased customer choice expected from easier market entry might be hugely beneficial.

Unified data models and hub interoperability could reduce market barriers

We see two main tasks that need to be addressed if the retail markets should be further harmonised with the help of the datahubs. We make two main recommendations in that respect:

- Establish an advisory group to identify regulatory and technical barriers to harmonisation and propose measures;
- Enable interoperability between hubs.

The advisory group has the task to identify, on a technical level, differences in processes and regulatory barriers preventing full harmonisation. The group should be run by representatives from the datahubs and supplied with other involved parties. After an analysis of the differences in implementation, the group should propose a common data model and harmonised processes based on this data model. This group should also highlight regulatory boundaries that limit further harmonisation, and propose changes. The final decision nevertheless has to be taken by the national regulatory authorities.

In parallel, the datahubs should strive for interoperability, ideally to reduce the number of interfaces to only one, independent of the number of markets a retailer is active in. With hub interoperability, we primarily refer to forwarding of messages between data hubs, so that a retailer could initiate a supplier switch in his local hub, even if the metering point is in another country. This would minimise the market entry barriers. There are, however, relevant challenges associated with this approach: if the underlying data model is not sufficiently similar, such a translation might be impossible. If errors occur, the retailer might contact the local hub and not the hub of the country where the error originated. Hence, a thorough analysis should be performed before this approach is taken. In addition to quantifiable costs and benefits, possible improvements of the end-user experience, for example combined billing, should be analysed. Further harmonisation of the process definitions also makes it easier to enable hub interoperability, hence the time line of hub interoperability and process harmonisation measures is relevant.

1. Introduction

1.1 Background

The Nordic countries are currently implementing supplier-centric market processes and datahubs, as part of the work towards harmonising the Nordic electricity market. Under NordREG's vision, all Nordic electricity customers enjoy free choice of suppliers and energy service companies, efficient and competitive prices, and reliable supply and energy services (NordREG, 2014a). To accomplish this, NordREG is currently working to reduce barriers to competition and to ensure that customers have the necessary tools to make informed choices and benefit from competition (Nordic Ediel Group, 2014). The harmonisation of retail market processes is one important step to improve competition, as it allows retailers from one country to easily provide their service in another Nordic country. It is, however, not the aim of NordREG and the Nordic ministries to implement a single retail market.

Over the past decade, NordREG's work has been primarily focused on the development of a well-functioning Nordic wholesale market with competitive prices. Today, the Nordic electricity market encompasses one common wholesale market and five separate retail markets. Although there is no objective to create one common retail market in the Nordic region, further harmonisation of the retail markets is needed to ensure that suppliers and third parties such as energy service companies and aggregators can operate smoothly across the whole Nordic region. Moving forward, regulatory and technical obstacles must be overcome to eliminate the biggest barriers to entry for suppliers and energy service-companies in the Nordic market. The purpose is thus to harmonise the Nordic retail markets to the degree that market players can easily operate across several Nordic countries. Moreover, NordREG (2014) states that the Nordic retail market should be the most efficient retail market in Europe, and have the highest customer service level, competitive prices and few barriers to entry.

1.2 Objectives of the report

Currently, all Nordic countries are implementing central datahub solutions with the same aim of improving market efficiency and removing market barriers. One of the hubs is operational (Denmark), while the others are at different stages of development. Nordic Energy Research, on behalf of the Electricity Market Group, has commissioned THEMA and Devoteam to carry out a study on how datahubs can contribute towards the overall objective of more harmonised rules for the Nordic end-user markets.

The following objectives should be met by the study:

- Establish an understanding of the design and functionalities of existing and planned data hubs from a market, regulatory and technical perspective;
- Assess how data hubs can contribute towards more harmonised end-user markets from both a stakeholder perspective and a regulatory perspective;
- Give recommendations on the most appropriate steps to be taken regarding the role and functionalities of data hubs in order to facilitate harmonisation.

The scope covers the datahub projects in Denmark, Norway, Sweden and Finland. These four countries are henceforth referred to as the Nordic countries, as the retail market in Iceland is out of scope of this study. While Norway, Sweden, Denmark and Finland have a common wholesale market for electricity and interconnected grids, Iceland has a separate market that is not connected to the internal European market. The study is a continuation of previous work on retail markets and market barriers, such as the study on market barriers by Vaasa ETT (Vaasa ETT, 2014).

1.3 About the report

The report is organised as follows:

- In Chapter 2, we review the status of the national retail market regulations with emphasis on the NordREG recommendations for more harmonised rules;
- In Chapter 3, we give an overview of the national datahub projects.
- In Chapter 4, we carry out a gap analysis to identify barriers to more harmonised Nordic retail markets with emphasis on data exchange and corresponding business processes.
- In Chapter 5, we analyse options for using datahubs to further harmonise retail market rules and facilitate cross-border competition, before making our recommendations.

2. The harmonised market model

In this chapter, we describe the status of the national retail market regulations in light of the NordREG recommendations for more harmonised end-user markets in the Nordic region.

2.1 Customer-oriented market processes

The Nordic countries are targeting a customer-oriented electricity model where the main point of contact for the customer should be competitive stakeholders. Under the supplier-centric approach proposed by NordREG (2014), suppliers would pass on network costs to customers in the form of combined bills, be responsible for ensuring payments of network costs, and handle the processes of switching and moving. National information exchanges (datahubs) would serve as the backbone of the supplier-centric model, and facilitate harmonisation of the Nordic retail markets.

As part of the work to harmonise the Nordic retail markets further, NordREG has identified four focus areas that should be prioritised: combined billing, supplier switching and customer moving, information exchange, and customer interface. The supplier-centric model should lay the foundation for the customer interface. Furthermore, NordREG has proposed mandatory combined billing, where the customers only receive one bill from the supplier that includes both the network tariff and the electricity consumption, instead of two (one from the supplier and one from the DSO).[2]

In 2013, NordREG published a harmonised model for supplier switching, which lays the principles for how the process should be carried out in the future. Under this model, the supplier switching process should be as easy, quick, smooth and secure as possible (NordREG, 2013). Customers in each country should have access to a neutral price comparison tool that enables them to make fully informed switching decisions, while the switching process should be supplier-centric. The DSOs and the national point of information must be completely neutral towards all market participants. Furthermore, meter readings used in supplier switching should be as accurate as possible, preferably conducted by remote reading at the hour of the start of supply. Like supplier switching, the process of customer moving should also be a supplier-centric process.

Datahubs are envisioned to serve as a centralised solution under the supplier-centric model. Since the datahubs could serve as a switchboard that carries out processes like customer moving and supplier switching, suppliers would not need to be directly in touch with DSOs for switching purposes. In addition, smart meters are

[2] We use the abbreviation DSO (Distribution System Operator) in this report to denote distribution grid companies, although the use of the term is not necessarily entirely precise.

installed or to be installed in all Nordic countries, which will provide automatic meter reading that facilitates easier supplier switching and reduced the amount of complaints. The datahubs and smart meters would also provide customers with easy access to consumption data and customised offers from competitive stakeholders.

2.2 Implementation is ongoing

The pace of implementation varies between the Nordic countries due to different prioritisation of focus areas. The processes of switching, moving and billing have been largely harmonised at a Nordic level and await to be nationally implemented (NordREG, 2016). Moving forward, Nordic co-operation on the information exchange systems will thus be particularly important. Depending on the country, the absence of data hubs, smart metering systems and supplier-centric models are considered the most important hurdles to entry by market participants (Vaasa ETT, 2014).

The table below provides a broad overview of the implementation status in the Nordic countries.

Table 1: Implementation status in the Nordic countries for NordREG recommendations

	Denmark	Finland	Norway	Sweden
Combined billing of distribution and supply	Yes Mandatory since 2016	No No legislation done or planned.	Yes Voluntary since 1 September 2016. If one DSO offers combined billing to a supplier it must offer it to all suppliers. Mandatory combined billing to be introduced	Proposed Proposal delivered from EI to the government in June 2017
National information exchange system	Yes DataHub introduced in 2013 and upgraded on 1 April 2016	Under development Datahub will be taken into use on 1 August 2019	Under development Elhub.no is estimated to be operational in Q1 2018, after the introduction of NBS*	Proposed by Ei in June 2017 Estimated to be operational in Q4 2020
Supplier-centric switching	Yes Supplier-centric since the implementation of the whole-sale model on 1 October 2015	Yes Already possible. Will be carried out in Datahub from 2019	Planned Will be changed when Elhub becomes operational	Yes Supplier-centric switching process is implemented
Supplier-centric customer moving	Yes The supplier takes of the moving processes since 1 March 2013	Yes At customer's request. Will be carried out in Datahub from 2019	Planned Will be changed when Elhub becomes operational	Proposed EI has proposed supplier-centric moving when the datahub becomes operational
Smart meters	Under development Set to be completed by 2020 (currently 1.8 million customers)	Yes Completed in 2013	Under development Set to be completed by 1 January 2019	Yes 2009
Independent price comparison tool	Yes New tool (Elpris.dk) launched in 2016	Yes Sahkonhinta.fi launched in 2006	Yes Strompris.no launched in 2015	Yes Elpriskollen.se launched in 2008 and 2016

Note: * Nordic Balance Settlement, see Section 2.2.2.

Source: NordREG, 2016.

So far, only Denmark has implemented mandatory combined billing (see 2.2.1 for further details). Denmark is also the only country that has introduced a datahub. The Norwegian datahub, Elhub.no, is under development and due to be operational in late 2018 according to the latest timetable. Finland's datahub is due to be taken into use in 2019, while the proposed datahub in Sweden is estimated to be operational by the end of 2020.

Furthermore, Sweden and Denmark have implemented supplier-centric switching processes. The customer moving process is also supplier-centric in Denmark, while the other countries plan to implement this along with the launch of the datahubs. The deployment of smart meters was completed in Finland and Sweden in 2013 and 2009 respectively. Norway and Denmark are currently rolling out smart meters, which is due to be completed by 2019 and 2020 respectively. All countries provide the customers with access to an independent price comparison tool.

2.2.1 Combined billing, supplier switching and customer moving

NordREG has suggested the supplier-centric model as the most customer-friendly market model. In comparison to the other Nordic supplier-centric models, the Danish supplier-centric model has been developed further towards a wholesale model. Since April 1, 2016, Danish customers only have one contract, which is in relation to the supplier. Hence, the DSO and the TSO sell their services to the supplier instead of to the customer, while the supplier is responsible for the customer contact and the customer-related master data. Consequently, the supplier bears the financial risk and must remunerate the DSO regardless of whether the customer pays. However, the DSO bears the risk of the customer's non-payment in the case of bankruptcy for the supplier.

The Norwegian market model can be considered as partly supplier-centric, as most market processes can be initiated through the supplier. There is an ongoing study on the implementation of mandatory combined billing in Norway. Norway has introduced a legislation that states that if one DSO offers combined billing to a supplier, which typically occurs if they are part of the same company group, the DSO must offer combined billing to all suppliers. In contrast, combined billing is usually only provided to customers in Finland and Sweden if the supplier is part of the same company group as the DSO. The Finnish model is nevertheless largely supplier-centric in practice.

Although the Nordic countries have some different regulations concerning billing and the information provided by the invoice, all countries require the companies to provide their customers with information about contractual terms, pricing alternatives and consumption data. They must also bill customers at least four times a year. Prepayment is not permitted in Sweden, while it is allowed in the other countries under certain restrictions. Article 18 of the proposed Electricity Directive (European Commission, 2016) of the EU Commissions Clean Energy Package also covers the minimum requirements for billing. Pricing alternatives are not mandated, but otherwise the requirements are similar to those in the Nordics.

Table 2: Billing systems in the Nordic countries

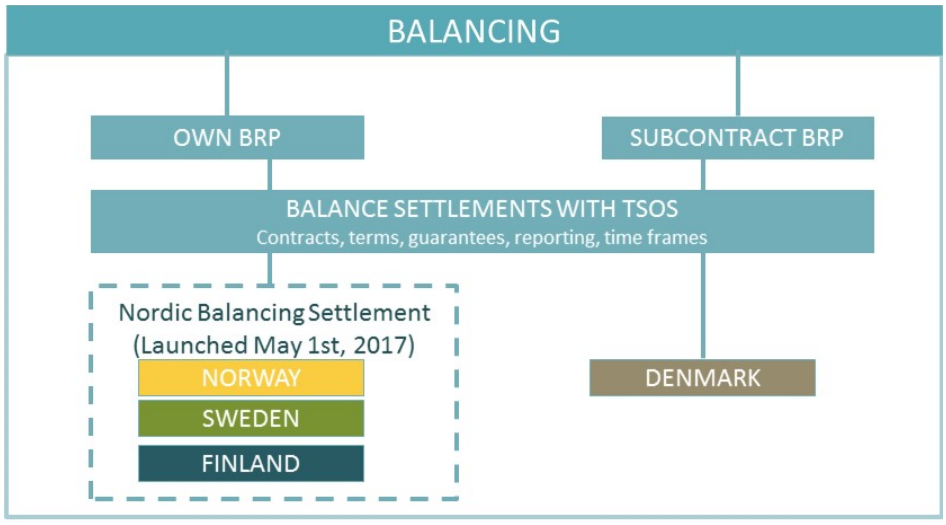
	Denmark	Finland	Norway	Sweden
Responsible for billing	Supplier	Supplier and DSO (voluntary combined)	Supplier and/or DSO	Supplier and DSO (voluntary combined)
Combined billing	Mandatory	If DSO and supplier are part of the same company group or there is an agreement between the DSO and supplier	If a DSO offers combined billing to one supplier it must offer it to all suppliers	If DSO and supplier are part of the same company group
Required format of supplier invoice	Supplier must offer a wide choice of non-discriminating payment methods	Electronic billing should be offered	No regulation	Electronic billing if requested
Billing based on actual consumption	Yes, if customer has a smart meter	Mandatory	Mandatory	Mandatory
Final invoice	Max. six weeks after termination of contract	Max. six weeks after termination of contract	General contract law applies, no specific energy regulation	Max. six weeks after supply has been cut off
Prepayment	Permitted, but supplier must specify the amount on the invoice	Permitted, but it must adequately reflect the estimated annual consumption	Permitted, but limited by regulation to maximum 10 weeks	Not permitted
Mandatory, industry-specific information on supplier's bill	- Consumption - Payment required - Contract type - Cost of supplier's service - Taxes - On-account payment - Contract termination date	- Prices - Units - Consumption - Taxes - Billing period - Validity period of contract - Information on customer complaints and dispute settlements	- Prices - Volume - Contract type (default or not) - Process for complaining	- Date and reason for price changes - Consumer rights - Information on customer complaints and dispute settlements - Energy source's share of supplier's sales - CO_2 emissions and nuclear waste

Source: NordREG, 2016.

2.2.2 *Metering requirements and imbalance settlement processes*

Following the launch of the joint Nordic Balance Settlement (NBS) service for Finland, Norway and Sweden on 1 May 2017, market participants in these countries now report in the same way. The NBS provides the first cross-border imbalance settlement operations in Europe (Statnett, 2017). It currently handles the daily settlement operations for over 1,000 different market participants, including balance responsible parties (BRPs), DSOs and retailers. Since all market participants receive the same efficient settlement services independent of their geographical location, the NBS lowers the entry barriers for market participants who want to operate in all countries. As Denmark decided to opt out of the project, the reporting is currently not harmonised between Denmark and the remaining Nordic countries.

Figure 1: Balancing in the Nordic market



Source: VaasaETT (2014) Market Entrant Processes, Hurdles and Ideas for Change in the Nordic Energy Market – the View of the Market; Statnett (2017) Nordic Balance Settlement Successfully launched.

The implementation of the NBS required changes in the national laws and regulations, such as on consumption estimation methods and consumption data reporting, to harmonise the balance settlements across the three countries. For instance, Sweden and Finland adjusted their reporting period for metered values from 14 and five days after delivery day, to 13 days after delivery day, to harmonise the schedule for reporting balance settlement data.

The countries participating in the NBS have further harmonised the requirements for the different main types of metered data, as illustrated in the table below. In addition, some countries have introduced additional reporting requirements, such as the consumption from pumped storage in Norway and large industrial consumers in Sweden. While Denmark is not part of the NBS, the requirements on metering are quite similar. A special case in Denmark is the separation between hourly metering in the eastern area which is synchronous with the Nordic grid, and quarter-hourly measurements in the western area which is synchronous with the continental grid.

Table 3: Metering requirements for Norway, Sweden and Finland

	Denmark	Finland	Norway	Sweden
Consumption Metering Points	Metered consumption Profiled consumption	Metered consumption Profiled consumption Production Unit Own consumption	Metered consumption Profiled consumption Pumped Pumped storage	Metered consumption Profiled consumption Interruptible Industry over 50 MW
Production Metering Points	Hourly/quarterly metered production Own consumption	Hourly metered production within the MGA	Hourly metered production within the MGA	Hourly metered production within the MGA
Hourly losses	Grid losses Profiled grid losses	Metered grid losses	Metered grid losses Profiled grid losses	Metered grid losses Profiled grid losses
Exchange metering points	Hourly metered exchange with adjacent MGAs	Metered exchange	Hourly metered exchange with adjacent MGAs	Hourly metered exchange with adjacent MGAs

Source: Fingrid, 2014.MGA = Metering Grid Area.

2.2.3 Smart metering

Sweden and Finland acted as the frontrunners of smart metering in the Nordic countries. They both have a clear regulation for smart meters and consumer information, and provide wide services to consumers. Meanwhile, Denmark and Norway are on track towards a full rollout of smart metering, which is scheduled for completion by 2020 and 2019 respectively. In Norway, Denmark and Finland metering occurs at least every hour and the data is reported daily to the DSO. As Sweden was an early-mover in the rollout of smart meters, the installed meters have less functionality than the meters in the three other Nordic countries.

Sweden finished a major rollout of new smart meters in 2009. Most meters should provide hourly metering and daily reporting, although sites with consumption below 63A are exempted from this regulation. For these sites consumption is measured and reported on a monthly basis, unless the customer requests hourly measurement.

In Finland, the legislation concerning smart meters already entered into force in 2009. Smart meters now cover approximately 97 percent of all the consumption points. Finland's smart metering requirements include hourly metering, remote reading, two-way communication, standardised connection for real-time electricity consumption, and load control abilities for all customers (USmartConsumer, 2016).

In Denmark, hourly metering has been mandatory for customers with an annual consumption exceeding 100 000 kWh/year since 2005. For customers without hourly metering, each DSO establishes one harmonised customer profile (template) that is calculated on an hourly basis based on the area's residual hourly consumption (NordREG, 2014b). By 2020, all consumers are expected to have remotely-read meters that should be able to register measurements at least every 15 minutes. The rollout of the first smart meters started quite early, and legacy meters with lower requirements might be in place beyond 2020 in some cases where a replacement is not economically feasible.

In Norway, the DSOs are obliged to have installed smart meters at all sites by 1 January 2019. Norway's smart metering requirements include the possibility of data measurement every 15 minutes, hourly actual measurement, daily data collection, and standard communication on consumption data to the consumer.

2.3 Conclusion

All four countries are progressing towards the harmonised market model. The datahub projects will be an essential step in this, and will allow for supplier-centric switching and moving processes once they are established.

With the ongoing harmonisation work and the implementation of datahubs, the most significant market barriers identified in (VaasaETT, 2014) will be addressed. However, the regulation still has differences and distinctions in more detailed questions. Some of these will be discussed in the next chapter, while chapter 5 will give recommendations on how these could be further reduced.

3. Nordic datahub projects

All datahubs have the common task of giving suppliers a central access point for all metering data of their customers, thus removing the need to talk to each DSO directly. The implementation of datahubs across Europe differs widely between different countries, but in the Nordics, there is a very similar approach. In this chapter, we give a high-level and non-technical description of the Nordic datahubs. We then review the conclusions from a gap analysis carried out by a technical working group on behalf of the Nordic Transmission System Operators (TSOs) to identify possible areas for harmonisation in the Nordic datahubs.

3.1 The datahub projects in the Nordics

3.1.1 Denmark

The Danish hub, owned and operated by the TSO Energinet.dk, is currently the only operational hub in the Nordics, offering it services since March 2013. It was recently updated to a second version.

3.1.2 Norway

The Norwegian Elhub, owned by a subsidiary of Statnett, is quite far in its implementation. Having been hit by delays and cost increases, the expected date for operation is now in late 2018 or early 2019.

3.1.3 Sweden

Svenska Kraftnät started the Swedish datahub project in August 2015 with specification of requirements and processes. At the time of writing, the tender process is ongoing and contract finalisation is expected end of 2017.

The legal framework has been proposed in June 2017, but needs to be ratified by parliament.

3.1.4 Finland

Fingrid is currently in the public procurement phase, where both the datahub and the data migration are being tendered. As in Sweden, the legal framework is still under preparation but expected to be in place soon.

3.2 Data models, processes and functionalities

We have identified five key areas or dimensions for comparison, listed in Table 4. These dimensions cover the data, the processes and functionalities, the access regime of the hub, the technical constraints and the regulatory framework. The entries in the table are not exhaustive, they rather highlight which set of items we compare for the different hub solutions.

Table 4: Datahub dimensions

Data model	Processes and functionalities	Access regime	Technical limitations and other relevant considerations	Regulatory framework
Meter master data Metering values Balance group Supplier, BRP DSO Contract (duration) Prices (…)	Access to metering values Supplier switching Change of master data Start / end of supply contract Move of customer Registration of BRP Correction and cancellation processes (…)	Access for customers to their own data Access rights of third parties Ability of customers to grant access to third parties Access for market players (TSO,DSO, suppiers, etc)	Frequency of metering value updates (near real time, next day, end of month)? Smart Meter rollout, and handling of traditional meters Interface standards, data formats Number of contracts allowed per metering point	Who operates the data hub? Is it mandatory to use the hub? How are costs shared? Who is responsible for data quality, and how can it be enforced? Who has access to data?

3.2.1 Data scope

The data scope describes which data is available through the hub. Master data includes information such as the ID and location of the meter, address and name of the customer, and contracts. The master data changes only on specific events, such as a move, supplier change or name change of a client, and hence much less frequently than metering values. Metering values are the actual measurements, which are updated regularly on availability. Other relevant data, which sometimes is included in the master data category, is the current supplier, the termination conditions of the contract, and the balance group. If the supplier is responsible for combined billing, information about the grid tariffs would also be stored on a hub.

All Nordic hubs are datahubs that include both metering values and master data. In other countries, communication hubs with decentral storage of metering values, or data routers which do not store any data are being used.

The data scope across the Nordics is not fully unified, but generally the same data is stored on all hubs. Major differences are found in the handling of prosumers, with

some hubs having separate contracts for production and consumption, while Denmark uses separate metering points.

3.2.2 Processes and functionalities

Depending on the data stored, there are different functionalities that can be offered by hubs. The fundamental, retail market functionalities are typically access to metering values, supplier switching, moving, and cancellation of a contract. In addition, correction functionalities such as change of master data or supplier switch correction are needed.

The Nordic hubs are also handling the imbalance settlement between balance groups and the TSO. While this is harmonised between Finland, Norway and Sweden, Denmark for the time being continues with its own balance settlement (see the previous chapter).

3.2.3 Access regime

An important functionality of recent hubs is to manage the access to data, allowing customers to access their own metering data and to grant access to third parties. This allows third parties to offer services to customers based on their data. For this, an access regime needs to be defined, and the authorisation usually can be granted, checked, and revoked. All countries plan to make data available to customers. The approaches differ slightly.

In Denmark, access is controlled via the public *NemID*. Once logged in, customers can access their own data, grant access to third parties, and check and cancel supplier switches. In addition, the Energinet.dk datahub offers aggregated data to registered research institutions and the public for research and information purposes. This public data contains no personal information.

Norway plans to allow customers to download data from the hub, but not to prepare a web interface on the hub. Rather, the suppliers are to offer an interface for their clients.

In Finland, customer authorisation is verified using the government authentication system eID. As of now, the planned implementation will allow customers to access their own data and grant access to third parties.

In Sweden, the access regime is part of the assignment for the datahub, but it is not yet clear how it will be implemented, and it may not be available to customers at the beginning.

In addition, the market players must receive the necessary certification to gain access to the hubs. The certification and access regime varies between the hubs.

3.2.4 Technical and other limitations

As discussed in Section 2.2.3, all the Nordic countries are on the way to installing smart meters. While currently there are differences in the smart meter penetration, the situation is likely to be quite similar in the near future.

All hubs base their interface on the ebix format. While this leads to very similar interfaces, from our understanding the ebix standard allows for country specific adjustments and implementations. As there is no common Nordic standard for communication, the interfaces are not fully interchangeable. This can create significant costs, particularly for the smaller market players, due to a number of factors:

- Need for certification of IT systems for each hub
- Costlier maintenance for IT systems because of change processes for each hub
- Barriers for new IT vendors entering the market
- Large existing IT vendors dominate the market resulting in less price competition.

The rules concerning availability of data, or due dates for data delivery are somewhat different across the countries. After a smart meter rollout, these could be further harmonised.

In Sweden and Finland, it is possible to have different contracts for production and consumption. In Denmark, this is solved by two different metering points. Also, in Denmark each consumption point can have up to two customers (e.g. husband and wife), while in Sweden and Norway it is limited to one customer, and in Finland the number is not fixed.

Finally, billing in Finland is currently not mandated to be supplier-centric. No decision has been made to change the current process, but from our understanding this would not constitute a barrier for market entry for a retailer from another Nordic country.

3.2.5 Regulatory framework

In all Nordic countries, it is the TSO or a subsidiary of the TSO that operates the Hub. As the Hubs are mainly seen to organise retail market processes, the TSOs were chosen as a neutral party.

Costs

The fees for the datahub projects are not yet finalised in all countries, but will most likely differ significantly.

In Denmark, the costs are covered via the grid fees that DSOs pay to Energinet.dk. This has the advantage of being easy to implement, as existing channels for collection of the fee can be used. However, it raises a question of fairness in the distribution of costs between datahub users.

In Norway, it is proposed that 80% of the costs are borne by the DSOs, and 20% by suppliers, since the cost-benefit analysis assumed large savings on the DSO side with a switch towards supplier-centric billing. The fees are split in a fixed fee and variable costs depending on the number of metering points.

In Finland and Sweden, we do not have any final confirmation about the planned fee framework. The Finnish cost benefit study (Fingrid, 2014) recommends to "factor in cost correlation and the fair and non-discriminatory treatment of electricity market

parties," and proposes to have roughly two-thirds of costs covered by grid operators and one third by suppliers. The cost should be based on the number of metering points. There should be no regular fixed payment, but a one-time connection fee. Third-parties might be charged differently, and regular access to hourly metering data might be penalised with a fee if it is in excess of the mandated data access.

3.3 TSO gap analysis for business processes

An extensive and detailed study of the process implementation differences was just recently conducted by the Nordic TSOs (Nesvik & Feddersen, 2016). The study highlights a number of differences in the implementations, but also substantial similarities in the core processes.

The study is focused on the processes, and does not discuss the underlying data models nor the data formats for the data exchange. Again, the formats are not of too much concern, as long as the underlying processes are consistent with a common information model which precisely defines the semantics. Note that the study analyses the processes for all market players, mainly DSOs, suppliers and balance responsible parties. With the focus on retail market barriers, it is sufficient if the processes are harmonised from a retailer's perspective, reducing the number of relevant issues highlighted in the study. However, in order to efficiently exchange data, this would also require a common information or data model. This data model defines which information has to be stored or exchanged, and how that data is structured.

Three technical implementation details are highlighted, which differ, but should be easy to rectify. These are cancellation and/or roll-back, acceptance messages, and rejection messages. These three areas are handled differently as of now, and a harmonisation should be possible and valuable independent of other issues.

A similar observation is made for the combination of processes, e.g., moving and switching a supplier. The experience from Denmark proved this to be a challenging issue, and the new Danish datahub has a process engine which handles interferences. The study recommends a similar model for all hubs, but it seems to be difficult to change after implementation of the hub.

Some regulatory issues are highlighted. Finland uses contracts that can be changed or cancelled rather than switching and moving processes. However, effectively the same processes are described by this. Denmark has a slightly different scheme for supply of last resort, where this concept is to be abandoned altogether. Rather, customers are to choose a supplier who cannot turn them down, and each metering point must be assigned to a balance group at all times.

In the following, we will discuss two processes – switching and moving – in more detail. An overview of the findings and our understanding of the challenges with respect to Nordic retail market harmonisation are given in the end.

3.3.1 *Supplier switching*

The supplier switch is or will be supplier-centric in all countries. Hence the processes are very similar in their execution and order of the steps that are being taken. The issue concerning the semantics is apparent here: in Finland, it is the contracts that are being changed, while the other countries have a supplier-switch process. However, essentially all achieve the same target.

In all countries, the *new supplier* informs the *hub*, which sends back customer master data to the new supplier, and informs the *old supplier*, with the exception of Finland where the process is slightly different (the other countries use a simple "Start of supply message" whereas in Finland a "Contract Master data message" containing contract information is sent). Other differences are: In Denmark, master data is sent back and forth between the hub, the new supplier, and the DSO. This is also related to the different settlement process in Denmark. On the side with the DSO, each country seems to send slightly different information to the grid operators – however this should not be of concern from a retail market harmonisation perspective. Finally, with the profiled meter readings, some differences exist. Here the expectation is that those parts of the process will be irrelevant after a full smart meter deployment.

Generally, this process seems to be very close to a harmonised implementation. It is not clear to what extent the Finnish contracts really differ from the definitions in the other countries. From a supplier perspective, both in Finland and the remaining Nordic countries, you need to inform the hub about the supplier switch, only in Finland you do not receive an update about the master data automatically. As an old supplier, no difference is apparent in the four countries.

Corrections: The correction processes seem to be differently handled and as argued above, there is much merit in standardising the correction, cancellation or roll-back of processes in general. However, many regulations affect this issue, such as the supplier of last resort regime, or grace periods in some countries.

3.3.2 *Moving*

By and large, the findings related to moving are similar to those related to switching. However, one should differentiate between moving in and moving out.

In *moving in*, besides the different semantics concerning contracts and processes and more master data being exchanged in Denmark, in all countries the supplier informs the hub, which informs the DSO and the old balance supplier. Differences for profiled meters can be assumed to become irrelevant in the future.

Cancelling a move in or *moving out* are more difficult, as in those cases the local regime for supplier of last resort becomes relevant. In Denmark, there effectively should not be a supplier of last resort in the future, while in Finland, Norway and Sweden different supplier of last resort models are in place. These differences are very hard to harmonise. However, it is our understanding, that from the perspective of the supplier this only means, that in Denmark they cannot stop supplying a customer without actually disconnecting the metering point. Effectively the supplier's request is more likely to be denied. This is a difference that needs to be kept in mind by retailers

in their planning, but it should not prevent a harmonisation of the processes in the sense of who sends which messages in which order.

3.3.3 *Overview over findings*

The TSO gap analysis (Nesvik & Feddersen, 2016) provides an overview over the technical differences in the processes. It also highlights a number of regulatory differences:

- Finland uses contracts rather than processes. This difference does not seem to affect the process flow significantly, but may make harmonisation more challenging;
- The regime for supplier of last resort is different in the Nordic countries and affects processes such as moving out and cancelling a move in;
- The balance settlement is not fully harmonised across the Nordics. As long as these differences remain, it will influence the need for master data exchange in processes such as supplier switching;
- It would be generally of merit to standardise cancellation and roll-back processes. This would also be of value independent of other harmonisation tasks.

Most of the issues that seem hard to solve stem from regulation, while technical barriers are small. From our understanding and the feedback from the authors of (Nesvik & Feddersen, 2016), the state of and potential for further harmonisation seems largely positive, with some provisions:

- In their underlying flow, the processes are already very similar;
- Especially from a supplier perspective, which is the relevant perspective for increasing competition across the Nordics, the processes are near-identical. Differences on the DSO side or related to profiled metering can be ignored;
- The interface and data format are not a main barrier, as IT systems can easily adapt to different formats. The interface could also be updated on an existing hub, with an old interface running in parallel, as long as the underlying data model does not change;
- The data model itself should be the focus of harmonisation, and starting from a harmonised data model it is easy to define harmonised processes. The data model should be flexible enough to handle different local regulations, such as the number of customers per metering point. It would then be the job of the hub to implement local regulations, while to the outside these issues could be largely transparent.

4. Gap analysis

In the previous chapter, we have described the status with respect to the NordREG recommendations for more harmonised Nordic retail electricity markets as well as the status of the national datahub projects. In this chapter, we analyse whether the NordREG recommendations are likely to be met and the role of datahubs in that regard. In addition, we also consider further barriers to increased Nordic harmonisation that can be reduced through datahubs.

4.1 Data exchange requirements for more harmonised Nordic retail markets

NordREG's recommendations for harmonised market rules are:

- Supplier-centric switching
- Supplier-centric moving
- Combined billing through the supplier
- Central data exchange
- Comparison tools for customers

From a data exchange perspective, this has a number of implications. Supplier-centric processes not only make it clear to the customer who is the contact person, it also means that the process flow is well standardised, as all processes are initiated by the supplier, and the other market parties are being informed. In these processes, it is mainly master data and meter mileage that is being exchanged between the parties. The detailed master data to be exchanged depends on other regulations, such as the balance settlement.

Combined billing has far more significant implications. The supplier not only needs the metering data for his own energy bill, but also all data that forms the basis for the grid tariffs. Depending on local regulation, different information might need to be given with the bill, and all that information has to be handed to the supplier from the DSO and the TSO.

Central data exchange platforms explicitly address the data exchange, or more specifically the exchange topology. Instead of a "many-to-many" communication topology, each market player has only the central hub as interface. This significantly reduces the effort to enter a new market, and helps to make communication more dependable and transparent.

The agreement on using a supplier-centric model goes a long way towards removing market entry barriers for Nordic retailers. There are some further points that were raised by our interview partners:

- Automatic meter reading is a general improvement for process efficiency and quality. This refers to improved balance settlement and better data availability and quality. For the time being, not all Nordic countries have rolled out automatic meter reading;
- Regulatory differences remain in the details, such as time limits, due dates and notice periods;
- Also, it will still be necessary to acquire a licence as retailer in every market. This is a hurdle, but the retailers agree to the necessity of this;
- With four different datahubs, IT systems must have a slightly different interface to communicate with each of the hubs;
- If rules and data accessibility were further harmonised, it would be possible to have a single tool for customer relations and customer information for all Nordic countries. This could significantly reduce development costs and streamline operations on the side of the retailers.

4.2 Gaps with respect to NordREG recommendations

All Nordic countries move towards the NordREG recommended model. The NordReg recommendations do not include detailed recommendations on data formats. Denmark differs slightly with respect to data format, as they are still compatible with Edifact in addion to XML used by the other countries. However, on a high level, harmonisation will be largely achieved after the implementation of all datahubs. Also, the rollout of smart meters is finished or ongoing in all countries, and will reduce many of the known market entry barriers.

The Finnish use of contracts rather than processes does not necessarily constitute a significant difference, and it needs to be seen how contract changes on the Finnish datahub differ from supplier switch or moving processes on the other hubs.

More significant is the current lack of mandatory combined billing in Finland. However, the hub could handle combined billing if it were to be introduced.

Table 5: Gaps with respect to NordREG recommendations

Requirements for harmonisation	Fulfilled? (Yes/ Mostly/ Somewhat/ No)	Possible role of hub?	Met by current hub design?	Possible hub design measures
Retail market process harmonisation				
Supplier-centric switching	Yes/proposed	Yes	Yes	None
Supplier-centric moving	Yes/proposed	Yes	Yes	None
Combined billing	Yes/proposed, except Finland	Yes	Yes	None
Automatic meter reading	Yes/proposed	Yes	Yes	None

While harmonisation on the general level has progressed significantly, and will take a huge step forward with the implementation of the datahub projects, there are some details that might require further attention. We will discuss these in the next section.

4.3 Gaps with respect to other barriers

While the high-level NordREG recommendations are largely met, the business processes are not fully harmonised. Based on the TSO group analysis, we have summarised the status and gaps in the table below.

Table 6: Gaps with respect to other barriers

Requirements for harmonisation	Fulfilled? (Yes/ Mostly/ Somewhat/ No)	Regulatory challenge	Possible measures
Data hub implementations Are the process flows identical from a suppliers' perspective?	Yes/proposed		Identify regulatory challenges preventing further harmonisation
Supplier Switching	Mostly	balance settlement schemes, profiled meters	Focus on harmonisation from supplier point-of-view
Supplier Switch correction	Somewhat	Supplier of last resort	Focus on harmonisation from supplier point-of-view
Move in	Mostly	balance settlement schemes, profiled meters	Focus on harmonisation from supplier point-of-view
Move out / correction	Somewhat	Supplier of last resort	Focus on harmonisation from supplier point-of-view
Are the data formats and interfaces the same?	Mostly	Underlying data model	Based on standardised data model
Is the underlying data model harmonised?	No	e.g., number of customers per metering point*	Standardise data model

Note: * The data model could accommodate different local regulations, but would need to be defined in a flexible manner.

As discussed in Section 3.3, the processes as they will be implemented on the hubs, are already largely harmonised. Especially from a supplier perspective, the differences are very small. However, some challenges remain, and they are partly based on different regulatory details in the Nordic countries. The supplier of last resort regulation affects moving out processes and supplier switch cancellation processes. Differences in balance settlement lead to different requirements on master data exchange. While these issues affect the process flow, it should generally be possible to make them very similar, at least in their interface to suppliers.

Also, the underlying data model is not harmonised. This relates to issues such as the number of customers per metering point. While a full harmonisation may neither be possible nor desirable, it should be possible based on the existing experience in the

industry to define a data model flexible enough to accommodate different local regulations. Defining such a data model is a time consuming and challenging task, but could foster many improvements in efficiency across all levels of data exchange.

As today, retailers will further need different IT systems for each country. This constitutes significant costs, and hence a market entry barrier. As the hubs are being implemented, the situation could improve towards some IT vendors offering interfaces to all hubs at a mark-up. This could reduce costs for retailers and promote competition. It would not remove all barriers, nor allow highly standardised and cost-efficient IT solutions. However, a remaining issue would in any case be the need to gain the necessary certification to gain access to the national hubs and also to maintain change programs to the IT systems that would necessarily be national with the current regulations.

5. Options for further harmonisation of datahubs

In the previous chapters, we identified barriers to cross-border competition in the Nordic electricity retail markets and concluded that the NordREG recommendations are to a large extent fulfilled once the planned datahubs are operational. Furthermore, we concluded that the underlying business processes in the hubs are harmonised to a significant extent and that further harmonisation of processes is largely dependent on regulatory decisions. However, we found that there are important barriers due to IT system costs that arise from the need to carry out certification and maintenance and change programs in each individual Nordic market. In this chapter, we therefore discuss how datahubs can reduce the barriers related to these IT system costs. We start by reviewing the potential benefits of further harmonisation from a market efficiency perspective, and also limitations to harmonisation that stem from regulation and requirements beyond data exchange. We then describe the most relevant measures that could be taken related to data exchange regimes, and carry out a high-level qualitative cost-benefit analysis of the different options. Finally, we give our recommendations on how datahubs can support harmonisation of the Nordic retail markets and increase cross-border competition.

5.1 Benefits and limits of data exchange harmonisation

The overall aim of Nordic data exchange harmonisation is to reduce market entry barriers for retailers that want to extend their business to another Nordic country, and to improve the user experience by having a supplier-centric model.

5.1.1 Benefits of harmonisation

The benefits can be stated quite clearly: reduced costs, and increased competition in energy retailing and energy services. In the following, we describe some of the main benefits that we have identified qualitatively.

Cost of IT systems: Further harmonisation and standardisation should allow for more cost-effective IT systems. That is, having a similar or identical data model, interfaces, and processes would allow IT suppliers to offer the same IT system across all Nordic countries, thus considerably cutting costs both in development of these systems and in change management if there is a change on the side of the hubs. These costs are passed on to the suppliers, and ultimately to the final consumer. This is also true for the cost of licensing IT systems with the hub – these costs could be further reduced if there

were only one hub interface, as the licence for connecting to one hub could be extended to the other hubs. Finally, if the processes on the hubs are similar, the internal processes at the suppliers could be aligned instead of having different processes for each Nordic country.

Reduced market barriers and increased competition: Having different hub implementations is a market barrier – both due to the cost of IT systems described above and due to the increased administrative effort. The number of interfaces needed will favour the largest IT suppliers already in the Nordic market, representing barriers for new entrants. Reduced market barriers should lead to more market players, more competition and hence better choice at lower cost to consumers.

However, the retail margins across the Nordic countries are already very low, especially compared to other countries such as Germany. There are some market specific reasons, as for example the high per-household consumption in Norway allowing better economies of scale. But generally, it seems that competition is already working well, and increasing competition may only have a limited effect on end-consumer prices.

Increased competition in energy services: More may be gained from increased competition in the much less mature market of energy services. This market includes aggregators offering demand response services as well as energy service companies (ESCOs) focussed on energy efficiency or information services both to small and medium sized clients. The market for these services is much smaller, access to data absolutely essential, and the differentiation today is mainly based on service type and service level rather than on costs.

In this market environment, allowing aggregators and ESCOs to more easily enter all Nordic markets could constitute a significant benefit for consumers. This benefit is not limited to costs, but also covers the availability and variety of services.

5.1.2 Limits to harmonisation

We also see a number of differences that cannot be addressed by data exchange harmonisation. These differences are mainly related to local regulations either beyond data exchange, or even beyond the energy sector.

Licence: A retailer needs a licence to operate in each country. The licensing requirements may be similar, nevertheless the process has to be passed several times.

Privacy and security: Local rules may apply concerning privacy and security. These rules often go beyond the general data protection guidelines, which are similar or will be similar in all countries after adoption of the EU General Data Protection Regulation (The European Parliament and the Council of the European Union, 2016). Relevant local regulation includes how to deal with customers that are under police protection and whose name must not be made public, or military installations.

Taxation: The taxation levels and rules differ between the countries, and retailers need to adhere to the local rules. Harmonisation is unlikely.

5.2 Data exchange harmonisation measures

We now discuss how a further harmonisation of data exchange could be carried out on a technical level. We distinguish two main types of harmonisation measures:

1. Reduction of the number of interfaces for suppliers;
2. Harmonisation of business processes across interfaces.

The aim of these measures is to reduce the IT costs from competing in several retail markets, both the costs of acquiring the necessary certification and the costs of adapting to different underlying business processes, including handling of implementation changes and maintenance.

5.2.1 Reducing the number of interfaces

In principle, it is possible to reduce the number of communication interfaces in several ways.

Option 1: No interaction – multi-interface IT systems

The current state-of-play is that of no interaction between the four Nordic retail markets. To enter a new market, a retailer needs to establish itself in that market, and operate an IT system compatible with the local processes, data models and communication procedures. With the introduction of datahubs in all four Nordic countries, this will become significantly less challenging, but the retailer must comply with four interfaces, one for each hub. In order to serve retailers in the whole Nordic market, the IT suppliers must develop and maintain one interface for each individual country. Operating four parallel IT subsystems constitutes a market barrier. This is both costly and complex and may be particularly problematic for new IT suppliers to enter the market.

Some IT suppliers start to offer IT systems compatible with all four markets, hence reducing the effort on the side of the electricity retailers. Still, this versatility comes at an additional cost for the retailers over a standard IT system. Hence, the market barriers for the retailers are somewhat reduced but not removed, and the additional cost is likely to be passed on the end consumers. However, competition between IT suppliers can be hurt due to this entry barrier for new entrants.

Option 2: Hub-to-hub communication

When the hub projects are online, a retailer entering a new market must connect to a new hub. It should be feasible to extend the hub functionalities to enable the hubs to talk with each other. This would allow forwarding of messages across borders, and retailers could handle processes on their local hub in the accustomed manner for both national and international customers. The communication should be limited to the most important market processes involving the end-user and the supplier directly, i.e. the customer-oriented processes (supplier change, move etc.). Processes related to

imbalance settlement can be handled more efficiently directly through the respective national hubs without the need for hub-to-hub communication.

This would create a certain implementation cost on the side of the hubs, but minimise the effort needed by retailers and their IT suppliers. The hubs would in addition have an incentive to press for Nordic harmonisation of processes and data models, as this reduces their cost of implementation. However, for this approach to work the data models need to be sufficiently harmonised.

Also, in case of errors the retailer would be inclined to contact the local hub, even though the issue may stem from the foreign hub. This creates challenges and inefficiencies in customer support that may reduce the benefits of having only one access point.

Option 3: "Super-hub" – central communication layer

As a half-way solution between a central hub and communication between hubs, a communication layer could be introduced. Offering a standardised common interface based upon a common data model and standardised market processes, would make it possible for the IT systems to exchange data with all hubs through one interface. This layer does not have to cover all communication, but can be limited in the beginning to the most important market processes. In a way, this is similar to the hub-to-hub solution in providing one interface instead of having several interfaces in each IT system. However, it would mean that the IT supplier must redesign the existing interface to comply with the new standard. The implementation would only have to be performed once, and only one interface must be maintained instead of four. This also simplifies the market entry for new IT suppliers. The expectation is that this approach removes market entry barriers related to cost and complexity of IT systems.

This approach would require changes on the supplier side, although they may be limited. The implementation of the communication layer and the standardisation of interfaces would require an adaptation by the retailers.

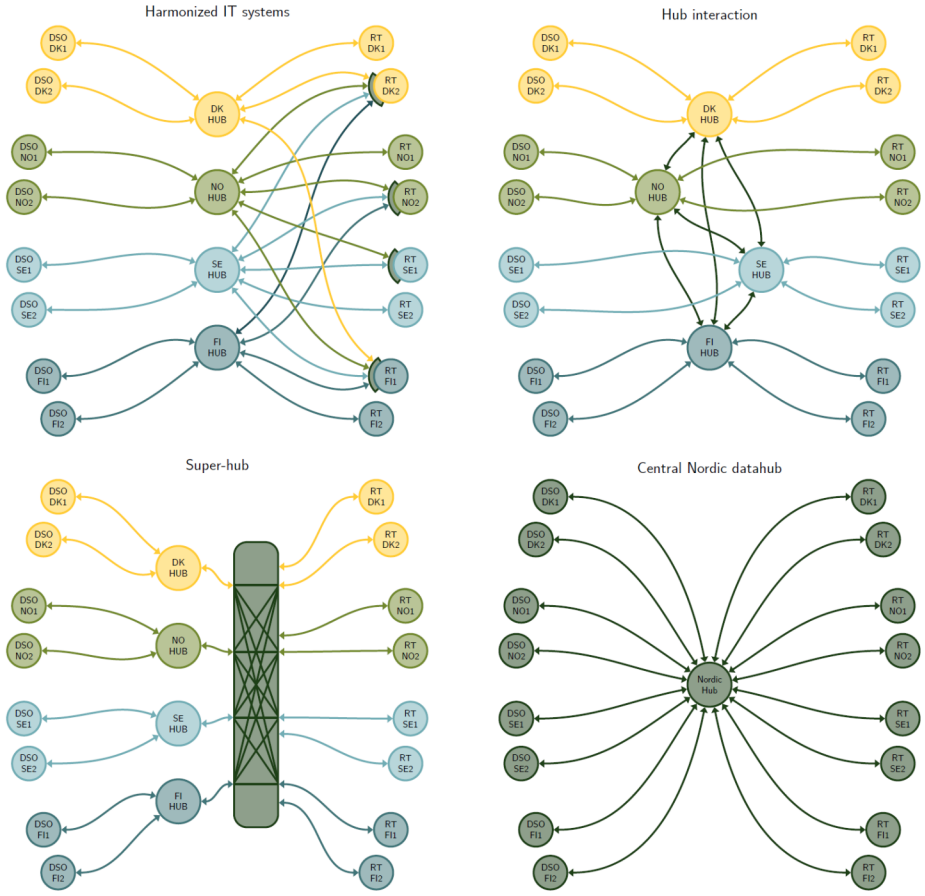
The responsible entity would have an incentive to press for further harmonisation of processes, and would be in an excellent position to highlight differences and challenges. At the same time, there are related regulatory challenges to ensure efficiency in implementation and operation of the "super-hub", as well as a governance structure that supports efficiency.

Option 4: A single Nordic hub

A central data hub for all of the Nordic countries seems to be a very simple solution on first sight, with one single interface which complies with all requirements in the four countries together. This would be the ultimate development of the "superhub" to a totally integrated solution. There are several caveats: Most of all, this would require a common data model and full harmonisation of all processes, which is unlikely to be realised before long. It would also raise questions concerning privacy laws and licensing of suppliers, and may be challenged by developments in national legislation. Thirdly, it would require adaptation to a unified process definition, also by the DSOs. Finally, it will be complex to administrate changes in the hub to accommodate changes in the

national regulations. The hub must adjust the internal processes to each individual national regulatory system. In effect, one may get a single hub with four underlying national systems.

Figure 2: Options for development of data hubs



Source: THEMA and Devoteam.

5.2.2 *Harmonisation of business processes*

As outlined in Chapters 3 and 4, the business processes in the hubs are to a significant extent harmonised or can be harmonised at a fairly low cost. However, we also saw that full harmonisation will require regulatory changes outside the jurisdiction of the hubs, and the benefits from different harmonisation measures will vary. In addition, the possibilities and benefits from further harmonisation will likely change with developments in the markets, such as for instance the proliferation of distributed generation and demand side flexibility, regulatory measures, such as for instance support systems for renewables and demand response, and technology.

There are two main options for facilitating further harmonisation of business processes:

1. The hubs are given an advisory role, for instance through a joint expert committee. The final decision on changes to the rules will still need to lie with the regulators and/or the legislator, but the hubs will have a key role in identifying areas for harmonisation and making the necessary proposals. The advisory role should be mandated in a clear set of rules and obligations for the hub to move the harmonisation process forward;
2. The regulators take responsibility for proposing and deciding changes to the processes.

With the experience of existing data hub projects, notably the Danish datahub, we strongly recommend putting a significant part of the technical work into the hands of the market players. Ideally and depending on the interest of the market, this is not only the hubs, but also retailers, IT systems suppliers, DSOs and all other affected parties. The market parties, based on their daily work and experience, have the best position to define rules that are practical and implementable. At the same time, both regulatory oversight and a broad selection of market players is necessary to prevent market participants from possibly changing rules in their own favour.

In the mid-term, this process can either be aligned with international standardisation processes, or provide the base for improved standards that get adopted across the European energy markets.

5.3 Cost-benefit analysis

5.3.1 Options for reducing the number of interfaces

Reducing the number of interfaces can in principle have two economic consequences:

1. Reduced costs of IT systems of the suppliers. We assume that the greater the cost reduction, the greater the positive impact on competition and service availability from third parties;
2. The direct cost of design, implementation and maintenance of the datahub solution(s).

We qualitatively discuss the costs and benefits of the different solutions sketched out above. Note that the ranking of costs and benefits does not constitute any quantitative statement, but should lead to an indication of which solution(s) is (are) most promising for further investigation.

Costs of datahub solutions

On the cost side, low costs are marked as positive. We further distinguish between implementation and maintenance costs on the side of regulated entities and the effort of drafting the regulations.

Obviously, not making any changes presents the lowest cost and effort, hence scenario "Today" is marked positive.

Implementing a central Nordic hub on the other hand would be expensive with respect to both the technical solution and the regulation side, as all processes would have to be perfectly aligned.

A Nordic communication hub that offers an interface to the existing hubs would be cheaper to implement, but some processes would need to be harmonised in more detail first.

Similar reasoning applies to the "Hub interaction" approach, but here we see slightly higher costs as all four hubs need to interact with each other.

Note that the costs can be reduced if the change processes are timed optimally, i.e. when the hubs are subject to redesign in any case. However, from experience, standardisation processes can be lengthy and complex and thus reduce the freedom with respect to timing of changes.

Benefits from lower IT costs

In today's situation, IT costs for retailers operating across borders are relatively high, and so are the market barriers. A central datahub or communication hub would reduce the costs, as one IT system could be used – but possibly would require investments to implement a unified access format.

With hub interaction, the existing IT systems could also be used in the future, thus minimising IT reinvestments.

All three approaches would reduce market barriers significantly.

Customer data access is not affected by the data exchange model, as customers always only need access to data from their own country. While sharing of best practices improves the quality of customer information services, it does not depend on whether data is exchanged in the same way across the Nordics. In general, there is little to gain from the customers getting access to their data through the hub, as the supplier or third parties can manage access on behalf of the customer.

Summary

The table below gives an overview over the cost-benefit analysis. Note that the sum is not weighted, and hence is just an indication. One should also keep in mind that already today, the retail margins in the Nordics are rather small. Hence the total economic savings from customer perspective which can be achieved are limited. However, the "hub interaction" model would seem to be the most attractive. The model is also attractive from a risk management perspective as it can be developed incrementally and be limited to the most central customer-oriented processes.

Table 7: Qualitative cost-benefit analysis of different harmonisation measures

Model	Costs Cost for datahub solution	Benefits Cost for IT systems at retailer	Sum
No interaction	++	−−	0
Hub interaction	−	++	+
Nordic comhub	−−	+	−
Nordic datahub	−−−	+	−−

5.3.2 *Harmonisation of business processes*

The regulatory framework for harmonising business processes is primarily a question of the quality of the decision-making and the effort involved in monitoring developments and formulating the necessary proposals.

We consider that the regulators would need to invest heavily in IT competence that falls outside the core competence areas of an electricity regulator in order to manage the harmonisation of business processes. Hence, the main tool for harmonisation in this area should be the hubs themselves. The regulators will still have the final say on the regulations, however. The model also requires a suitable regulation and governance of the hubs themselves.

5.4 Recommendations and conclusions

From the previous analysis and discussion follow two main recommendations. On the one hand, going forward with a framework for further harmonisation of detailed market rules should be implemented. On the other hand, we see benefits in providing interoperability between the datahubs.

5.4.1 *Establish a framework for coordinated changes to hub designs*

While the harmonisation of the overall market processes is quite far advanced and will to a large extent be realised when the datahubs are online, differences in the detailed implementation remain.

To address these differences, a technical working group should be established, in order to develop a common data model and analyse the processes as well as the regulatory barriers that may prevent further harmonisation. This group should be responsible for overlooking the market and proposing to the regulators any necessary adjustments that contribute to harmonisation, and if accepted by regulators implementing them on the hubs.

The group should have a permanent function and consist of experts from the datahub organisations. They should communicate with the market players and involve IT suppliers, retailers and DSOs.

The harmonisation would allow IT suppliers to more cheaply offer systems that are operational in all Nordic countries, and retails to streamline their processes. This has direct and indirect benefits:

- *Direct*: Reduced costs for processes and IT systems for inter-Nordic retailers can be passed on to the end-consumer. Reduced entry barriers for new IT suppliers;
- *Indirect*: The reduced costs of entering a new market should increase competition and hence reduce cost for end-consumers and improve choice. It should be noted that Nordic electricity retail margins are already quite low today. The smaller and less mature energy service markets could profit more profoundly from increased competition.

5.4.2 Enable hub interoperability

Parallel to fully harmonising the data models and data formats, the hubs could be developed towards interoperability. This would reduce the number of interfaces for retailers, and ideally hide hub implementation details from the retailer IT systems. A common data model will facilitate harmonisation.

There are challenges associated with hub interoperability, but they are smaller than with a single hub or "super-hub" concept. For example, questions about who is responsible for support in which case have to be clarified. Also, differences in the underlying data model or time limits could be challenging to handle.

Hence, a thorough cost-benefit analysis needs to be performed before any hub interoperability project is initiated. The analysis must take into account the saved expenses for IT systems, the cost for adjusting the hubs, potential benefits from competition both on the IT market and the electricity retailing and energy services markets, and finally possibilities for providing improved services to end-customers creating better user experience.

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Sammendrag

Bakgrunn og problemstilling

Nordiske[3] regjeringer og reguleringsmyndigheter har som mål å harmonisere sluttbrukermarkedene for elektrisitet for å redusere inngangsbarrierene for kraftleverandører fra de andre nordiske landene. Dette vil i sin tur fremme konkurranse og fritt leverandørvalg, og bidra til reduserte kostnader ved å være til stede i forskjellige nasjonale markeder. Nordisk Energiforskning har på vegne av Elmarkedsgruppen gitt THEMA Consulting Group i oppdrag å analysere hvordan de planlagte og eksisterende datahubene i Norden kan støtte harmoniseringsprosessen, og eventuelt gi anbefalinger om ytterligere tiltak med hensyn til datautveksling. Konkret er det formulert følgende hovedmål for analysen:

- Etablere en forståelse av design og funksjonalitet I eksisterende og planlagte datahuber fra et markeds-, regulatorisk og teknisk perspektiv.
- Vurdere hvordan datahubene kan bidra til mer harmoniserte sluttbrukermarkeder bade fra et aktørperspektiv og et regulatorperspektiv.
- Gi anbefalinger om de mest egnede tiltakene knyttet til rollen og funksjonaliteten til datahuber som kan legge til rette for harmonisering.

På vei mot mer harmoniserte nordiske sluttbrukermarkeder

Ved å foreslå harmoniserte markedsregler sikter NordREG mot å gjøre det enklere for en kraftleverandør fra ett land å etablere seg i andre nordiske land. Forventningen er at felles markedsregler styrker kundenes valgfrihet og gir reduserte kostnader. Kostnadsreduksjoner kan oppnås på flere måter:

- Ved å forbedre effektiviteten og utnytte stordriftsfordeler i datahåndtering, forretningsprosesser og IT-systemer. Dette omfatter kostnadene til IT-systemer, som bør bli billigere dersom de kan utvikles felles for alle landene framfor å ha spesifikke systemer for hvert nordisk land.
- Ved å øke konkurransen og oppnå ytterligere reduksjoner i marginene i sluttbrukermarkedet. Reduserte inngangsbarrierer bør lede til et økt antall leverandører i hvert land, økt valgfrihet og mer konkurranse på pris.

[3] For enkelhets skyld bruker vi betegnelsen nordisk når vi refererer til Danmark, Finland, Norge og Sverige, ettersom Island ikke er omfattet av studien.

NordREG-anbefalingene omfatter felles fakturering av kraft og nettleie, leverandørsentriske leverandørbytter og flytteprosesser og krav til kundegrensesnitt.

Datahubene som er i drift (Danmark) eller i planleggingsfasen (Finland, Norge, Sverige) har mange felles designtrekk og vil alle kunne møte kravene fra NordREG sett fra et teknisk perspektiv. De overordnede anbefalingene fra NordREG bør derfor i hovedsak kunne implementeres så snart datahubene kommer i drift. Det gjenstår noe arbeid med å vedta relevante lover og forskrifter som er foreslått, blant annet i Finland og Sverige. I tillegg er felles fakturering ikke obligatorisk i Finland på det nåværende tidspunkt.

De overordnede markedsreglene er harmonisert, men noen utfordringer gjenstår

Selv om de overordnede prosessene vil bli harmonisert, er det forskjeller i den detaljerte implementeringen. Noen av forskjellene kan lett fjernes, mens andre avhenger av den tilhørende nasjonale reguleringen. For eksempel er det forskjeller i reglene vedrørende leveringsplikt (for kunder som ikke har avtale med en kraftleverandør) som påvirker prosessene for flytting og leverandørbytte, og det er forskjeller i balanseavregningen som påvirker utvekslingen av masterdata. Et generelt spørsmål er reversering og kansellering av prosesser, som p.t. ikke er harmonisert.

Innenfor rammen av denne analysen er det tilstrekkelig at forretningsprosessene i datahubene er harmonisert fra et leverandørperspektiv. For leverandørene er harmonisering relevant dersom de vurderer å gå inn i nye markeder. I en leverandørsentrisk modell vil dette også bidra til å harmonisere sluttbrukerprosessene og gi en mer enhetlig sluttbrukeropplevelse.

For å sikre kompatibilitet må den underliggende datamodellen være enhetlig. Det betyr at data som måles, lagres og utveksles må være tilstrekkelig like til at det tillater harmonisering av prosesser og dataformater.

Selv med full harmonisering av datautvekslingen vil det fortsatt være andre inngangsbarrierer. Disse inkluderer behovet for å ha konsesjon eller lisens i hvert land for å drive med kraftsalg, forskjeller i nasjonal lovgivning vedrørende personvern og sikkerhet og nasjonale avgiftsregler. Datahubene har ikke noen naturlig rolle i å fjerne slike barrierer.

Det bør også tas med i vurderingen at marginene i sluttbrukermarkedet allerede er relativt små. Derfor kan gevinstene ved økt konkurranse være begrenset. I det mindre modne markedet for energitjenester kan det imidlertid være annerledes. Der kan økt valgfrihet som følge av enklere markedsadgang gi store gevinster.

Enhetlige datamodeller og interoperabilitet mellom datahuber kan redusere markedsbarrierer

Vi ser to hovedområder hvor det kan gjøres tiltak som vil bidra til ytterligere harmonisering ved hjelp av datahuber. Vi har to hovedanbefalinger:

1. Etablere en rådgivende komité for å identifisere regulatoriske og tekniske barrierer for harmonisering.
2. Legge til rette for interoperabilitet mellom datahuber.

Den rådgivende komiteen vil ha i oppgave å identifisere forskjeller i forretningsprosesser og regulatoriske barrierer som hindrer full harmonisering, ut fra et teknisk perspektiv. Komiteen bør bestå av representanter for datahubene og suppleres med andre relevante aktører. På grunnlag av en analyse av forskjellene i implementering av forretningsprosesser, kan gruppa foreslå en felles datamodell og harmoniserte prosesser basert på modellen. Komiteen bør også peke på regulatoriske forhold som begrenser ytterligere harmonisering og foreslå endringer. Beslutninger om endringer må imidlertid tas av de nasjonale regulatorene.

Parallelt med arbeidet i den rådgivende gruppa bør datahubene etterstrebe interoperabilitet for å redusere antall nødvendige grensesnitt til bare ett, uavhengig av hvor mange markeder en leverandør er til stede i. Med interoperabilitet sikter vi primært til utveksling av meldinger mellom datahuber, slik at en leverandør eksempelvis kan initiere et leverandørbytte i sin nasjonale hub selv om målepunktet er i et annet land. Det vil bidra til å minimere inngangsbarrierene. Det er imidlertid også utfordringer ved denne tilnærmingen: Hvis den underliggende datamodellen ikke er tilstrekkelig harmonisert, kan en slik oversettelse mellom huber være umulig. Videre kan det hende at leverandøren tar kontakt med sin nasjonale hub når det oppstår en feil og ikke huben der feilen oppstod. Derfor bør det gjøres en grundig nytte-kostnadsanalyse før en går videre med tiltak for å sikre interoperabilitet. I tillegg til nytte- og kostnadsvirkninger som kan tallfestes, bør også mulige forbedringer i kundeopplevelsen, som felles fakturering, analyseres. Ytterligere harmonisering av prosessdefinisjoner gjør det også enklere å sikre interoperabilitet, slik at timingen av tiltak for harmonisering av prosesser og interoperabilitet blir et viktig spørsmål.

Appendix

Stakeholder Interviews

We conducted a round of stakeholder interviews with suppliers, datahub responsible parties (DRP) and national regulatory authorities (NRAs) to identify their respective views, needs and expectations on retail market harmonisation and the effect that datahubs can have to further reduce market barriers across countries. In the following, we will summarise the main points raised.

National regulators

All national regulators support further harmonisation of the market rules, and are actively working on following the recommendations by NordReg closely. However, each country has its own regulatory history and grown frameworks which constitutes a certain inertia, and the datahub projects are first and foremost designed to solve national challenges in the retail market. The close cooperation between the Nordic countries, also on datahub projects, at the same time leads to a natural harmonisation and sharing of best practices that effectively lead to largely aligned implementations.

The regulators highlight that a regulatory harmonisation of processes should come before a harmonisation of business processes on the datahub. In addition, there are other requirements on the national level, such as that each retailer must have a licence in each country they are active in. These requirements cannot be addressed by datahubs, and are hence beyond the scope of this study.

Datahub Responsible Parties

In all Nordic countries, the TSOs are responsible for implementing the datahub. While not all countries have final decisions on the regulatory framework, most likely in all cases TSOs will establish a subsidiary company that operates the hub.

All DRPs are interested in harmonised processes and, importantly, harmonised data models. However, the leading task is to implement a solution for the national retail markets, and existing differences in regulation mean that it is not possible to have fully harmonised implementations. Nevertheless, the DRPs are closely cooperating on exchange of knowledge, lessons learned and best practices, and have internal discussions and reports on harmonisation of processes (Nesvik & Feddersen, 2016). The differences in processes are seen to be mainly driven by differences in regulation, and technical challenges should be manageable. Hence the DRPs look for further harmonisation from the regulators. At the same time, the hubs raised the point that too tight regulation will actually make it harder for the hubs to harmonise their processes,

and that there should be flexibility and room for the market participants to agree on common rules and practices.

Data models are an integral part of harmonisation. They are already very similar in the Nordics and mainly are based on ebiX,[4] but there is no agreed upon standard Nordic implementation. The Clean Energy Package of the EU Commission proposes a European standard for data formats, which is understood by the hubs to mean data model. A common Nordic data model could be a possible starting point also for a European initiative, and the hubs are cooperating with the IEC on developing a standardised data model. The experienced gained with data exchange in Europe and specifically in the Nordics should enable the definition of a generic, international data model and data exchange standard for retail markets. This would likely still require a flexible implementation that can be adjusted to local regulations while offering a unified interface to the outside.

Suppliers

The suppliers confirmed that the differences between process implementations in the different countries are indeed a market barrier and make the business model of entering a new market quite challenging. The business processes related differences are mainly in the details of the implementation and to a large degree are historically grown rather than based on essential differences in regulation. Some of these issues will be resolved in the next years, such as having automated meter readings in all countries. Other issues need regulatory harmonisation, such as notice periods and time limits for process execution. Lastly, a few issues are beyond the scope of data exchange and datahubs, such as different taxation schemes, the need to legally establish a company in each country, and national privacy regulations.

The suppliers we interviewed – which are large, already internationally established incumbents – are very interested in further harmonisation and streamlining of processes, even though it would lead to increased competition in the retail market. They argue that improved processes allow for better customer service, an area where they see themselves with an advantage. Related to new customer services, they also argue that harmonisation will allow better services, as they can be developed once for the whole Nordic market, rather than for each independent market. Some local suppliers which stem from vertically integrated utilities on the other hand argue against supplier-centric models, fearing that it would increase their cost and reduce their competitiveness against large suppliers.

IT systems are a main market entry barrier. As of today, there are no IT system suppliers offering solutions that cover all Nordic countries. Rather, retailers must use different IT systems for each market, creating both cost for these systems as well as inefficiencies in operation. Hence, a market entry is only warranted if a sufficient turnover can be generated. This situation might improve in the future as some IT

[4] European forum for energy Business Information eXchange, http://www.ebix.org/

system suppliers have communicated to be working on Nordic solutions. In the long term, the IT market might shift from offering country-specific solutions to offering services for retail companies.

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NORDIC DATA HUBS IN ELECTRICITY SYSTEM

The Nordic ministries and regulators aim to harmonise the electricity retail markets to reduce market entry barriers for retailers from the other Nordic countries, hence promoting competition and customer choice and reduced costs of operating in different national markets. The Electricity Market Group under the Nordic Council of Ministers gave THEMA Consulting Group the task of analysing how the datahub projects can support the harmonisation process. This study explores the design and functionalities of existing and planned data hubs and how data hubs can contribute towards more harmonised end-user markets. Two main recommendations are made; enabling interoperability between hubs, and establishing an advisory group to identify regulatory and technical barriers to harmonisation and propose measures.

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