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Implementation of data hubs in the Nordic countries

Status Report, June 2020

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Preface

NordREG, a cooperation between Nordic energy regulators, has for several years been devoted to the work of developing the Nordic electricity market. In recent years, NordREG has focused on establishing joint recommendations to achieve a harmonized Nordic electricity retail market. The Nordic countries have, and still are, making substantial changes to their national electricity markets to make them coherent. Such measures include supplier centric market processes and the development of data hubs.

NordREG provides an important platform for information exchange and sharing of best practices. This report describes the status of the implementation of data hubs in the Nordic countries. The information comes from both the Nordic transmission system operators (TSOs) and the Nordic regulators.

Simo Nurmi
Chair of NordREG

Helsinki, June 2020

Executive summary

Since 2005, NordREG has worked towards a harmonized Nordic electricity retail market. Many important steps have been taken, and in three years' time it is estimated that all Nordic countries have data hubs that will facilitate wholesale and retail market processes. The successful implementation of data hubs and the ability to centralize the handling of market processes is a key factor for the Nordic retail market to work effectively.

The governments and regulators in all the Nordic countries have given the transmission system operators (TSOs) the responsibility to develop and operate the data hubs in each respective market. Today, data hubs are up and running in Denmark and Norway and under development in Finland and Sweden, with a scheduled start around February 2022 in Finland and, depending on the legislation, 2022/2023 in Sweden.

In February 2020, the Finnish TSO started to test their national data hub together with a pilot group, consisting of suppliers and DSO's (distribution system operator). The TSO has, in cooperation with the Finnish Energy Industry, delivered a proposal for secondary legislation to the Ministry. In 2021, the work to develop a system for data migration will continue. At the same time, testing will continue, and certification of users will open for market participants.

The Swedish data hub's go-live date may be delayed since the necessary legislative package has been delayed. The latest estimate for the data hub to be operational is 2022/2023 at the earliest. Some of the project activities that the Swedish TSO has highlighted in this report are dependent on the legislation. Further delay on the legislation will therefore impact the go-live date. In 2020 and 2021 the TSO will continue to develop the national data hub and focus the work on implementing data migration systems and working with system vendors for data hub communication tools.

The data hub in Denmark is up and running since 2013. In 2019, it was operational 99,9 percent of the time. In 2019 and 2020 the goal has been to improve consumer access to data and the TSO launching an improved version of 'My Data Access', the IT systems that gives the customer access to his/her own data¹. In 2021 and going forward, Denmark will focus on the development of the updated data hub (Data hub 3.0) which should go live in 2022.

In Norway, the data hub went into operation in February 2019. The TSO is now in the process of changing to a new service provider for hardware operations and building up internal technical staff to operate and develop the data hub. From 2021, the TSO will develop a new solution with adequate functionalities for serving the upcoming demands for 15-minute resolution in accordance with EUs electricity balance guidelines (EBGL), coming into effect late 2022 or 2023.

In this year's report, NordREG concludes that none of the Nordic data hubs are integrated with the national PCT (Price Comparison Tool), but end-users can access their hourly consumption data in Denmark and Norway, and this will soon be possible in Finland and Sweden too. NordREG believes that enabling customers to access actual consumption data when searching for a new electricity contracts can reduce the barrier to switch supplier. However, none of the Nordic TSO's have found the need for this integration and it has therefore not been implemented or is planned to be implemented.

Finally, in this report, the TSO's from Denmark and Norway share valuable insights from implementing their data hubs, which could be useful in the work to implement the Finnish and Swedish data hubs. One of the main findings in Denmark and Norway was to maintain close cooperation with the necessary regulatory authorities as well as with the market actors.

¹ At www.eloverblik.dk, customers can log in and see their consumption and other data.

1. Introduction

In 2020, Denmark and Norway are the only NordREG members that have fully implemented data hubs in their markets. In Finland and Sweden, the development of data hubs is underway, with planned launches for Finland in February 2022 and 2022 or 2023 for Sweden.

NordREG believes that implementation of data hubs is beneficial for the development of the Nordic electricity retail markets. The development of national data hub solutions and adhering regulations will be implemented on a national level.

In recent years, NordREG's Retail Market Working Group (RMWG) has followed the work to implement national data hubs and reported the findings to the NordREG Board on an annual basis. Initially, the report was based on information from the national regulators. Now, with the legislation in place (or suggested to the government²) and the TSOs gradually taking responsibility for the implementation, the RMWG has included the TSOs in this annual report.

NordREG promotes the exchange of ideas and lessons learned from current data hub projects. Increased cooperation between data hub operators may potentially lead to lower costs and improved IT services for the industry. Therefore, in this report, the Danish and Norwegian TSOs were asked to provide lessons learned to the Finnish and Swedish TSOs.

In 2020, NordREG is also conducting a cost-benefit analysis regarding interoperability of the Nordic data hubs. The study, that is scheduled to be published Q4 2020, will answer the following questions:

1. Is it socioeconomically efficient on a Nordic level to interconnect the Nordic data hubs to enable interoperability for further development and harmonization of the Nordic retail energy markets?
2. If interoperability creates a positive net result, what is the most cost-effective way to make the data hubs interoperable?
3. What rules and regulations need to be harmonized for interoperability to work?
4. If interoperability creates a negative net result, what are the reasons for this?

In chapter 2 of this report, the TSOs have provided an update on the status of the implementation (or operation) of the different data hubs. In chapter 4, the national regulators have described the legal framework and functionalities of the data hubs in their country. Chapter 4 has not changed in substance since the last annual report.

² Ei (Energimarknadsinspektionen) has suggested new legislation to the Swedish government. New law has not yet been approved by Swedish parliament.

2. Summary of the status of the Nordic TSOs' implementation of data hubs

The TSOs are responsible for developing and operating the data hubs in the Nordic countries. This chapter gives an update from each of the Nordic TSOs regarding the status of the implementation of data hubs in their country. Table 1 (below) presents a summary of the answers from the national TSOs. This is followed by a full presentation of the answers.

Table 1. Summary - Status of the TSOs data hub implementation.

Question	Denmark	Finland	Norway	Sweden
What is the status of the national data hub implementation in March 2020?	Up and running since 2013. Operational 99,9% of the time.	A pilot group is testing the data hub. The legislative changes are proposed to the Ministry.	Up and running since February 2019.	Implementation is underway. Go-live date postponed due to delayed legislative package.
What overall activities are planned in 2020?	Possible system upgrade considered, to secure a modern and up to date data hub architecture.	Data migration and cleaning processes continue. Testing of certification service will open for market participants.	Statnett is changing to a new service provider for hardware operations and building up internal expertise to operate and develop new releases.	Continued development of the data hub functionality for the first release. Implementation of the migration system and start of actor migration activities of structure data.
What activities are planned 2021 and going forward?	Focus on development of the updated data hub (Data hub 3.0), as well as on how a data hub can support and ensure the Green Value from RE (renewable energy) resources.	The market participants are obliged to certify their IT systems by using the testing and certification service provided by Fingrid Datahub Oy. Production tests and go-live rehearsals will be conducted with market participants, eSett Oy and Fingrid Datahub Oy.	Development of a new solution for the 15-minute settlement resolution. Strengthening and improving internal staff experience and skills for maintaining and improving the Elhub solution.	Same as above.
When do you estimate that the implementation of the data hub is completed?	The data hub has been up and running since 2013. An update is estimated to go live in 2022.	2022	The has been up and running since 2019. An update is estimated to go live in 2023 (with 15-minute data).	2022/2023
Is the data hub integrated in any way with the national PCT?	No	No	No	No
What are the lessons learned in Denmark and Norway?	Thorough testing and a long mandatory end-to-end test before go-live is needed. A well-prepared support organization is essential. For more lessons learned, see chapter 6.	N/A	Do not take the quality assurance from the market actors on the quality level for structural data for granted. For more lessons learned, see chapter 6.	N/A

3. TSO answers to the data hub questionnaire

In this section the individual responses from each TSO on the data hub questionnaire is presented.

What is the current status of the national data hub?

Denmark (Energinet.dk)

Energinet.dk's data hub has been up and running since 2013. It has been operational 99,9 percent of the time in both 2018 and 2019 within working hours³. In 2019 our focus was on improving consumer access to data in the data hub, and in December we launched an improved version of 'My Data Access', the IT system that gives the customer access to his/her own data⁴.

Finland (Fingrid Oyj)

In 2018, CGI Finland was chosen as the data hub system supplier. The development of the IT project is currently running as scheduled. During 2019, Fingrid Datahub Oy and the market participants have cooperated closely. The work with mandatory data migration and cleaning processes are now in progress. The market participants started to test the software used in the data hub in May 2019 and tests with a pilot group started in February 2020. The tests carried out in 2019 were only for the system developers, while 2020 tests are for the pilot group (which includes both market participants and their system developers).

In 2019, Fingrid Datahub Oy, in cooperation with Finnish Energy Industry, delivered a proposal for the needed secondary law changes to the Ministry of Economic Affairs and Employment.

The Electricity Market decree for the go-live date of the Finnish data hub came into effect in December 2019. The go-live date of the Finnish data hub is now 21 February 2022. The go-live date was postponed from April 2021, as the market participants in Finland needed more time.

Norway (Statnett)

The regulator gave Statnett the assignment to design, develop and operate the Norwegian data hub in May 2013. The data hub (Elhub) system went into operation in February 2019.

Elhub receives, validates and distributes hourly metering values received from grid owners daily before 07:00. Elhub calculates hourly profiles for consumption received from non-hourly metering points. On a daily basis, Elhub aggregates as well as calculates grid loss for each metering grid area (MGA). The hourly data is reported to eSett after two days (D+2) and updated after five days (D+5) for the imbalance settlement calculation.

Elhub calculates a reconciliation for all changes made on a monthly basis, after the final D+5 is sent to eSett. Elhub performs settlements between the parties. Consumption and production data are also used for reporting to the Norwegian Energy Certificate System and Statistics Norway.

Market processes such as change of supplier, moving, etc., are executed according to common market process business specifications and are orchestrated by the Elhub solution. This includes cancellation and roll-back processes.

³ Within working hours is the time between 8-17, the time where the market can expect the datahub to be operational.

⁴ At www.eloverblikk.dk, the customer can log in and see their consumption and other data.

End-users can access information for their metering points via a dedicated Web based solution, accessible via their chosen power supplier's web page. End-users can grant 3rd party access to metering values and metering point information via the Web based solution.

Market actors have access to a Web portal with several services. Services include MGA balance overview, meter data verification, market process overview and a set of status reports.

Elhub produces a monthly status report, published on; <https://elhub.no/brukerfora/elhub-manedsrapport/> These monthly reports will give stakeholders a detailed insight and well documented information on the current situation and operations at Elhub.

Elhub facilitates a monthly user forum where operational issues and functional enhancements are discussed with a representative group of market actors. More information on the user forum can be found here: <https://elhub.no/brukerfora/elhub-brukerforum/>

Elhub's strategic forum, the Advisory Board, meets on a regularly basis every second month to discuss current market issues, regulator issues and plans, as well as future strategic issues on Elhub development. Representatives are nominated among the market actors for a two-year period. Observers from the Branch organizations as well as other important stakeholders participate in these meetings. More information on the Advisory Board can be looked at here: <https://elhub.no/brukerfora/bransjerad/>

The market participants have steadily, since the go-live, increased their reported daily data quality, which has had a positive effect on Elhub's day-to-day operations and service deliveries towards market actors. In addition to daily operations, Elhub has designed and planned for new functionalities, and for some issues finished development, as well as some needed maintenance and upgrading of software.

So far, Elhub has been working well over all and the market actors fulfill their obligations and responsibilities in the electricity market. For further information on Elhub services, go to www.elhub.no.

Sweden (Svenska kraftnät)

The expected legislative package from the Ministry has been delayed, which affects the timetable. The Ministry expects the legislative package to be implemented by the beginning of 2021. Some of the project activities are dependent on the legislation, and further delay will impact the go-live date. The Swedish hub will be operational at the earliest in 2022/2023.

The following has been carried out in the Swedish data hub project:

- A prototype of the hub solution was completed in June 2019. Since then, the development of the full-scale data hub has continued.
- An API portal has been launched containing process descriptions and technical oriented material for the all participating actors' preparations of IT systems.
- A purchase process of a migration solution for structure data has been completed. A contract is about to be signed with the chosen supplier.
- The hub solution is being developed in close market cooperation. Four different actor groups are connected to the project including both market participants as well as IT system developers. Recently, a branch advisory board was started with participation from the higher management levels of the actor companies.

- Establishment activities have been started to prepare Svenska kraftnät for the maintenance of the data hub including staff planning, IT sourcing strategies and business models. Svenska kraftnät has also made the decision to operate the data hub within Svenska kraftnät, and not as a subsidiary to Svenska kraftnät. Evaluation of sourcing strategy is on-going.

What is planned for 2020?

Denmark (Energinet.dk)

In 2020 Energinet is looking into a system upgrade to secure a modern and up to date data hub architecture. This will be accomplished through an internal development project, with help from consultants. An essential focus during the system upgrade will be the involvement of our external stakeholders. During the same period, the integration of Nordic Balancing Settlement will be implemented alongside various minor upgrades to the existing data hub.

Finland (Fingrid Oyj)

The data hub system IT project planning, development, testing and implementation is going on between Fingrid Datahub Oy and CGI Finland.

Fingrid Datahub Oy has prepared a table of milestones in cooperation with the market participants towards the end of 2019 and at the beginning of 2020. This documentation describes concrete milestones, what market participants are obliged to do and when, what kinds of data hub activities there are, such as data migration and industry testing and market participant certification.

Data migration and cleaning processes continue throughout 2020. Market participants' new codes (GLN, GSRN and EIC⁵) are to be delivered to the data migration tool. Testing and certification service will be opened for market participants.

Norway (Statnett)

The Elhub solution has since autumn 2019 been executing a Transition project with the end goal of changing to a new service provider for hardware operations and building up internal technical staff to have the ability to operate, maintain and develop new releases of the solution. Additionally, the focus will be to achieve a higher degree of quality of received metering values from grid companies and encourage them to focus on a higher degree of process automation in respect of the meter value distribution.

⁵ GLN refers to the party identifier based on the GS1 Company ID which needs to be applied by DSOs and retailers. GSRN is the location and metering point identifier. EIC is the code retrieved by DSOs for their metering areas.

Sweden (Svenska kraftnät)

The plan for the next 12 months depends on the plan for the legislation and pending approval from the Svenska Kraftnät Board. It includes:

- Continued development of the data hub functionality in the first release.
- Implementation of the Migration system and start of actor migration activities for structure data.
- Get system vendors to start with activities to modify their systems and API development for communication with the Swedish data hub.
- Execution of the change management program, including plans and material for education and information around the new market model and processes.

What activities are planned in 2021 and forward?

Denmark (Energinet.dk)

The development of the updated data hub (Data hub 3.0) will be our primary focus in the coming years. The expected go-live will take place in 2022. This means that the everyday operation of our existing system will coexist during the development project. We will also be investigating how a data hub can support and ensure the green value from renewable energy resources all the way to the end-user, whether it is proof of the green stream or of PtX products.

Finland (Fingrid Oyj)

The data hub system IT project development, testing and implementation will continue between Fingrid Datahub Oy and CGI Finland. The market participants are obliged to certify their IT systems by using the testing and certification service provided by Fingrid Datahub Oy.

Production test run phases and go-live rehearsal will be driven between the market participants, eSett Oy and Fingrid Datahub Oy. Commissioning and go-live date of the Finnish data hub is 21.2.2022.

Norway (Statnett)

In 2021 and onwards the focus will be to develop a new solution with adequate functionalities for serving the upcoming demands for a 15-minute resolution in accordance with EUs electricity balancing guidelines (EBGL) in late 2022 or in 2023.

Additionally, internal focus will be on strengthening and improving internal staff experience and skills for maintaining and improving the Elhub solution.

Sweden (Svenska kraftnät)

See answer for question 2 above.

When do you estimate that the data hub is implemented (or for Denmark and Norway, the next release)?

Denmark (Energinet.dk)

The Danish data hub was first released in 2013 and upgraded with the Wholesale model in 2016. Changes, upgrades and enhancements are released every other month. Furthermore, we estimate that the release of the new system (Data hub 3.0) will take place in 2022.

Finland (Fingrid Oyj)

The Finnish data hub system must support reporting data in 15-minute intervals and with 15-minute settlement periods. Based on the high-level plans, the Finnish Data hub system will support 15-minute data reporting periods from the beginning of 2023. 15-minute settlement periods will be supported then when the go-live day has been regulated.

Norway (Statnett)

Elhub has plans for several types of releases during the year. New releases are executed in close cooperation with the market and system vendors serving the market actors, including project plans for changes to new releases as well as development and testing plans. The production execution plan is executed under orchestration of Elhub, so that all market parties' ICT systems and processes are changed and updated simultaneously.

Sweden (Svenska kraftnät)

The first release of the Swedish hub can at the earliest be operational at the earliest in 2022/2023. The go-live date depends on the delivery of the legislative package. We are planning for a sequential go-live, where functionality is activated during a go-live period to mitigate risks.

Is the data hub integrated in any way with the national PCT?

The TSO's were asked if it is possible for the customer to retrieve consumption data from the data hub and use it on the PCT. If it is not possible, TSO's were asked if they had any plans for this type of integration in the future. This question was asked in order to investigate the development of the integration between PCT and data hubs that was proposed in the conclusions from the NordREG Retail Market Working Group's Monitoring Workshop in 2018. The integration would make it possible for customers to retrieve consumption data from the data hub when searching in the national PCT. This would reduce the barrier for customers to switch supplier.

Denmark (Energinet.dk)

We are not considering PCT at the moment.

Finland (Fingrid Oyj)

At the moment, there are no plans to integrate the Finnish data hub system with the national PCT.

Norway (Statnett)

There are no plans for integration with the national PCT, but the end-users can retrieve their consumption data via the Balance Supplier provider's web page or directly by accessing Elhub's web-based solution. Every end-user at a metering point can log in to 'their locked area' using what is called 'ID-porten'. ID-porten is a common login solution for Norwegian public services on the internet which allows for secure access to the reported metering values.

Sweden (Svenska kraftnät)

The Swedish hub is not integrated with the Swedish PCT, elpriskollen.se. We have not identified a need for this and have no future plans for it. If a need is identified, we will analyze that need and see how it can be fulfilled.

What are the lessons learned from the implementation of data hubs?

The Danish and Norwegian TSO's were asked what lessons they have learned from the implementation of their data hubs and what could be shared with the Swedish and Finnish TSO's development teams.

Denmark (Energinet.dk)

The lessons learned from the project and operations are:

- Involvement of market players is important before, during and after the project
- Close cooperation with authorities is needed
- Thorough testing and long mandatory end-to-end testing before go-live
- Business processes are complex but crucial for operation
- Wide access to data and data correction is required
- Well prepared support organization

The lessons learned from a technical perspective is:

- Ability to migrate an unlimited number of times
- Importance of using different project managers for external market issues and internal technical issues
- Smooth migration into production – no last-minute big bang migration before cutover
- Staff need broad knowledge of underlying data structures
- Long migration period and many opportunities to correct mistakes
- Extensively reporting facilities to detect faulty data and structures
- It was possible to stop or reject active migrations at all stages (time and HW savings)

The lessons learned from scheduled and prioritized execution of migrations (preventing system overload)

- The importance of experienced data quality
- Avoid missing data in mandatory fields
- Line shifts in data fields – results in split records
- Importance of date/time fields in general
- Make sure that fields conform to the agreed data hub domain codes
- Too few or too many data fields
- Adding a price link with no corresponding price element
- Overlapping start and stop dates
- Creating incorrect metering point type for new technical metering points
- Missing child metering points where required
- Missing metering points when creating links or master data updates

The lessons learned from testing

- Know what to do if a partial delivery fails to meet the acceptance criteria
- The test cases are time-consuming to create, just like the test data
- Access to in-house developers has been essential
- Cooperation with in-house Solution Architects has been essential

Norway (Statnett)

- Do not underestimate the time usage for executing the necessary tasks for designing, developing, testing, as well as education of the market actors' staff.
- Do not take the quality assurance from the market actors on the quality level for structural data for granted.
- Do not underestimate the level of central coordination and orchestration needs to improve the common data quality. A central coordination of data migration activities and quality level control are of immense importance for achieving success.
- Do not underestimate the need for cooperation between the system vendors and market actors, so these important stakeholders work parallelly according to data hub project timelines, priorities and execution qualities.
- Manage a realistic and thorough Risk Assessment dashboard during the project, so you can identify, prepare actions and navigate through 'rough times', as the project paves its way to the end-goal.
- Establish a robust service center for all the market actors and other stakeholders.
- In terms of governance, establish a Branch Advisory Board with a representative participant from market actors at management level, for executing strategic discussions and way forward decisions. At operational level, it is recommended to establish a Market Actor Forum for executing operational discussions and detailed decision choices. This forum should include representatives from all market

actors, system vendors and other important stakeholders. Manage orchestration and follow-ups on their progress and internal priorities that might enhance risks for the project's critical path.

- Plan for and execute regular meetings on different levels with the NRA. Accept and gain understanding on the different timelines to fulfill a complete regulatory legislation for the data hub. The national regulatory body time plan for developing the regulatory framework and the time needed for designing, developing and testing of the data hub need to be well coordinated.
- Accept and plan for unexpected events and the need for changes to be made.

4. The legal framework described by the Nordic regulators

This section describes the legal framework for the Nordic data hubs and the functionalities that will be available. Information has been provided by the Nordic regulatory agencies from each respective country.

Governance of data hub development and operation of data hubs

Denmark (Energinet.dk)

The Danish TSO, Energinet, owns and operates the Danish data hub. Energinet is in close cooperation with stakeholders and authorities, including DERA who approves methods within Energinet's market regulations. A key area of cooperation between companies, authorities and stakeholders is quality assurance of data. The data hub ensures a level playing field for all electricity suppliers through:

- Standardized processes for registration and distribution of market data
- Low entry barriers for new market participants
- Single point of entry for change of supplier
- Clear definition of DSO and electricity supplier, and separation of roles

The data hub protects data by providing a secure environment and a secure and traceable access process to data. Data stored in the data hub is e.g. meter readings and master data. Further, the data hub features services such as market support, reporting, monitoring and statistics. The data hub registers e.g. change of supplier and a consumer's change of address.

Finland (Fingrid Oyj)

Fingrid Oyj (TSO) is responsible for developing the Finish data hub and is in charge of the project. The data hub will be operated by a fully owned subsidiary of Fingrid Oyj, named Fingrid Datahub Oy. The necessary legislation is now in place.

Fingrid Oyj has established four different working groups for industry cooperation. An implementation working group has been working with issues related to implementation of the data hub. The council has monitored the progress of the project, contributed to the achievement of the project objectives, increased stakeholders' knowledge and given views in matters relating to industry and stakeholders. There are also sub-working groups that have concentrated on DSO processes, supplier processes and technical issues.

The industry is now making the required preparations. Fingrid has, in cooperation with the industry, prepared a deployment plan for the introduction of the data hub.

Norway (Statnett)

Statnett (TSO) owns and operates the Norwegian data hub Elhub. RME-NVE (The Norwegian Energy Regulatory Authority) is responsible for regulating Elhub, e.g. make legal decisions towards Statnett, DSOs, suppliers and third-party service providers. Statnett provides guidelines.

RME also regulates the Elhub's revenues. The purpose of the economic regulation is to give Statnett incentives to provide an efficient and secure service and operation. The revenues are audited every year, but an improvised economic regulation will be determined every third year. The current economic regulation period is from go-live in February 2019 to the end of 2022. An external audit of Elhub is planned at the end of 2022.

RME-NVE monitors the quality of the metering point data in Elhub. In 2019, the DSOs who did not comply with the requirements for reporting consumption, production and power exchange to Elhub where imposed a coercive fine by RME-NVE.

As required by RME-NVE, Statnett facilitates a stakeholder council for Elhub. The council consists of representatives from DSOs and suppliers, while RME-NVE participates as observer. The council provides the industry with recent developments and the progress of on-going issues, and the parties of the council are invited to raise and discuss issues.

Sweden (Svenska kraftnät)

The national TSO, Svenska kraftnät (Svk), is responsible for developing, building, implementing and running Sweden's data hub. It is also responsible for developing features in the user contract, compiling a handbook and other detailed requirements. Energimarknadsinspektionen (Ei), the Swedish regulator, is responsible for producing the overall regulatory framework that is required for giving the data hub a place in the electricity market.

In June 2017, Ei handed over a report to the Government containing proposals for legislative changes necessary to allow the introduction of the data hub as well as a supplier-centric market model. The report was on public consultation during the Fall of 2017. During the process that led up to the finished report, Ei and Svenska kraftnät worked closely with stakeholders in different reference and working groups to ensure stakeholder involvement.

The government has been working on Ei's proposals, and it is estimated that the bill with the legislative changes will be approved by the Government and Parliament next year. Svenska kraftnät has already started development of the data hub, having produced a prototype so far. Ei has started a project in preparation for issuing secondary regulation, after the legislation has been passed.

5. Functionalities in Nordic hubs

In this section the functionalities for each respective data hub is presented.

Table 2 Compilation of functionalities in the Nordic data hubs

	Norway	Denmark	Finland	Sweden
Meter point management	Yes. DSO provides data.	Yes	Yes. DSO provides data (creates, updates and removes metering points). Supplier may request changes, which the DSO carries out.	Yes. DSO provides data.
Customer data management	Yes. The supplier is responsible for updating customer information.	Yes	Yes. Supplier provides customer data in connection with a new contract. The supplier is also responsible for updating customer information. The DSO may request changes. The data hub forwards the request to the supplier with the latest customer contract.	Yes. The supplier will be responsible for updating customer information.
Customer moving and switching	Yes	Yes	Yes. When providing data on a new supply contract, it is not necessary to specify whether it is due for moving or switching -> the data hub validates it automatically.	Yes, these processes will be part of the hub.
Contract management	Includes contract data for start and end of supply, but no data on supply prices. Elhub does not notify suppliers of fees for cancellation of fixed price contracts.	The data hub has no legal authorization for storing data concerning the contract between the supplier and the customer.	Supplier provides information on new supply contracts as well as updates them. The data hub automatically terminates the previous rolling contract once a new contract is registered in the data hub and communicates it to the previous contract party. The data hub includes the end date for fixed contracts, but not possible contractual penalties for breach of contract. In valid fixed time contracts, the data hub prevents making a new supply contract in cases where the same customers are in question. The DSO confirms new network contracts and updates them.	Suppliers register information on customers' supply contract (end date and any fee for ending the contract early). The data hub will not contain any physical contracts. These will be handled outwith.
Forwarding service requests from supplier to DSO	Yes	Yes	Yes, and vice versa.	Yes
Meter value management	Yes. DSOs are responsible for data quality.	Yes	Yes. The DSO or a service provider is responsible for providing meter values. The DSO is responsible for	Yes

	Norway	Denmark	Finland	Sweden
			meter equipment and data quality. Meter values will be stored for six years.	
Third party access to metering data	Yes	Yes	Yes	Yes
Provides settlement data to NBS	Yes	No	Yes. Provides balance settlement data to eSett according to NBS rules.	Yes
Market monitoring	Yes	Yes, to a limited extent.	Yes	Yes
Correction settlement	Yes	Yes	Yes	Yes
Compiling statistics	Yes	Yes	Yes, that is planned (no details yet).	Compiling information for Statistics Sweden, etc.
Billing	Mandatory combined billing has not yet been implemented by law in Norway, and this functionality has not been included in the first version of Elhub. It will be possible to include the functionality at a later stage (probably closer to 2019).	In accordance with the supplier-centric model, the bill from the DSO and the bill from the supplier have merged into one bill. The supplier sends the bill to the consumer.	Mandatory combined billing has not been implemented in Finland. The data hub includes information on separate/combined billing as well as on billing channels (paper bill, E-billing, email, etc.). DSOs and suppliers can submit more detailed billing data to the data hub (e.g. billing frequency, start and end date, product, price, amount).	Ei has suggested to the Government that mandatory combined billing should be introduced.
Other functionalities	<ol style="list-style-type: none"> 1. Reversal of business processes (e.g. in case of faulty switches) 2. Security management system 3. Privacy management for customers incl. giving data access to other persons or companies and view own data stored in Elhub 4. Security management system 	The data hub sets up possibilities for third party access to the. A consumer controls third party access to the data hub. The data hub handles data from prosumers.	<ol style="list-style-type: none"> 1. Disconnection and reconnection processes 2. Handling of customers' power of attorney 3. Cancellation (due to distance selling regulation) and contract 	<ol style="list-style-type: none"> 1. Central registration and/or handling of customers' power of attorney 2. Supplier of last resort functionality for customers that are without power supply.