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Implementation of data hubs in the Nordic countries

Status Report, December 2021

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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.

Tore Langset
Chair of NordREG

Oslo, December 2021

Executive summary

Since 2005, NordREG has worked towards a harmonized Nordic electricity retail market. A lot of progress has been made, and in 2022 Denmark, Norway and Finland will all have data hubs in place to facilitate wholesale and retail market processes. In Sweden, the work to implement a data hub is currently put on hold with no date for restart scheduled.

NordREG believes that successful implementation of data hubs and the ability to centralise handling of market processes are key factors for the Nordic retail market to work effectively. In October 2021, data hubs were up and running in Denmark and Norway and under finalisation in Finland, with a scheduled go-live date on 21 February 2022.

There is no estimated go-live date for the Swedish data hub since the necessary legislative package has been further delayed. However, according to the Swedish TSO, Svenska Kraftnät, the project will be restarted as soon as legislation is in place. Depending on when the legislation is enacted, the estimated time to complete the project is 3 to 4 years.

The Danish TSO, Energinet, is currently developing a new version of the data hub, set to go live in the second half of 2022. Meanwhile, Energinet is also developing a new granulated guarantee of origins system.

In Norway, an investment decision has been made to move the current data hub from an on-premise based locally operated environment towards a cloud-based solution with servers and solutions. This project will also pave the way for changes needed to facilitate the operationalisation of the Electricity Balancing Guideline (EBGL) and the 15-minute time resolution due in 2023.

Finally, the TSO's from Denmark and Norway share valuable insights from implementing their data hubs. For example, the importance of carefully estimating the time needed to achieve an acceptable level of data quality alignment along the value chain.

1. Introduction

Denmark and Norway were the only NordREG members that had fully implemented data hubs in their markets in 2021. In Finland, the development was in its final phase, with planned launch 21 February 2022. In Sweden, the work has been put on hold while waiting for government and parliament to put the necessary legislation in place.

NordREG believes that implementation of data hubs is beneficial for the development of the Nordic electricity retail markets. 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. In recent years, the RMWG has included reports from the TSOs in the 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, as in previous reports, the Danish and Norwegian TSOs were asked to provide lessons learned to the Finnish and Swedish TSOs.

Chapter 2 of this report summarises the TSOs' answers regarding the current status of implementation (or operation) of the different data hubs. In chapter 3, 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. Summary of the status of the Nordic TSOs' implementation of data hubs

The Nordic 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 (October 2021).

Question	Denmark	Finland	Norway	Sweden
What is the status of the national data hub implementation in October 2021?	Up and running since 2013 with a runtime of 99,9 % in 2018, 2019 and 2020.	Most of the preparatory work completed for go-live in February 2022.	Up and running since February 2019.	The development of the datahub is put on hold due to delays of the Swedish legislation.
What overall activities are planned in the near future (2021)?	New version is set to go live in the second half of 2022.	Final rehearsal of go-live with the market parties completed in December 2021.	Investment decision taken to move the current Elhub towards a cloud-based solution with servers and solutions physically located in a European country.	The legislation that was scheduled to come at the end of 2021 has now been further delayed at least six months, potentially longer.
What activities are planned in 2022 and going forward?	The development of the Green Energy Hub/DataHub 3.0 is our primary focus in 2022.	Datahub go-live 21 February 2022. After that, testing of datahub project 2.0 functionalities will start.	Continued focus on a cloud-based data hub. The EBGL/15-minute time resolution project will be prepared for testing.	The project will be restarted when the legislation is in place.
When do you estimate that implementation of the data hub is completed?	The next release of the data hub will be implemented during the second half of 2022.	Data hub project 1.0 will go live in February 2022. Data hub project 2.0 will go live in January 2023.	Elhub will have a continues improvement approach.	Depends on when the legislation is delivered. Estimated time for project is 3-4 years, dependent on strategy and possibilities to assign resources.
What are lessons learned in Denmark and Norway?	When you change the system, consider your existing processes carefully. We learned that there was a lot to gain in rethinking a lot of them.	N/A	Do not underestimate the amount of time needed to achieve an acceptable level of data quality alignment along the value chain.	N/A

3. TSO answers to the data hub questionnaire

In this section the TSOs' individual responses to the data hub questionnaire are presented.

Current status regarding the national data hub

Denmark (Energinet.dk)

Energinet's data hub has been up and running since 2013, with a runtime of 99,9 % in 2018, 2019 and 2020 within working hours. In 2020 our focus was on improving access to data in the data hub to activate the inherent potential in our data for green innovation.

Finland (Fingrid Oyj)

The following work has been completed:

- The development work for version 1.0 of the data hub was finalised in November 2020. Data migration, cleaning processes and consistency checking with the market parties has been completed.
- Site Acceptance Tests for version 1.0 of the data hub was finalised in May 2021.
- Market party testing and certification of the data hub was completed in May 2021.
- Trial production run periods 1 (June 2021) and 2 (September 2021) were completed in cooperation with the market parties.
- Data hub project 2.0 (e.g. support for energy communities and 15-minute reporting and settlement) has been started together with the system supplier.
- The necessary secondary law changes were finalised in cooperation with the Ministry of Economic Affairs and Employment.
- The Energy Authority confirmed the Service Agreement for the distribution system operators (DSOs) and electricity suppliers in the retail market in August 2021.
- The Energy Authority updated and confirmed the reasonable profits for data hub investments in September 2021.

Norway (Statnett)

Elhub is in operation and works in line with expectations.

Elhub was implemented on 18 February 2019, and it is mandatory for all market participants in the Norwegian retail market for electricity to utilise the hub in regard to business processes and settlements. There are currently 324 active users of the hub (129 grid companies, 161 balance suppliers and 34 3rd party suppliers). In addition, Elhub consist of 3,2 million active metering points at end-users and prosumers.

Elhub receives around 70 million metering values every day. In 2020 Elhub managed 755 000 changes of supplier, 585 000 metering point takeovers (i.e. customers moving in or out of a house) and 74 million market processes between market participants.

Sweden (Svenska kraftnät)

The development of the Swedish data hub has been put on hold since September 2020 due to delays in the Swedish legislation. The project started in 2015 and estimated completion of development was approximately 20 % when stopped.

Planned activities in the near future (late 2021 and early 2022)

Denmark (Energinet.dk)

We are currently developing the new version of the data hub – called Green Energy Hub. It is set to go live in the second half of 2022. The new data hub is developed as an open source project, which means that we are working in close cooperation with IT partners as well as sharing our knowledge of open sourcing development

of a system of this magnitude. This is clearly drawing the interest of other TSOs across the world. Strengthening these potential partnerships is also a major priority for us.

Also, we are working on developing a granulated guarantee of origins system, EnergyOrigin. We are developing this system both as a Danish solution to be implemented in 2022 and as part of several international partnerships to contribute to a European wide/global system development.

Finland (Fingrid Oyj)

Final rehearsal of go-live with the market parties is taking place November/December 2021. The law for the commissioning period of the data hub will come into force.

The service agreement signing process with the market parties was completed in October 2021.

Norway (Statnett)

Elhub's Board has made an investment decision to start up a project called Optimus. The objective of the Optimus project is to move the current Elhub solution from an on-premises based locally operated environment to a cloud-based solution with servers and solutions. All necessary steps are taken in advance to fulfill the GDPR and Schrems II requirements for stored and incoming data from market actors. Elhub are also following the outcome of the upcoming EU Digital Service Act and will analyze if there are any new demands valid for Elhub. The Norwegian regulatory authority is orientated about the plans for a cloud-based solution.

The Optimus project will also facilitate Elhub for measures such as e.g. Electricity Balancing Guideline (EBGL), project as 15-minute time-resolution which is suggested to be in operation in 2023.

In addition, Elhub is in the investigation phase of gaining knowledge to consider establishing a data platform for stakeholders and market participants. Market participants in this context are Grid companies, balance suppliers, and 3rd parties.

Market participants are making further improvements to the solution code, service level and data quality on a daily basis, showing great progress.

Sweden (Svenska kraftnät)

The proposed legislation was announced to be enacted at the end of 2021 and is further delayed at least six months, potentially longer. Due to this, the development of the Swedish hub will continue to be on hold.

Planned activities from 2022

Denmark (Energinet.dk)

The development of the Green Energy Hub/DataHub 3.0 is our primary focus in 2022. The system will go live in September 2022, but work to develop and perfect its features will continue past September.

We will also prioritise strengthening our partnerships across all stakeholder groups.

Finland (Fingrid Oyj)

Data hub go-live is planned for 21 February 2022, followed by stabilising retail market operations with the market parties. Implementation and testing the data hub project 2.0 functionalities with the system supplier and later with the market parties.

Norway (Statnett)

Statnett will continue and finalize the Optimus project. The EBGL/15-minute time resolution project will be made ready for testing purposes for market participants. Statnett will also consider working to establish the Elhub data platform, and further improve solution codes, the service level provided to market participants and the data quality from market participants.

The goal is to reduce operational costs and make investments towards a more future-oriented solution.

Sweden (Svenska Kraftnät)

The project will be restarted when legislation is in place.

Estimated implementation of the Finnish and Swedish data hubs and Denmark's and Norway's estimated next releases

Denmark (Energinet.dk)

The next release of the data hub will be implemented in the second half of 2022.

Finland (Fingrid Oyj)

Data hub project 1.0 goes live in February 2022. Data hub project 2.0 will go live in January 2023, as stated in the secondary legislation (supporting energy communities and 15-minute reporting in January 2023 and 15-minute settlement in May 2023).

Norway (Statnett)

Elhub will have a continuous improvement approach. Version 2.0 will be implemented at a later date, when there is a need for a major system change, with new functionalities or technological improvements are available. On a strategic level, big and costly projects for building system monoliths will hopefully be replaced by ones that are better designed and established, with an approach that opens up for smaller units that work together to build an agile, efficient and maintenance friendly ecosystem solution.

Sweden (Svenska kraftnät)

Progress here depends on when legislation is enacted. The estimated time for project completion is 3 to 4 years, depending on which strategy is used and what the possibilities are for assigning resources.

Lessons learned while implementing data hubs in Denmark and Norway

Denmark (Energinet.dk)

Building a whole new system after years of experience with an intricate system, is a very complicated process. So, when you do decide to change the system, consider your existing processes carefully. We learned that there was a lot to gain in rethinking a lot of them. Besides that, the learnings are:

Project and operational:

- Involvement of market players is important both before, during and after the project
- Close cooperation with authorities is necessary
- Thorough testing and mandatory end-to-end testing before go-live is a must
- Business processes are complex but crucial for operation
- Wide access to data and data correction is required
- The importance of a well-prepared support organisation

Technical:

- A dedicated application for controlling migrations from start to end
- Ability to migrate an unlimited number of times - each migration should be able to correct previous errors
- Different Project Managers for external market issues and internal technical issues
- Migration into production – no last-minute big bang migration before cutover
- Staff must have broad knowledge of underlying data structures
- A long migration period, providing many opportunities to correct mistakes
- Extensive reporting facilities to detect faulty data and structures
- Possibility to stop or reject active migrations at all stages (time and HW savings)
- Scheduled and prioritised execution of migrations (to prevent system overload)
- Experienced data quality
- Missing data for mandatory fields must be avoided
- Line breaks in data fields result in split records
- Date/time fields in general are recommended
- Fields that do not conform to the agreed data hub domain codes and too few or too many data fields must be avoided
- Adding a price link without a corresponding price element should not be possible
- Overlapping start and stop dates must be avoided
- It must not be possible to create incorrect metering point types for new technical metering points
- It must not be possible to have missing child metering points when required, or missing metering points when creating links or master data updates

Testing:

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

To sum up, a data hub project is a market project, an organisational project, a business project and an IT development project. However, it is not an IT project.

Norway (Statnett)

Statnett shared the following lessons learned:

- It is important not to underestimate the amount of time needed to achieve an acceptable level of data quality alignment along the value chain
- It is important that market actors' ICT systems are renewed, updated and adjusted, as well as the that their organisations are introduced to new market processes and internal procedures. High competence and knowledge transfer can prevent market failure and operators' wrong-doings, and thereby reduce system errors and slow down system operation progress, due to handling and correction of errors
- Resource constraints at the market actors' ICT system vendors are inevitable
- It is recommended to re-use and harmonise market process design in the Nordic countries to a highest possible degree. Share and ask for knowledge from your Nordic colleagues
- Design and go for a cloud-based solution, it will reduce operational cost. However, make a thorough risk assessment on GDPR compliance and information security before choosing the final vendor for operating the data hub solutions
- Analyse and decide whether an internal operation unit for system operation is beneficial as opposed to increasing the commando line, especially when system incidents occur. Too long a chain of command will slow down the correction time of an incident
- Read Elhub's report on Benefit Realisation for the Elhub project. Link: [Elhub Gevinstrealiseringsrapport](#)
- Include actions towards Benefit realization during the data hub project and plan for realization of benefit both on data hub and market actor level after go-live
- Introduce a well-functioning governance for the industry, with an industry council for strategic and tactical purposes and a market forum for operational issues. Find, when needed, analysis and research teams for solving issues of common interest, with participants from the data hub's organisation and the industry
- Crucial factors for a secure project and operational success require highly competent inhouse employees, focusing on market processes, IT solutions expertise, functional and regulatory issues, as well as project management. In the process, it will also be beneficial both for quality assurance and operational excellence
- In addition to the obvious market roles, include and embrace the market role of 3rd parties into market activities and data hub governance

Other learning points:

- Undertake several real market testing together with the market actor prior to go-live
- Execute a market actor survey twice a year to get feedback for analysis and adjustment
- Introduce "hype care" services towards market actors at least six months before and after go-Live
- Remember, every metering point must be included at time of go-live

- Intensify market actor follow-up work, as you get closer to go-live
- Be in close dialog with market actors' system vendors and increase reporting frequency the closer to go-live you get
- Have an open and including dialog with market actors and set up an internal market service team prior to go-live.
- Gain support and backing from your national regulator and energy department throughout the project and after the go-live date. "You are all in the same boat".
- Learn and share knowledge with your Nordic colleagues
- Be aware that, after the go-live date, that is when the real work starts, executing system optimisation, bug fixing, adjusting market processes, continuous data quality improvement for received metering values as well as metering installation data maintenance from responsible parties and orchestration of introducing new functionalities into the market.
- Look for opportunities to establish a connected data platform for metering values and installation data. The demand for accessible and aggregated data in a secure and GDPR compliant environment after go-live will increase month by month as stakeholder's awareness of your 'valuable data' evolves.

4. The legal framework described by the Nordic regulators

This section describes the legal framework for the Nordic data hubs and the functionalities that are 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:

- Standardised 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 a clear distinction between 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 Finnish data hub and oversees 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. NVE-RME (The Norwegian Energy Regulatory Authority) is responsible for ensuring that Elhub operation is in accordance with regulations.

NVE-RME also regulates 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 is set 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 towards the end of 2022.

NVE-RME monitors the quality of 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 NVE-RME.

As required by NVE-RME, Statnett facilitates an industry council for Elhub. The council consists of representatives from DSOs and suppliers, while NVE-RME 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, 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.

Legislation from the government has been delayed and Svenska kraftnät put their development of the data hub on hold in September 2020. Svenska kraftnät estimated that they were 20 percent done with the development when the project was paused. Ei's work regarding the data hub was paused as well.

5. Functionalities in Nordic hubs

In this section the functionalities for each respective data hub are 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 will provide 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 authorisation 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 will 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 elsewhere.
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
			metering equipment and data quality. Meter values are 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.