Aalto-yliopisto
Aalto-universitetet
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Master's Programme in Advanced Energy Solutions

Service development of the third parties in centralised information exchange services for electricity retail market

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Master's Thesis
2022

Aalto-yliopisto
Aalto-universitetet
Aalto University

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Title of thesis Service development of the third parties in centralised information exchange services for electricity retail market

Programme Advanced Energy Solutions

Major Sustainable Energy Systems and Markets

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Collaborative partner Fingrid Datahub Oy

Date 18.02.2022 **Number of pages** 87 / 7 **Language** English

Abstract

Remarkable changes have been occurring in the electricity markets in recent years, and one of the most significant changes in the Finnish electricity market is the implementation of the datahub system. The datahub is a centralised information exchange system for the electricity retail market. The datahub goes live on February 21, 2022. The datahub system is utilised by electricity retail suppliers and distribution system operators. Additionally, third parties can use the datahub system. The third parties are service providers who can provide services to the market parties and the end customers in the electricity retail market.

This study aimed to discover what kind of companies would act as third parties in the datahub and what type of service development the parties have planned for the forthcoming years. Furthermore, the target was to discover the role of the datahub operator in service development. The research was conducted with a questionnaire, followed by party-specific interviews. The questionnaire was targeted to as a large group of parties as possible. For the interviews, a total of six parties were interviewed.

As a result, the operation of third parties in the electricity markets in general and in the datahub system was clarified. All in all, the third parties consider the implementation of the datahub system a good change in the retail market with several advantages. Some challenges and development ideas were detected as well. Potentially feasible development ideas are added to the development request backlog of the datahub development team. Via the backlog, development ideas are considered in the further development of the system. The role of the datahub operator is to support the development. However, it shall be considered that all the realised development stays within the legislative scope set for the datahub operator.

Keywords datahub, electricity markets, service providers, third parties

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Aalto University

Tekijä Anni Holmström

Työn nimi Kolmansien osapuolten palvelukehitys sähkökaupan keskitetyissä tiedonvaihtopalveluissa

Koulutusohjelma Advanced Energy Solutions

Pääaine Sustainable Energy Systems and Markets

Vastuuopettaja/valvoja Professori Matti Lehtonen

Työn ohjaaja(t) diplomi-insinööri Jukka Rinta-Luoma (tradenomi Marjut Puukangas, sähkövoimatekniikan insinööri Pasi Lintunen)

Yhteistyötaho Fingrid Datahub Oy

Päivämäärä 18.02.2022 **Sivumäärä** 87 / 7 **Kieli** englanti

Tiivistelmä

Sähkömarkkinoilla on viime vuosina tapahtunut merkittäviä muutoksia, ja yksi merkittävimmistä Suomen sähkömarkkinoilla tapahtuvista muutoksista on datahub-järjestelmän käyttöönotto. Datahub on sähkön vähittäismarkkinoiden keskitetty tiedonvaihtojärjestelmä. Datahub otetaan käyttöön 21.2.2022. Datahub-järjestelmää käyttävät sähkön vähittäismyyjät ja jakeluverkonhaltijat. Lisäksi kolmannet osapuolet voivat hyödyntää datahub-järjestelmää. Kolmannet osapuolet ovat palveluntarjoajia, jotka voivat tarjota palveluita sekä markkinaosapuolille että loppuasiakkaille sähkön vähittäismarkkinoilla.

Diplomityön tavoitteena oli selvittää, millaiset yritykset toimisivat datahubissa kolmansina osapuolina ja millaista palvelukehitystä osapuolet ovat suunnitelleet tuleville vuosille. Lisäksi tavoitteena oli selvittää, mikä on datahub-operaattorin rooli palvelukehityksessä. Tutkimus tehtiin kyselylomakkeella, jota seurasi osapuolikohtaiset haastattelut. Kysely suunnattiin mahdollisimman suurelle joukolle toimijoita. Haastattelut toteutettiin kuuden osapuolen kanssa.

Työn tuloksena käsitys kolmansien osapuolten toiminnasta sähkömarkkinoilla yleisesti sekä datahub-järjestelmässä selkeytyi. Kaiken kaikkiaan kolmannet osapuolet kokevat datahub-järjestelmän käyttöönoton olevan hyvä muutos vähittäismarkkinoilla lukuisine hyötyineen. Haasteita ja kehitysideoita havaittiin myös. Mahdollisesti toteutettavissa olevat kehitysideat lisätään datahub-kehitystiimin kehityspyyntöjen seurantalistalle. Seurantalistan kautta kehitysideat huomioidaan järjestelmän jatkokehityksen suunnittelussa. Datahub-operaattorin tehtävänä on tukea toiminnan kehitystä. On kuitenkin otettava huomioon, että kaikki toteutettava kehitys on datahub-operaattorille asetetun lainsäädännön rajoissa.

Avainsanat datahub, sähkömarkkinat, kolmannet osapuolet, palveluntarjoajat

Contents

Preface

I want to thank Fingrid and Fingrid Datahub for this great opportunity to do my master's thesis in collaboration with them. The thesis was written in the datahub project just before the datahub go-live. It has been very exciting to be part of the datahub implementation project, and I am grateful for everything I have learnt during the project.

From Fingrid and Fingrid Datahub, I especially want to thank my thesis advisors Marjut Puukangas, Pasi Lintunen and Jukka Rinta-Luoma for their guidance. I also want to thank all the specialists in Fingrid Datahub team, who gave their support to the study with their expertise via several discussions and interviews. I have learnt lots from everyone who has shared their knowledge during the writing process of the thesis. Also, a big thank you to my supervisor, Professor Matti Lehtonen, for great guidance and cooperation.

Finally, the study would have not been successful if it wasn't for the market actors, who participated in the research of the study. I appreciate the effort of each party who took part in this study. Without them, the study would not have succeeded.

Helsinki, 18 February 2022
Anni Holmström

Abbreviations

AG	Third party (in Elhub)
ASP	Application Service Provider
CIS	Customer Information System
CSP	Communication Service Provider
DDM	Grid Access Provider
DDQ	Energy Supplier
DSO	Distribution system operator
ebIX	the European forum for energy Business Information eXchange
EDI	Electronic data interchange
EFET	European Federation of Energy Traders
ENTSO-E	the European association for the cooperation of transmission system operators (TSOs) for electricity
ERP	Enterprise Resource Planning
ESCO	Energy Service Company
ESP	EDI Service Provider
EU	European Union
FCR-D	Frequency Containment Reserve for Disturbances
FCR-N	Frequency Containment Reserve for Normal Operation
FFR	Fast Frequency Reserve
GDPR	General Data Protection Regulation
HRM	Harmonised Electricity Market Role Model
ICT	Information and Communication Technology
MDR	Metered Data Responsible
MSP	Managed Service Provider
SaaS	Software as a Service
SME	Small and medium-sized enterprise
TSO	Transmission system operator (Fingrid in Finland)

1 Introduction

Remarkable changes have occurred in the electricity markets during recent years, and many changes are yet to come. One of the most significant changes taking place in the Finnish electricity market is the implementation of the datahub system. The datahub is a centralised information exchange system for the electricity retail market (Fingrid, 2021a). In compliance with the go-live decree, the Finnish datahub goes live on February 21, 2022 (Fingrid, 2021b). The market parties in the scope of datahub services are electricity suppliers and distribution system operators. These market parties are obliged by the Finnish Electricity Market Act to use the datahub services (Fingrid, 2021a). Additionally, third parties can utilise the datahub system (Fingrid, 2021b). The third parties are service providers who can provide services to both the market parties and the end customers in the electricity retail market (Fingrid, 2021c).

According to the Electricity Market Act 588/2013, the transmission system operator, Fingrid Oyj (later Fingrid), is responsible for the operational management of the centralised information exchange services (Electricity Market Act 588/2013). Fingrid Datahub Oy (later Fingrid Datahub), a wholly-owned subsidiary of the transmission system operator Fingrid, will manage the operational activities of the information exchange services. In addition to the operational management of the services, the transmission system operator has an obligation to develop further the information exchange and services of the electricity retail market and the datahub system (section 49 Electricity Market Act 108/2019). The requirements include developing the information exchange in an equal and non-discriminatory way for all the retail market participants and maintaining the required data security level at all times. Furthermore, the act obliges the operator to develop the possibilities for implementing value-added services. (section 49 Electricity Market Act 108/2019).

These value-added services may be provided by third parties. This study aims to discover what kind of services the third parties could provide to the electricity retail market. Via discovering these services, the object is to clarify the opportunities datahub can provide to third parties and how datahub can support the service development of the third parties. That is, the object is to clarify the role of the datahub operator in enabling and developing the services provided by third parties. A relevant matter to consider is the concrete benefits of the services and the service development to the Finnish electricity retail market. The constraints of the present legislation are an issue to consider as well. Other constraints to consider are the constraints of the role of Fingrid Datahub as the system operator to develop the service possibilities.

The structure of this study is as follows. In Chapter 2, the background and central legislation behind the implementation of datahub are covered. Next,

the information security and personal data processing issues are discussed. The changes between the current information exchange and the roles of the market parties in the datahub are discussed as well. In Chapter 3, third parties are widely covered in terms of their operation in datahub and the requirements for them to join the datahub system. Additionally, the need for the third parties, their services, and possibilities of their service development, and some reports available for the third parties in the datahub system are also discussed. Next, a comparison to other centralised information exchange systems is included in the study in Chapter 4. The information exchange services in Estonia, Denmark, Norway, and the Netherlands are discussed in the study. The discussion aims to discover what kind of service development opportunities have been utilised in the other countries and how similar services could be utilised and developed in the Finnish datahub.

Once the matters mentioned above have been covered, the research part of the study is covered next. In Chapter 5, the research methods are discussed. The methods used in the research are a questionnaire and party-specific interviews. In Chapter 6, the results of the questionnaire and the interviews are widely discussed. Finally, Chapter 7 summarises the main findings and conclusions of the study.

2 General introduction of datahub

The datahub is a centralised information exchange system for the electricity retail market (Fingrid, 2021a). The Finnish datahub goes live on February 21, 2022, in compliance with the go-live decree (Fingrid, 2021b). This chapter discusses on a general level what datahub is, why datahub is implemented in Finland and what kind of impacts the datahub implementation poses to the market compared to the current market situation. To begin with, the first subchapter describes where the change from the current information exchange towards datahub originates. Fingrid studied the potential information exchange solutions in 2014. The result of the study was that the datahub solution is the most suitable solution for the electricity retail market information exchange. That is, information exchange via the datahub system will replace the current, decentralised information exchange via messaging operators (Fingrid, 2021b).

The second subchapter discusses the obligations of the datahub operator and market parties related to the datahub. The obligations are given in the Finnish Electricity Market Act 588/2013. Information security is also discussed as a separate subchapter, being an essential matter in both the commissioning phase and the operational activities of datahub. Next, the changes in information exchange after datahub goes live are discussed. Market parties will communicate only with the datahub system once the operative activity of datahub begins instead of decentralised information exchange, which offers remarkable advantages to the market. (Fingrid, 2021b). In the last subchapter, the different market parties joining the datahub and the market roles of the parties are discussed.

2.1 From decentralised information exchange model to the datahub information exchange solution

In 2014, Fingrid conducted a study on future solutions for the information exchange in the electricity retail market (Fingrid, 2014). The objective of the study was to present a solution for the information exchange after studying the current situation in the electricity retail market information exchange (Fingrid, 2014). The need to search for alternative information exchange solutions has been detected as the energy markets are facing remarkable changes in the present and the near future. Changes in the energy markets include the increasing need for demand response, the growing proportion of decentralised electricity production, and the development of electricity retail markets (Fingrid, 2014). The development requires new services to the market. The services can be provided by the third parties, which are studied in more detail in later chapters, being the main objective of this thesis. A centralised information exchange solution supports the equality of the service providers within the market (Fingrid, 2014).

The study on future solutions for the information exchange was conducted in cooperation with the industry. Industry representatives were included in the project organisation of the study, and several stakeholder interviews were conducted during the study. Information received from the industry was also utilised in the cost-benefit analysis of the study. (Fingrid, 2014).

The study was conducted in two phases. First, the current state of the electricity retail market and its information exchange were analysed. The future requirements for information exchange were defined, and lastly, a comparison to datahub solutions in other countries was conducted (Fingrid, 2014). The datahub solutions in other countries are discussed later in a separate chapter of this current study. In the second phase of the study conducted by Fingrid, the proposal for the future information exchange solution was formed based on the studies in the first phase (Fingrid, 2014).

Four solution types were recognised in the study. The first solution type is the decentralised information exchange solution. The second one is a communication hub, in which the metering and market process information exchange is conducted via a centralised solution, but the database for metering and customer data is decentralised between market parties. The third one is a metering database, in which the metering data is located in a centralised solution, but the market process information exchange is decentralised or conducted via a communication hub. The fourth solution type is a datahub solution, in which both metering data and the customer, accounting point and agreement data are located in a centralised solution. Additionally, the market processes are conducted via the centralised solution. (Fingrid, 2014).

The datahub solution was chosen as the potential solution for the centralised information exchange for the retail market. The datahub solution was compared to the improved version of the current information exchange solution. Based on an extensive review and comparison of the solutions, the result of the study was that datahub has both qualitative and economic advantages to be chosen as the new solution for the electricity retail market information exchange. (Fingrid, 2014).

The administration of the datahub solution was discussed in the study as well. The considered options for administrators were commercial operators, the industry, the transmission system operator or the authorities. Based on the evaluation of the options mentioned above, the most suitable option to manage the datahub would be the transmission system operator. (Fingrid, 2014). Arguments for the chosen option are the following, amongst others. The transmission system operator does not act in the retail market and is thus an objective and independent actor. Secondly, the tasks and obligations towards the TSO can be set via legislation. (Fingrid, 2014). Additionally, TSO already provides other operative services to the retail market and already cooperates with other Nordic countries, which is considered an increasingly

important factor in the near future with the changes and innovations in the industry and the markets (Fingrid, 2014).

Similar matters were discussed in the government proposal of the proposed changes to the electricity market act and other related legislation (TaVM 21/2018 vp). The proposal suggested implementing a centralised information exchange system for the electricity retail market. According to the proposal, the current information exchange solution functions technically well. However, the retail market business processes are not supported sufficiently in the current solution. Additionally, the future requirements are not fulfilled. That is, the information exchange solution should enable the implementation of a smart energy system, in which demand response, energy communities and electric transportation, amongst others, play an increasingly important role. (TaVM 21/2018 vp). As an outcome, the electricity market act was updated to determine the obligations related to datahub for both the datahub operator and the electricity retail market participants. The process of the study and its outcome is summarised in Figure 1.

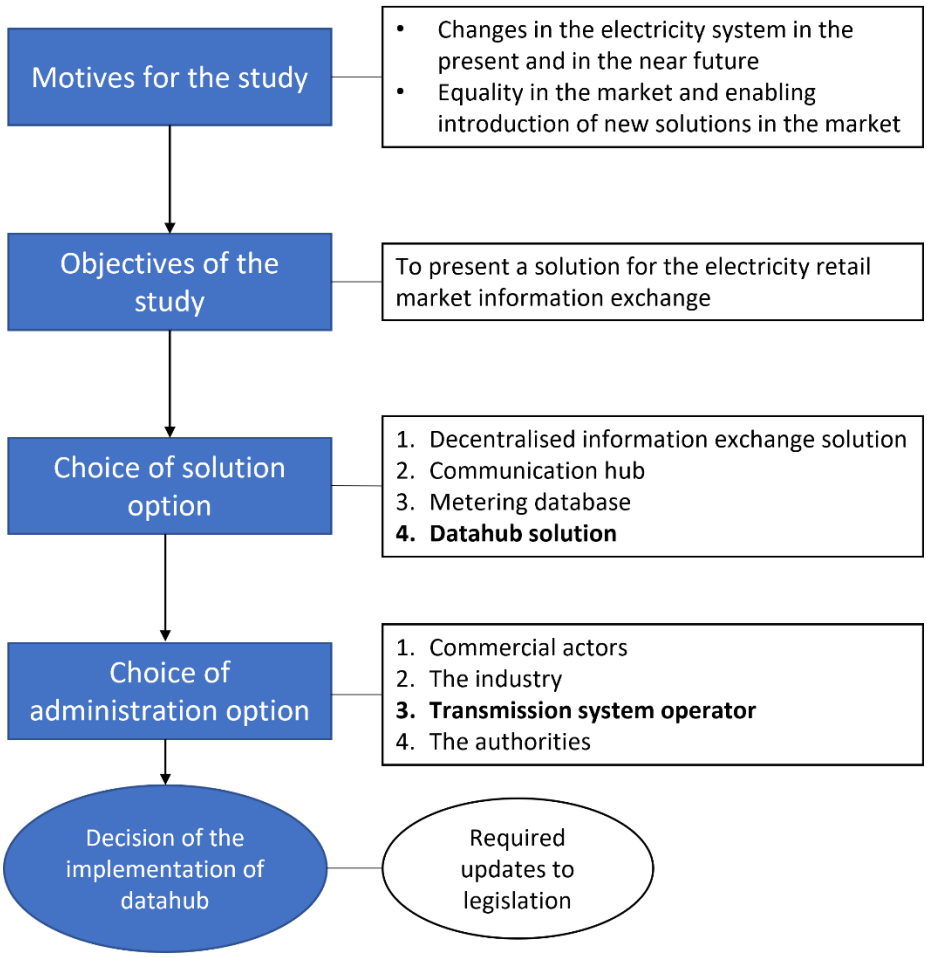

Figure 1 The decision path of the implementation of datahub in the Finnish electricity retail market (Fingrid, 2014).

2.2 Central legislation related to centralised information exchange services

The implementation of the datahub system for electricity retail market information exchange required updates to the Finnish legislation. The basis for the national level legislation of the member states is determined by the European Union (EU) legislation (Kimari, 2021). Related legislation of the electricity markets on the EU level is the Directive (EU) 2019/944 of the European Parliament and of the Council of 5 June 2019 on common rules for the internal market for electricity (EUR-Lex, 2019). When the Finnish national-level legislation, Electricity Market Act, was updated related to the implementation of the centralised information exchange services, the previous EU directive, the Directive 2009/72/EC of the European Parliament and of the Council of 13 July 2009 concerning common rules for the internal market in electricity, was still in force. The said directive had no proper guidelines on how to organise the retail market or protect the consumers, yet the member states have the discretion on arranging the information exchange in the internal markets (HE 144/2018 vp). Therefore, the EU level legislation did not directly affect the choice of implementing datahub as the solution for the information exchange. However, it does not mean that the EU and national-level legislation are contradictory. Instead, the national-level legislation defines more precisely how the EU level legislation is carried out nationally.

In addition to the Directive 2019/944, also the Regulation (EU) 2016/679 of the European Parliament and of the Council of 27 April 2016 on the protection of natural persons with regard to the processing of personal data and on the free movement of such data (General Data Protection Regulation, GDPR) affects the implementation and operational activities of the datahub system (Fingrid, 2021b; EUR-Lex, 2016). The regulation sets the guidelines for personal data processing. On the national level, the Finnish Data Protection Act (1050/2018) defines the rules for personal data processing based on the EU regulation. Furthermore, the Electricity Market Act defines more specifically how personal data is processed in the centralised information exchange system. (Kimari, 2021). The Electricity Market Act and personal data processing are discussed next in more detail.

2.2.1 Electricity market legislation

On the national level, the Electricity Market Act (588/2013) ensures the preconditions for efficient and sustainable national and regional electricity markets and the European Union electricity internal markets. Services of the centralised information exchange of the electricity retail market are regulated in the Electricity Market Act. (Electricity Market Act 588/2013). An Electricity Market Act amendment, which came into force on February 1, 2019, obliges the electricity retail market parties, that is, the electricity retail suppliers and distribution system operators, to use the datahub services

(Fingrid, 2021a). As the Electricity Market Act defines the scope of the services and the obligations to different market parties, observing the legislation is a relevant matter within the scope of this study.

The implementation of datahub has affected several sections of the law of the Electricity Market Act. Some of the main changes and additions in the legislation are discussed next.

Section three defines all the terms used in the Electricity Market Act. A definition of the centralised information exchange unit has been added to the section, as a paragraph 27a (108/2019). Section 49 has been updated as follows. According to section 49, the transmission system operator is responsible for the operational management of the centralised information exchange services and the development of the information exchange (108/2019). Fingrid Datahub will manage the operational activities of the information exchange services. Fingrid Datahub is a wholly-owned subsidiary of the transmission system operator Fingrid. (Fingrid, 2021c).

Additionally, sections 49a and 49b have been added to the act. Section 49a defines the services of the centralised information exchange and the legal basis of the processing of personal data (TaVM 21/2018 vp). The services of the centralised information exchange of the electricity retail market are listed below. The following list of services is a direct translation of the Finnish Electricity Market Act section 49a to English. There is no official English translation version available of the act, and thus, the following translations are not official translations of the act:

1) Maintenance of the customer information and accounting point information of the electricity retail suppliers and distribution system operators;
2) Organising the information exchange required for the customer agreement processes of electricity retail and distribution;
3) Organising the information exchange of metering data which is the basis of electricity invoicing and imbalance settlement;
4) Organising the information exchange of electricity supply and distribution disconnection and connection processes;
5) Organising the maintenance of product and invoice row information of distribution system operator, and organising the maintenance possibility of product and invoice row information of electricity supplier;
6) Forwarding of the party information of electricity supplier and distribution system operator;
7) Organising access for the customer of electricity supplier and distribution system operator to their own information in the centralised information exchange system of electricity retail market;
8) The imbalance settlement of electricity trade in distribution grids, and organising the information exchange related to the imbalance settlement;
9) Retaining the information related to the services of points 1–8 described above. (Section 49a 108/2019).

Section 75a has been added to the act as well. According to the section 75a of the Electricity Market Act, the electricity suppliers and distribution system operators are obliged to utilise the services of datahub (section 75a Electricity Market Act 108/2019). Here, the electricity suppliers are suppliers acting in the retail market, who deliver electricity to the end consumers via a distribution system (section 3 Electricity Market Act 588/2013). Distribution system operators are grid owners who operate a distribution grid or a high voltage distribution grid, to which they hold a licence for the operation (section 3 Electricity Market Act 588/2013). The obligation to use datahub services does not apply to the grid owners, who operate only high voltage distribution grids (Fingrid, 2021b). Only distribution grid owners operating distribution grid are within the scope of datahub services.

In addition to distribution grids, there are the above-mentioned high voltage distribution grids and industrial grids and production grids in the power system. Operators of these grids, the so-called other grid operators, are not within the scope of datahub services as such. However, if there are exchange point metering between such grids and distribution grids, and the other grid operator is the responsible party of the metering of the exchange point, then the other grid operator is obliged to report the metering data of the exchange point to the datahub (section 75a Electricity Market Act 891/2021).

Besides the changes already discussed, some additions have been made related to data processing. Chapter 11 a has been added to the act (TaVM 21/2018 vp). Chapter 11 a contains, amongst others, the following sections. Section 75c defines the storing rules of the data related to the electricity market business processes. The data shall be stored for six years starting from the market event, after which personal data shall be removed unless there is some legal basis for a longer data storing period (section 75c Electricity Market Act 108/2019). Section 75d defines that a personal identification number may be used to identify the end customers of the market parties. Additionally, the market parties may handle the personal identification numbers to fulfil the requirements given for the parties in the Electricity Market Act. (section 75d Electricity Market Act 108/2019). A personal identification number or similar is needed to identify the end consumers unambiguously. (TaVM 21/2018 vp). Additionally, section 86a, considering the information required from the end-user before signing a sales or a grid agreement, has been added to the act. Section 86a authorises the suppliers and grid operators to request personal identification numbers from their customers. (section 86a Electricity Market Act 108/2019).

As mentioned above, Fingrid has an obligation to develop further the information exchange and services of the electricity retail market and the datahub system (section 49 Electricity Market Act 108/2019). The requirements include developing the information exchange in an equal and non-discriminatory way for all the retail market participants and

maintaining the required data security level at all times. Additionally, the act obliges the operator to develop the possibilities for implementing value-added services. (section 49 Electricity Market Act 108/2019). Such matters related to equality in the market and service development are also discussed in the EU directive 2019/944, which was the basis for the national-level legislation. According to the directive, there shall be enough competition in the markets to enable the development of new innovative market solutions. Additionally, the consumers should be at the centre in enabling their participation in the market, for instance, via demand response. The lack of innovative service solutions challenges the active participation of consumers. (EUR-Lex, 2019).

Third parties may provide these innovations and value-added services. Third parties have no direct obligation by the national legislation to operate in the datahub system. However, if the third parties are willing to provide services for the market parties and end consumers, the third parties benefit from joining the datahub. This study aims to clarify what kind of services the third parties could provide to the electricity retail market. Via discovering these services, the goal is to clarify the opportunities datahub can provide to third parties and how datahub can support the service development of the third parties. The third parties are discussed in more detail in Chapter 3. The services are clarified in the research section of the study.

The supervisory authority of the operational activities and the terms of service of datahub is the Energy Authority (Fingrid, 2021b). According to the Act on the Supervision of the Electricity and Natural Gas Markets section 10, the Energy Authority has to verify the terms of service and the pricing methods of the centralised information exchange services (Act on the Supervision of the electricity and natural gas markets 328/2020). The Energy Authority verified the terms of centralised information exchange services on August 12, 2021. Fingrid Datahub offers verified services starting from the go-live date of February 21, 2022. (Energiavirasto, 2021).

2.2.2 Personal data processing regulation

The EU level guidelines for personal data processing are defined in the EU regulation 2016/679 (GDPR), and then more specifically in the national legislation, as was mentioned previously in this chapter. The definitions of the central concepts related to personal data processing are covered here as a separate subchapter.

The datahub system contains data from 3.8 million electricity accounting points. According to the definition of personal data in the EU regulation 2016/679, data related to the accounting points includes personal data. The regulation defines personal data as follows: "'personal data' means any information relating to an identified or identifiable natural person ('data subject'); an identifiable natural person is one who can be identified, directly or indirectly, in particular by reference to an identifier such as a name, an

identification number, location data, an online identifier or to one or more factors specific to the physical, physiological, genetic, mental, economic, cultural or social identity of that natural person." (EUR-Lex, 2016). Personal data is processed in the datahub system according to the definition of data processing in the regulation. The processing of personal data is defined as follows: "'processing' means any operation or set of operations which is performed on personal data or on sets of personal data, whether or not by automated means, such as collection, recording, organisation, structuring, storage, adaptation or alteration, retrieval, consultation, use, disclosure by transmission, dissemination or otherwise making available, alignment or combination, restriction, erasure or destruction" (EUR-Lex, 2016).

There are two central roles related to the processing of personal data. The roles are controller and processor. (Tietosuojavaltuutetun toimisto, 2021). The EU regulation 2016/679 defines the controller as a "natural or legal person, public authority, agency or other body which, alone or jointly with others, determines the purposes and means of the processing of personal data", and the processor as a "natural or legal person, public authority, agency or other body which processes personal data on behalf of the controller" (EUR-Lex, 2016). An example of a controller is an organisation that collects data about the members of the organisation. An example of a processor is an IT service provider, who would have access to the personal data which the controller has collected. (Tietosuojavaltuutetun toimisto, 2021).

The Electricity Market Act defines Fingrid Datahub as a controller in the centralised information exchange services of the electricity retail market (Fingrid, 2021b). The market participants also act as controllers when considering the processing of their own registers containing personal data (Fingrid, 2021b). The personal data must be processed lawfully and collected for specified and legitimate purposes (EUR-Lex, 20216). As discussed in the previous subchapter, the legal basis is set in the Electricity Market Act for electricity suppliers and distribution system operators to process personal data related to electricity market business processes (Fingrid, 2021b).

2.3 Information security in centralised information exchange services

The legal basis for the personal data processing was covered in the previous subchapter. This subchapter focuses more on the information security related to personal data processing, specifically in the datahub system. As the datahub system contains data from 3.8 million electricity accounting points, including personal data, information security is one of the main issues to be considered both in the commissioning phase and in the operational activities of datahub (Fingrid, 2021a). Some issues to be especially considered in the datahub services are described next.

The market parties must ensure that only personnel with appropriate access rights have access to the data and databases. The personnel using the datahub system shall be sufficiently instructed to process the personal data in datahub carefully and confidentially. Furthermore, the user and access control shall be considered. The usage of shared credentials is forbidden in the datahub system, and each user needs to have personal credentials to access datahub. (Fingrid, 2021b).

Market parties must also consider the data security of their own systems. (Fingrid, 2021b). The market party itself may not be the only party that processes its data, but the data processing may be outsourced to another company in the industry. Different service providers and ICT services may act via delegation with the electricity retail market parties, and thus, the service providers participate in the personal data processing (HE 144/2018 vp). In this instance, the access control and processing agreements with the third party providing the service shall be considered. Furthermore, contact persons and necessary procedures should be determined in case of a potential data breach. (Fingrid, 2021b). The information security related to the activities of third parties in datahub is an essential issue to consider in the scope of this study.

The datahub service agreement defines the required information security for the market parties. The service agreement has a separate appendix for the information security standards. (Fingrid, 2021b). The appendix defines the responsibilities of Fingrid Datahub as the operator of the datahub system, the general information security requirements, how the market parties shall be prepared for disconnections to the datahub system in case of potential information security threat, and the requirements for information security management. The requirements given in the appendix apply both for the electricity suppliers and distribution system operators and for the third parties using datahub services. (Fingrid, 2021d).

One issue which could be discussed is how to ensure that all the third parties joining the datahub practise legitimate business. Joining the datahub requires a service agreement and certification, which will be briefly discussed later in Chapter 3. Such requirements and procedures already require effort and well-functioning systems from the joining parties. The procedures determine a more specific set of requirements for the market parties than the previous information exchange model. The datahub operator has no authorisation to investigate the backgrounds of market actors, and the operator must treat equally all market parties. If a market party fulfils all obligations given in the Electricity Market Act and the service agreement, the party can practice business in datahub. Therefore, the issue can be considered here but does not need to be stressed too much.

2.4 Changes in information exchange with datahub

This subchapter discusses the significant changes and improvements that occur with implementing the datahub system compared to the current information exchange. When datahub has gone live, the market parties will communicate only with the datahub system instead of the current, decentralised information exchange (Fingrid, 2021b). Market parties send information to datahub, which forwards the information to entitled parties once the information has been processed. The centralised information exchange enables all the improvements described in this subchapter. (Fingrid, 2021c).

To start with, datahub enables synchronous information exchange instead of the current asynchronous information exchange. Synchronous information exchange decreases the need to resolve issues between different market parties. (Fingrid, 2021c).

The sales agreement and the grid agreement to an accounting point are made to the same customer in datahub. In comparison, in the current information exchange model, the grid agreement and the sales agreement can be made with different residents of the same accounting point. The agreement processes become clearer after the change. Together with the synchronous information exchange, the change enables also better customer service to the end customers, as the issues related to agreements of the customers decrease. (Fingrid, 2021b; Fingrid, 2021c).

Datahub enables better supervision to ensure that all market parties act according to rules and legislation. Additionally, the data quality improves as the data is validated more specifically in datahub. The data contents available for the market parties are also more extensive compared to the current model. (Fingrid, 2021c).

Additionally, changes related to metering and imbalance settlement occur in the datahub implementation. The metering data is delivered as hourly metering values to datahub. Datahub conducts the imbalance settlement of the distribution system operators and reports settlement calculation information to the Nordic imbalance settlement company eSett. (Fingrid, 2021c). Starting from January 1, 2023, the Finnish retail market will move over to 15-minute metering. Furthermore, starting from May 22, 2023, the Nordic countries will move over to 15-minute imbalance settlement. (Fingrid, 2021e). The changes in metering and imbalance settlement time step require changes to the datahub system. The required changes for the datahub system will be implemented in the next version of the system, datahub 2.0 (Fingrid, 2021e).

In the scope of this study, the significant changes are related to enabling better participation of the third parties in the market. As the information exchange is centralised and the interfaces standardised, it is easier and more cost-effective for the third parties to access the required data for their business solutions. Third parties can access accounting point and customer-

specific information if they have an authorisation from a customer or a market party to the data. The accessible data includes metering data as well. Additionally, invoice row information can be forwarded in datahub, enabling the utilisation of billing service providers in datahub. (Fingrid, 2021c).

Moreover, the business operations can be even further developed due to datahub. New business operations could be related to such themes as demand response of consumers, electric vehicle charging solutions, and different energy services related to, for instance, energy efficiency and energy management. (Fingrid, 2021c). The new business operations could be provided and developed by third parties.

2.5 Market roles in datahub

This subchapter describes the different market parties who use the services of centralised information exchange and their market roles.

The market participants obliged to use datahub services by law are electricity retail suppliers and distribution system operators (section 75a Electricity Market Act 588/2013). An electricity supplier is a person or an organisation that buys or sells electricity. Here, buying means buying the small-scale production of a customer or a production unit. (Fingrid, 2021b). Electricity retail means that electricity is delivered in the distribution system, and the electricity is delivered to the end consumer (section 3 Electricity Market Act 588/2013). There are approximately 80 electricity retail suppliers in Finland. That is, approximately 80 suppliers are within the scope of datahub services. (Fingrid, 2021f). Distribution system operators are grid owners who operate a distribution grid or a high voltage distribution grid, to which they hold a licence for the operation (section 3 Electricity Market Act 588/2013). There are approximately 80 distribution system operators in Finland required to join datahub (Fingrid, 2021a).

In datahub, the roles of the market parties are defined based on The Harmonised Electricity Market Role Model (HRM) (Fingrid, 2021c; ebIX, 2020). The HRM model is developed by ebIX, EFET, and ENTSO-E (ebIX, 2020). ebIX, a European forum for energy business information exchange, is a European platform of transmission system operators, distribution system operators, suppliers, and regulators, which provides standardisation for the information exchange in the energy industry (ebIX, 2017). The target of the HRM is to unify the used roles and terminology within the European electricity market information exchange. The HRM covers both retail electricity markets as well as wholesale electricity markets. (ebIX, 2020). In the HRM, the roles are divided based on the information exchange processes, which is a more specific way to divide roles compared to the current EDIEL based information exchange (Fingrid, 2021c). The HRM does not provide a model of how the electricity markets function, yet it provides the roles and objects used for the information exchange of the markets. The HRM is updated whenever needed if any new market roles, which are not yet covered

by the current version, occur. The version referred to in this study is version 2020–01. (ebIX, 2020).

In the electricity markets, one party can play several different roles. Thus, market party and market role are different matters in this context, and the model focuses on identifying the different roles. A party who acts in a market and has one or several roles is called an actor in the model. The roles are called harmonised roles. The actors who play the harmonised roles may differ between different marketplaces. (ebIX, 2020). In the context of datahub, only the applicable roles are used, as only the retail market is within the scope of datahub (Fingrid, 2021c). The applicable roles are discussed next.

Based on the model, the role of electricity retail suppliers is Energy Supplier (DDQ). By definition, the Energy Supplier "supplies electricity to or takes electricity from a Party Connected to the Grid at an Accounting Point". Party connected to the Grid is the role for the electricity end-user. (ebIX, 2020). In datahub, the main tasks for the suppliers are initiating agreement processes and maintaining the customer information (Fingrid, 2021c). Energy Supplier is the only HRM role for suppliers in datahub.

In contrast to the suppliers, distribution system operators have several HRM-based roles in datahub. The roles for the distribution system operator are Metered Data Responsible (MDR) and Grid Access Provider (DDM) (Fingrid, 2021c). Metered Data Responsible is responsible for establishing and validating metering data of metering points (ebIX, 2020). MDR is also responsible for delivering the metering data to datahub (Fingrid, 2021c). Grid Access Provider is responsible "for providing access to the grid through an Accounting Point for energy consumption or production by the Party Connected to the Grid" (ebIX, 2020). DDM is responsible for grid agreement management and accounting point information maintenance in datahub (Fingrid, 2021c). There also is a role called Grid Operator in datahub for the distribution system operators. The role is responsible for the metering grid area information in datahub. (Fingrid, 2021c). However, Grid Operator is not an HRM role.

As was already discussed in Subchapter 2.2.1, there are also other grid operators who have obligations to deliver metering data of the exchange point metering. The other grid operators act as Metered Data Responsible when delivering the exchange point metering data to datahub.

Market parties can utilise third parties in datahub to manage some or all of their business processes (Fingrid, 2021c). Third parties are also called service providers, and they provide services to the market parties and the end customers in the electricity retail market. For instance, a distribution system operator can delegate the metering data delivery to a third party (Fingrid, 2021c). When the metering data delivery is delegated to a third party, the third party then acts as Metered Data Responsible. A third party can also act in HRM roles of Energy Service Company or Billing Agent (Fingrid, 2021c; ebIX, 2020). In the scope of this study, the third parties are the most relevant

actors to be covered. Therefore, the third parties are wider discussed in Chapter 3 as a separate chapter.

All the market parties described above need to sign a service agreement for the operational activities of datahub. The actual electricity market parties, that is, suppliers and distribution system operators, sign a service agreement of the electricity market parties. Third parties sign a service agreement of a delegated party or an authorised party, depending on which role they act. Other grid operators sign an information exchange agreement of the other grid operators. (Fingrid, 2021f).

In addition to the parties and roles described above, the end customers can also be considered one party segment. The datahub system is the background system of suppliers and distribution system operators for the end customers. However, the datahub enables the end customers to take a more active role in the market, especially via the services provided by third parties. The customers have visibility to their own information via the datahub end customer portal. Additionally, the customers manage the authorisations they have given to the third parties via the end customer portal. The login is implemented via Suomi.fi service, maintained by Digital and Population Data Services Agency. (Fingrid, 2021c). As was previously mentioned, the HRM role of the electricity consumers is Party Connected to the Grid.

The role of the datahub operator was defined via legislation in Subchapter 2.2.1. To sum up, the task of the operator is to maintain and develop the datahub system according to the needs of the industry. Datahub operator does have some HRM roles in which it acts. Datahub operator acts as Metered Data Aggregator when it calculates the imbalance settlement of distribution grids, which is one of the statutory tasks of the operator (Fingrid, 2021c). The Metered Data Aggregator is by definition “a party responsible for the establishment and qualification of measured data from Metered Data Responsible”. Additionally, the operator acts as Metered Data Administrator and Metering Point Administrator. Metered Data Administrator stores and distributes validated metering data. Metering Point Administrator administrates and makes available metering point characteristics in the system. (ebIX, 2020).

Market roles discussed in this chapter are summarised in Table 1.

Table 1 Market roles in datahub (ebIX, 2020; Fingrid, 2021c).

Role	**Actor**	**Function**	**HRM role (Y/N)**
Billing Agent	Third party	Invoicing of a concerned party	Y
Energy Supplier (DDQ)	Electricity supplier	Supply of electricity to an end consumer	Y
Energy Service Company (ESCO)	Third party	Offering energy-related services to an end consumer	Y
Grid Access Provider (DDM)	Distribution system operator	Providing access to the grid for an end consumer	Y
Grid Operator	Distribution system operator	Responsibility for metering grid area information	N
Metered Data Aggregator	Datahub operator	Calculation of the imbalance settlement of distribution grids	Y
Metering Data Responsible (MDR)	Distribution system operator	Metering data establishment, validation and delivery	Y
Metering Point Administrator	Datahub operator	Administration, makes available metering point characteristics in the system	Y
Party Connected to the Grid	End consumer	Electricity end usage	Y

3 Third parties

As was discussed in the previous chapter, the market parties within the scope of datahub services are distribution system operators and electricity suppliers. However, the market parties called third parties can also utilise datahub in their business activities. Third parties are market parties who provide services to the end customers or the electricity retail market parties within the scope of datahub (Fingrid, 2021g). Third parties may also be called service providers (Fingrid, 2021g).

This chapter focuses on third parties. The chapter discusses the roles of the third parties, the current functionalities to be utilised by third parties in datahub, and the requirements for the third parties to get access to use the datahub system. Additionally, the chapter outlines the basis for the need of third parties in the electricity market as well as the need for their service development and discusses how the implementation of datahub provides possibilities to third parties to act in the market. The current services of the third parties in the market are also discussed.

3.1 Operation of the third parties in datahub

The roles used in datahub were discussed on a general level in Subchapter 2.5. This chapter discusses the roles of the third parties in more detail. The roles of the market parties are defined based on The Harmonised Electricity Market Role Model (Fingrid, 2021c; ebIX, 2020). In datahub, a third party can act in HRM roles of Energy Service Company (ESCO) or Billing Agent (Fingrid, 2021c; ebIX, 2020). An Energy Service Company is defined as a party "offering energy-related services to the Party Connected to Grid, but not directly active in the energy value chain or the physical infrastructure itself". Such services might be, for example, energy management services. A Billing Agent is defined as the party "responsible for invoicing a concerned party". (ebIX, 2020). When a third party acts in the role of an Energy Service Company or a Billing Agent via an authorisation, the party is defined as an authorised party in datahub (Puukangas, 2021).

Additionally, third parties can act on behalf of a market party in another role in datahub. For example, a third party can deliver metering data to datahub on behalf of a distribution system operator (Fingrid, 2021c). When a third party delivers metering data to datahub, the party acts as Metered Data Responsible (ebIX, 2020). That is, the third parties can adopt another role in the datahub process when they act on behalf of another market party. Such a party is called a delegated party (Fingrid, 2021g).

A third party must always have permission to access the data in the datahub system. The permission to access the data is granted by an authorisation given by an end customer or by a market party, or by a delegation granted by an electricity supplier or a distribution system

operator. (Fingrid, 2021g). The authorisations and delegations are discussed in the next subchapters. Additionally, the market processes related to the operation of third parties in datahub are discussed.

3.1.1 Authorisations granted by the customer

The first type of a third party in datahub is an authorised party. Authorised parties act via authorisations, providing electricity market services to the end customers. The HRM role of a third party is Energy Service Company (ESCO), when the third party act as an authorised party and the authorisation is granted by a customer.

The end customer can be a company customer or a consumer customer (Fingrid, 2021g). Customer type defines whether the market parties can report the authorisations to datahub on behalf of the customer or not. If the customer is a company customer, a market party can report an authorisation to datahub on behalf of the customer with a corresponding notification event. (Fingrid, 2021c). The market processes and events are further discussed in Subchapter 3.1.4. If the customer is a consumer customer, the customer has to report the authorisation to datahub themselves (Fingrid, 2021c). The notification of the authorisation requires a strong identification, and the notification is conducted in the datahub end customer portal. The Electricity Market Act and the current data protection regulation require such a course of action described above to report consumer customer authorisation. (Fingrid, 2021c).

Via the authorisation, the customer authorises a market party to access its own information (Fingrid, 2021c). The authorisation covers customer and accounting point information but does not cover agreement information of sales and grid agreements of the customer (Puukangas, 2021). The authorised party can retrieve the customer and accounting point information from the datahub. The customer and accounting point information returned to the authorised party are shown in Figure 2. Additionally, the authorisation covers the metering data of the accounting point of the customer. The market party can utilise the information to provide service to the customer for several purposes. (Fingrid, 2021c).

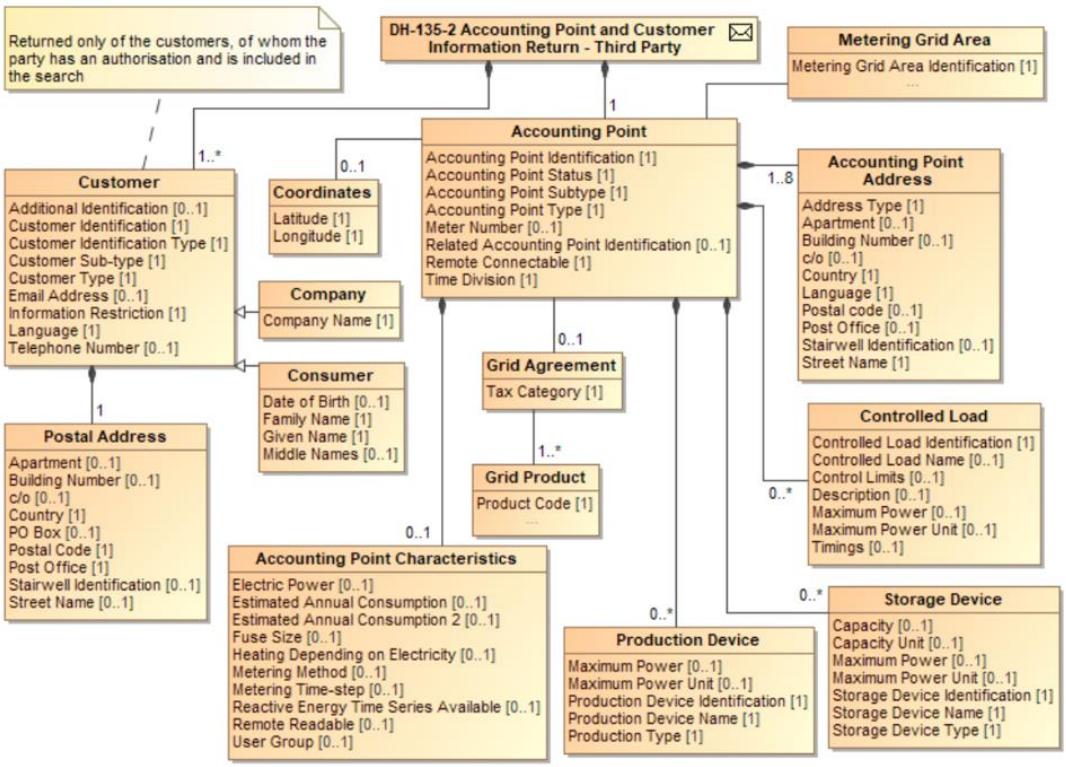

Figure 2 Customer and accounting point information returned to a third party (Fingrid, 2021h).

Some examples of authorisations of third parties are given next. A customer can authorise a third party to competitive bidding of a sales agreement. The authorisation is valid for the competitive bidding process, yet not more than 30 days. The third party gets rights to the customer information via the authorisation. Access to the metering data of an accounting point depends on whether the customer has an agreement on the accounting point at the time of the competitive bidding process. If the customer has a valid agreement at the accounting point, the third party receives access to accounting point data and metering data retrieval in addition to the customer information. The metering data from the last three years of the accounting point can be retrieved. However, if the customer has had a valid agreement for less than three years for the accounting point, the maximum period of metering data retrieval is the validity period of the agreement. If the customer does not have an agreement at the accounting point at the time of the competitive bidding process, the third party does not have the right to receive the metering data from the accounting point but only basic information and the current agreement situation of the accounting point. (Fingrid, 2021c).

Another type of authorisation is energy reporting. In this type of authorisation, the customer has a valid agreement on the accounting point,

and the customer authorises the third party to manage all matters concerning the electricity usage of the customer. The authorisation is valid for up to two years. The authorised party receives access to customer information, accounting point information and metering data retrieval via the authorisation. The metering data from the last six years of the accounting point can be retrieved when it comes to metering data. However, if the customer has had a valid agreement for less than six years for the accounting point, the maximum metering data retrieval period is the validity period of the agreement. The authorised party automatically receives the metering data of the customer during the validity of the authorisation in the datahub. (Fingrid, 2021c). The authorised party uses metering data retrieval to provide its service to the customer (Puukangas, 2021).

The validity of the energy reporting authorisation needs to be renewed every two years if the authorisation and the service provided via the authorisation is to be continued. The third party does not receive any notification of the expiring validity. Therefore, the parties must renew their authorisations without letting them expire. If the validity of the authorisation expires, the authorised party does not receive any metering data thereafter. (Puukangas, 2021). The examples mentioned above are later shown in Table 2, which summarises the examples of authorisations and delegations given in this chapter.

An authorised party cannot update any customer or accounting point information in the datahub. However, the party can send a request for a customer information update to a supplier or an accounting point information update to a distribution system operator if the party has received updated information related to the customer or accounting point information. Correspondingly, if customer or accounting point information is updated by supplier or distribution system operator in datahub, the authorised party receives a notification of the information update from datahub. If an accounting point of the customer of an authorised party is disconnected or connected, the authorised party does not receive any notification on this matter. However, the disconnections and connections can be observed based on the metering data that the authorised party receives from the accounting point. (Puukangas, 2021).

The authorisations granted by a customer are always accounting point specific (Fingrid, 2021c). If a customer has several accounting points to which the customer wants to grant authorisation, the authorisations need to be given to every accounting point. In the end customer portal, several authorisations may be given at once by the customer, but in the datahub system, each authorisation is notified to the accounting points separately. (Puukangas, 2021). A customer may have several authorised parties providing them services simultaneously in datahub. For instance, an energy reporting authorisation may be granted to several service providers concurrently. (Puukangas, 2021).

The authorisations must have a period of validity. The maximum period of validity to be given is two years. However, the length of the validity period depends on the purpose of the authorisation, as discussed above. Additionally, the authorisation is ended if the customer moves out from the accounting point. The authorisation is ended automatically in datahub in such a case. (Fingrid, 2021c).

Another reason which automatically ends the authorisation of a customer is if the information of a customer becomes restricted (Puukangas, 2021). A customer may apply for information restriction if the customer has a valid reason to suspect that there is a threat to the safety of the customer or the family of the customer (Fingrid, 2021c). The authorisation cannot be created for the customer with information restricted. Information restricted means that the information of the customer must not be reported or given to any other party, but the information may only be forwarded between the supplier and the distribution system operator of the customer. The supplier of the customer has the information of the information restriction of the customer. The supplier cannot delete the information restriction from the customer, but only the customer can remove it via the end customer portal. (Puukangas, 2021).

The authorisations can be granted to a third party, but additionally to a supplier or a distribution system operator. After an authorisation has been granted, the authorised party can retrieve the information to which the authorisation permits access. (Fingrid, 2021c). A market party that has received authorisation from a customer cannot forward the authorisation to another third party (Fingrid, 2021c).

3.1.2 Party authorisations

In addition to authorisations granted by customers, party authorisations can also be granted in datahub. Party authorisations are authorisations given by a market party to another. A party authorisation permits access to the other party to receive information of the party, to which the other party would not have access without the authorisation. Examples of such information are invoice row information and product information of a supplier. A party can authorise another party via the datahub user interface. A party can grant authorisations to several parties simultaneously. (Fingrid, 2021c). The HRM role of a third party is Billing Agent when the third party act as an authorised party and the authorisation is granted by a market party.

Examples of party authorisations are given next. The following party authorisations can be granted to a third party and a supplier or a distribution system operator. The first type of party authorisation is that a supplier can authorise a third party or a distribution system operator to manage its customer invoicing. The authorisation grants access to invoice row information. A supplier can additionally authorise a third party or a distribution system operator to its product information if needed for the

customer invoicing. (Fingrid, 2021c). The product information of a supplier is not visible to other parties in the datahub system without a party authorisation to the information. The product information of a distribution system operator is public in the datahub, and thus, there is no need for a corresponding party authorisation for distribution system operators. (Puukangas, 2021).

Similarly to the first type of party authorisation, a distribution system operator can authorise a third party or a supplier to manage its customer invoicing. Correspondingly, the authorisation grants access to invoice row information. (Fingrid, 2021c). The customer invoicing examples are later shown in Table 2, which summarises the examples of authorisations and delegations given in this chapter.

Similar to customer authorisations, the party authorisations cannot be forwarded to another market party. However, a market party who has received authorisation from another market party can delegate a third party to conduct the operation that the party authorisation covers. (Fingrid, 2021c). An example of such a case is when a distribution system operator authorises invoice row information to the supplier, similarly to the last example given above, but then the supplier delegates the invoice row information forwarding to its service provider (Puukangas, 2021).

3.1.3 Delegations

The second type of a third party in datahub is a delegated party. Delegated parties act via delegations, providing electricity market services to the electricity suppliers and distribution system operators (Fingrid, 2021g). Delegations between market parties differ from party authorisations. As an authorisation only gives access to certain information, a delegation permits a delegated party to act on behalf of the delegating party. For instance, the delegated party can be a third party, who would not have access to the information in datahub without the delegation. The third party handles then some or all of the business processes of the delegating market party in datahub, depending on which of the processes are delegated to the delegated party. (Fingrid, 2021c). That is, if a market party delegates all processes to a third party, the delegated party may act in any process and any role of the delegating party (Puukangas, 2021).

Some examples of delegations of third parties are given next. The first is that a supplier can delegate a third party to manage its invoicing as a service. Via delegation, the third party gets access to retrieve customer information, metering data, agreement information and product information of the supplier.

The following three examples are related to the operation of a distribution system operator. The first one is that a distribution system operator can delegate a third party to act as a metering data collector and deliver the metering data to datahub. The delegated party gets access to metering data

delivery and retrieval via such delegation. A distribution system operator can also delegate a third party to handle its balance error management. The delegation permits access to balance error invoicing information retrieval. The last example is similar to the first example of a delegation of a supplier related to invoicing. A distribution system operator can delegate a third party to manage its invoicing as a service. The delegated party gets access to retrieve customer information, metering data, agreement information and product information of the distribution system operator via delegation. (Fingrid, 2021c). The examples are shown in Table 2 below, summarising the examples of authorisations and delegations given in this chapter.

The delegations can be granted explicitly based on a datahub event, entities, or both. It depends on the type of event whether the event can be delegated to multiple parties. If the event includes sending notifications to datahub, the event can be delegated to multiple market parties. On the contrary, if the event includes sending notifications from datahub, the event can be delegated to only one market party. The delegating party can define the validity period of the delegation. (Fingrid, 2021c).

Market parties have visibility to the delegations they have given in the datahub user interface. The datahub operator conducts the updates on delegations based on a notification about the delegation from a market party to the operator. (Fingrid, 2021c). Even if a market party has delegated an information request event to another party, both the delegating party and the delegated party can conduct the information request event (Fingrid, 2021c).

Similar to authorisations, also delegations can be granted to any market party in datahub. Forwarding the delegation to a third party after receiving a delegation from another party is prohibited. (Fingrid, 2021c).

Table 2 Examples of authorisations and delegations of third parties in datahub (Fingrid, 2021c; Puukangas, 2021).

Authorisation or delegation type	**Role of the third party**	**Customer**	**Information received**	**Duration**
Competitive bidding of a sales agreement	Energy Service Company (ESCO)	End consumer	Customer information. Access to metering data depends on whether the customer has had a valid agreement on the accounting point	maximum 30 days
Energy reporting	Energy Service Company (ESCO)	End consumer	Customer information, accounting point information and metering data	maximum 2 years
Customer invoicing	Billing Agent	Supplier or distribution system operator	Invoice row information, and product information if needed	Valid until further notice
Invoicing as a service	Delegated party	Supplier or distribution system operator	Customer information, metering data, agreement information, product information of a supplier or DSO	Valid until further notice
Metering data collecting	Delegated party	Distribution system operator	Metering data delivery and retrieval	Valid until further notice
Balance error management	Delegated party	Distribution system operator	Balance error invoicing information	Valid until further notice

3.1.4 Market processes of the third parties

This subchapter discusses the market processes which third parties can conduct. The market processes of the third parties depend on whether the party acts as an authorised party or as a delegated party.

The notifications of authorisations are the only market processes that the authorised parties conduct in the datahub (Puukangas, 2021). The authorisations are notified with DH-800 market processes. There are two types of authorisation processes, which are DH-810 – Customer

Authorisation from Party and DH-820 – Customer Authorisation from Customer. (Fingrid, 2021i).

The notification event of a customer authorisation from a party conducted by a third party is the event DH-812. In the event, the authorised party requests access to the information of a customer from datahub. The event requires that the authorised party is registered to the datahub system, the party needs the information to provide its service to the customer, and the customer has authorised the party to the needed information. Additionally, the customer has to be a company customer, and the customer and the accounting point to which the authorisation is given have to exist in datahub. The customer needs to have an agreement on the accounting point for the validity period of the authorisation. If the conditions described above are met, the event saves the authorisation information to the datahub system. (Fingrid, 2021i). There are no separate events in datahub for creating and terminating an authorisation, but the same event DH-812 is also used for terminating an authorisation of a third party. In case of a termination, the authorised party reports the authorisation again to datahub but with a new ending date. The new notification replaces the previously reported authorisation. If authorisation is to be cancelled, the authorisation is reported to datahub with the same starting and ending date. However, an authorisation that has already been valid cannot be cancelled. The earliest date to be given as an ending date of the authorisation is the current date. This way, the existed authorisation does not disappear from the datahub system, but the visibility of who has had access to certain information stays in the system. (Puukangas, 2021).

The notification event of a customer authorisation from datahub to a third party is the event DH-822. In the event, datahub system notifies an authorised party of authorisation or a change in the authorisation. The event is initialised once a customer has agreed on a service with a third party and the customer has reported the authorisation in the end customer portal. Alternatively, if the customer has ended or updated an authorisation, the authorised party receives a notification with the event DH-822. (Fingrid, 2021i).

Additionally, the party receives a notification of an ended authorisation from datahub if the sales agreement of the customer has ended on the accounting point, and thus, the authorisation is ended. In case of a move-out, the datahub system ends the authorisation. (Puukangas, 2021). The described authorisation notifications of third parties in the datahub are shown in Figure 3.

A delegated party can conduct almost any market process via delegation. Only the party information-related events, DH-9XX events, and the customer and accounting point information update request events, DH-112, DH-113 and DH-124 events, cannot be delegated to another party (Fingrid,

2021c). From such market party information updates, the information of the update is sent to all market parties in the datahub system (Puukangas, 2021).

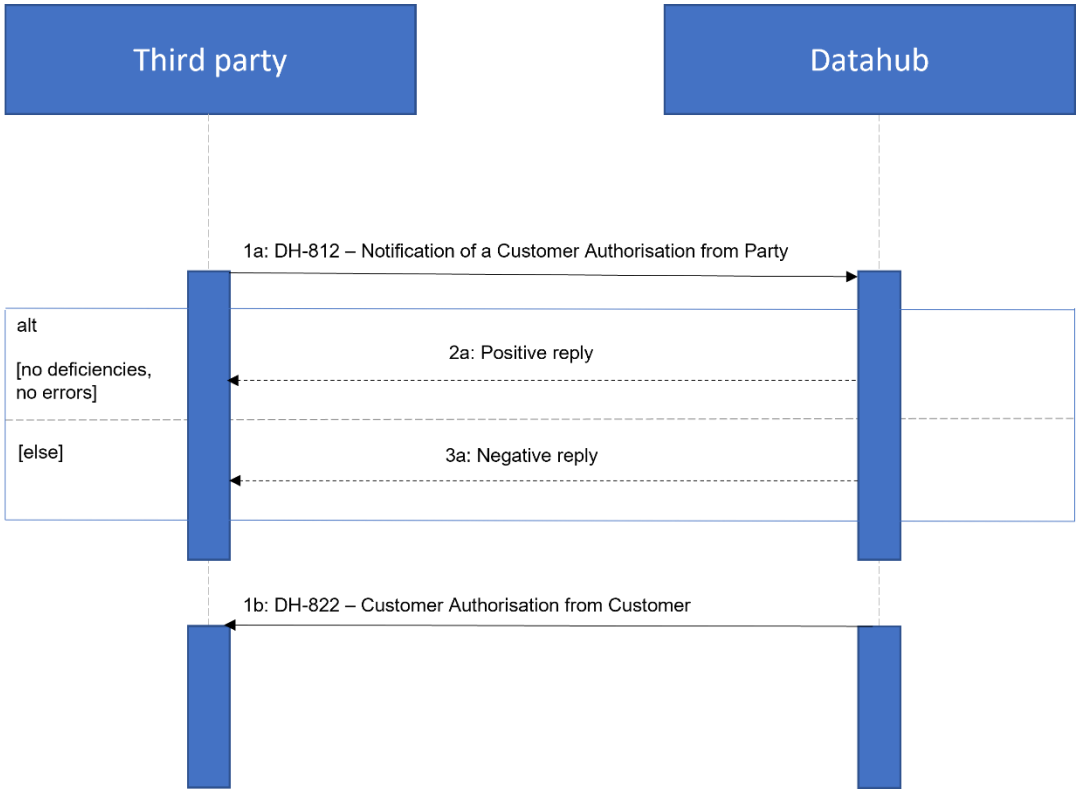

Figure 3 Authorisation notifications of third parties in datahub (Fingrid, 2021h).

3.2 Requirements for the third parties to access the datahub system

Like other market parties, the third parties also need to sign a service agreement with Fingrid Datahub to access the datahub system (Fingrid, 2021g). There are separate service agreements for a delegated party and an authorised party. Thus, it depends on the type of the third party, which service agreement the party shall sign with Fingrid Datahub. (Fingrid, 2021f). The access to data is received via delegations or authorisations as described in the previous subchapter.

Additionally, the third parties need to certify the market processes they will use in their role in datahub (Fingrid, 2021g). Certification is a means to verify that the systems of a market party are compatible with the datahub system, and the market party is ready to start the operational activities of datahub. Certification is required from the market parties who use the B2B interface of datahub. Parties who only use the datahub user interface do not need to conduct the certification. (Fingrid, 2020).

Certification is conducted with certification use cases which are run in the testing and certification service provided by Fingrid Datahub (Fingrid, 2020). The use cases in the testing and certification service include complete business process chains. A market party conducts only the business processes and events which are specific to the role of the market party. The service then acts as the counterparty and runs the business processes of the counterparty required to run the whole business process chain. (Fingrid, 2021j).

The scope of the certification depends on the roles of the market party (Fingrid, 2020). The certification scope of the Energy Service Company (ESCO) role includes three certification use cases. All three use cases include notification of an authorisation for a company customer. Additionally, the first use case includes a customer information update request, the second one an accounting point information update request, and the third one a metering data request. (Fingrid, 2021k). Once the party has passed all three use cases, the market party is certified to use the datahub system.

The scope of the certification of delegated parties depends on the scope of the business activities of a delegated party. The delegated parties need to certify the market processes which they will perform on behalf of the market parties, from which they will have a delegation in datahub (Fingrid, 2021g).

3.3 Need for the third parties, their services, and possibilities of their service development

Discussion about the need for services provided by third parties in the electricity market has taken place in several sources. Most importantly, the obligation to develop the information exchange and services of the electricity retail market is written in the Electricity Market Act (section 49 Electricity Market Act 108/2019). The legislation related to datahub was broader discussed in Chapter 2. The act obliges Fingrid Datahub as the datahub operator to develop the possibilities for implementing value-added services. (section 49 Electricity Market Act 108/2019). Third parties are likely to be the actors who would provide these value-added services in the market.

The matter has been broader discussed in the Government proposal regarding the changes to the electricity market act (HE 144/2018 vp). The centralised information exchange model enables the usage of information of customers and market parties for third parties to provide energy services to the market. As the information can be found in one place in the centralised information model, the third parties do not need to integrate with party-specific systems but only to one system. The more straightforward access to the needed information facilitates the service supply of third parties to the market. Furthermore, the more straightforward way to access the system and information lowers the cost for third parties to operate in the market. (HE 144/2018 vp).

The Smart Grid Working Group of the Ministry of Economic Affairs and Employment has discussed the potential of the third parties in its final report

as well (Pahkala et al., 2018). The report emphasises the importance of customer-centric electricity systems and markets. According to the report, the customers could benefit from market parties, who provide services to support customers with their electricity consumption and production activities, and who have financial incentives in the competitive market to develop their services. New services may appear in the market rapidly, as new concepts, such as blockchain technology and demand response, provide possibilities to develop the services. (Pahkala et al., 2018).

The report brings out the need for metering data to be available for the service providers, who have been authorised to the information by their customers. The availability of the data supports the service development of the service providers. (Pahkala et al., 2018). Such availability is realised as datahub is implemented, as has been discussed previously in this chapter of this study.

3.3.1 Current services of the third parties

Once the operating principles and the need of third parties have been recognised, the current and potential future services of the third parties can be covered next. Several service providers are currently in the market providing energy and electricity-related services. Some service providers provide current data exchange services to the electricity market parties (Enerim, 2021). Such service providers may also provide datahub integrations to market parties. In such a case, the actors in question are rather system vendors than service providers.

Current service providers may also provide metering services, such as meter installations, meter reading and metering data validation. Such services can be provided in the datahub system as well (Enerim, n.d.). A market party can delegate the metering data processes to a third party via delegation in datahub. Delegations were broader discussed previously in this chapter. Furthermore, market forecasting services are provided already by the service providers (Enerim, 2021).

There are also services related to invoicing in the market. For instance, energy invoicing validation services exist already in the market. In such services, the service provider validates the electricity invoice of a customer to check any inaccuracy in the invoicing. (VENI Energia, n.d.a). Additionally, service providers can provide competitive bidding of electricity deals to their customers (VENI Energia, n.d.b).

In addition to the services mentioned above, there are also different kinds of energy consultation services available. Such services can be in a broader scope than just the electricity consumption of consumers (Granlund, n.d.). However, some consultant services cover electricity consumption related matters, such as demand response, which could be a relevant matter in the future energy services to cover, and potentially within the scope of services

that utilise the datahub system. The current services are wider discussed in Chapter 6 of this study, where the research results are discussed.

3.3.2 Potential services of the third parties

The possibilities of the services provided by the third parties in datahub are vast. Some examples are services and applications related to energy efficiency and energy management. Moreover, demand response and electric transport are concepts that could be further developed via a centralised information exchange model. Such services could become economically viable via further service development. (HE 144/2018 vp). This subchapter discusses the different concepts and potential service solutions.

To start with, the definitions of central concepts are given next. Demand response is defined in the EU directive 2019/944 as follows: "'demand response' means the change of electricity load by final customers from their normal or current consumption patterns in response to market signals, including in response to time-variable electricity prices or incentive payments, or in response to the acceptance of the final customer's bid to sell demand reduction or increase at a price in an organised market as defined in point (4) of Article 2 of Commission Implementing Regulation (EU) No 1348/2014, whether alone or through aggregation" (EUR-Lex, 2019). Aggregation is then defined as "a function performed by a natural or legal person who combines multiple customer loads or generated electricity for sale, purchase or auction in any electricity market" (EUR-Lex, 2019).

Two different types of demand response can be detected. The types are implicit demand-side flexibility and explicit demand-side flexibility (European Smart Grids Task Force, 2019). Implicit demand-side flexibility means the flexibility of the consumers, which is based on price signals. The consumers can adjust their electricity consumption to reflect the market prices and thus, earn savings in their electricity costs. Therefore, the implicit demand-side flexibility may also be called price-based demand-side flexibility. The implicit demand-side flexibility can be realised by automation or the personal choices of the consumers. (European Smart Grids Task Force, 2019). The implicit demand-side flexibility can be considered energy management. The role of the service provider providing such service via data available in datahub would be the Energy Service Company (ESCO), which receives the data of a customer from datahub via an authorisation.

On the other hand, explicit demand-side flexibility is the flexibility that can be traded on the energy markets, such as wholesale, balancing or reserve markets (European Smart Grids Task Force, 2019). Another term used for explicit demand-side flexibility is incentive-driven demand-side flexibility. An aggregator often manages explicit demand-side flexibility. (European Smart Grids Task Force, 2019).

The EU directive 2019/944 defines independent aggregators as follows: "'independent aggregator' means a market participant engaged in

aggregation who is not affiliated to the customer's supplier" (EUR-Lex, 2019). Aggregators are discussed in the final report of The Smart Grid Working Group of the Ministry of Economic Affairs as well (Pahkala et al., 2018). The final report defines the concepts in line with the EU directive. An aggregator is a market party who combines the consumption, production, or energy storages of the customers to form a larger set of resources, by which participation in the electricity markets is possible. Thus, aggregators enable more active participation of even small customers to the markets. Independent aggregators are market actors, who do not act as suppliers or as balance responsible parties of customers, and who do not need an agreement with the supplier or with the balance responsible party when acting in the market. The operation of independent aggregators can, amongst others, even out the consumption, which benefits the power system and lowers the power costs for the consumer and increases competition in the market. Aggregators could provide advantages to the power system and markets as a whole. (Pahkala et al., 2018).

However, some issues should be considered regarding the effects of aggregators on other market operators. The activities of an independent aggregator may affect the operation of balance responsible parties, suppliers, and distribution system operators. Independent aggregators do not have their own role in the electricity markets yet, and there are no clear rules on how the independent aggregators may act in the market. Clearer rules and responsibilities should be defined, especially if the volume of such operation increases. (Pahkala et al., 2018).

The Energy Authority has recommended that the current Electricity Market Act should be updated regarding the aggregators. Independent aggregators should be considered a market party, and the rights and responsibilities of such market party shall be determined. (Energiavirasto, 2020). During the writing process of this study, the government proposal of updates to the Electricity Market Act and other related acts have been published. The Electricity Market Act would contain, amongst others, the definitions of aggregation and independent aggregator (Lausuntopalvelu, 2021). Moreover, a whole new chapter covering aggregators would be added to the act. It is proposed that the independent aggregator would be responsible for the balance deviation that is caused by its operation. The compensation of the costs related to the activation of demand response caused by the independent aggregator would be determined in the act. Additionally, matters such as making an aggregation agreement or switching of aggregators would be covered in the act. (Lausuntopalvelu, 2021). Updating the legislation will clarify the operating principles of aggregators, which is essential as the number of aggregation services in the market increases.

Due to the matters mentioned above, aggregators do not have their own role in the datahub system either. Aggregators could most likely be

considered third parties in datahub as they are parties providing service to the electricity consumers and are not the suppliers of the customer. However, the operation of the aggregators in datahub and the HRM role of the aggregators are not yet defined. The potential updates to the legislation might support updating the model.

Another rather new concept in the electricity markets is energy communities. Datahub 2.0, which will be implemented in 2023, will support the operation of local energy communities (Fingrid, 2021e). Energy communities are a form of sharing economy. In an energy community, for instance, the benefits of local electricity production are shared within the community. (Pahkala et al., 2018). Citizen energy communities are defined in the EU directive 2019/944 as follows: "'citizen energy community' means a legal entity that: (a) is based on voluntary and open participation and is effectively controlled by members or shareholders that are natural persons, local authorities, including municipalities, or small enterprises; (b) has for its primary purpose to provide environmental, economic or social community benefits to its members or shareholders or to the local areas where it operates rather than to generate financial profits; and (c) may engage in generation, including from renewable sources, distribution, supply, consumption, aggregation, energy storage, energy efficiency services or charging services for electric vehicles or provide other energy services to its members or shareholders" (EUR-Lex, 2019). Once the datahub 2.0 is implemented, the datahub system will handle the processes related to the local energy communities. The party that maintains the energy community in the datahub system is the distribution system operator, whose metering grid area the energy community is located in. If a third party has authorisation to an accounting point, which joins an energy community, the third party receives a notification of the joining. The notification includes the name and identification code of the energy community. Similarly, the authorised party receives a notification if the accounting point is deleted from an energy community. Also, the netted and community energies of an energy community, calculated by datahub, are forwarded to the parties who have permission to the information. That is, also the third parties who have authorisation to the related accounting points receive such information. (Fingrid, 2021e). The management of the energy communities probably requires some external party to maximise the benefits of the energy community. Third parties could potentially provide such management service.

Another increasingly important factor in the electricity sector is electric transportation. The share of electric transportation in the transportation sector is increasing and will most likely introduce challenges yet also new services and innovations to the electricity system and markets. A potential concept to be furthered is Vehicle-to-Grid (V2G). V2G refers to the interaction of an electric vehicle and the power grid, in which the interaction

is supported with a communication system (Tan et al., 2016). The power flow between the vehicle and the grid is managed to optimally balance the grid, improve power quality, and gain financial profit. There are two types of V2G technologies: unidirectional V2G and bidirectional V2G. (Tan et al. 2016). Especially the bidirectional V2G technology is interesting from the grid balancing point of view, as the bidirectional technology allows the power to flow in both directions between the vehicle and the grid. V2G solutions do exist already (Virta Global, n.d.). However, the solutions are not widely implemented yet. Nevertheless, the technology is being constantly studied (Virta Global, n.d.). The role of the datahub related to electric vehicle charging services is yet somewhat unclear. The role is clarified in the research part of this study.

3.4 Data reports for market parties in the datahub system

As was discussed above, the third parties can develop their services around the datahub system. In addition to developing their own system by which they integrate to datahub, the parties can utilise some reports available for them in the datahub user interface. The reports are available for market parties to support their business activities in datahub. The reports may, amongst other things, give information about the transactions or errors in events of a market party in the system. The reports available for the third parties are described next.

Reports available to a market party depend on which role the market party acts. The reports present the data to which the market party is timely obliged. For third parties, there are several types of reports available. First, there are six different types of Business reports. Business reports reflect how the datahub system is used. The first two reports, functional business errors and technical business errors, monitor disturbances that may affect the fluent use of the system. Violations of datahub business process validation rules appear in the functional business errors report.

On the other hand, technical business errors report shows errors caused by system technical reasons. The target of the error reports is to enable the market party to act if errors in its business processes occur and to minimise the errors. (Konttinen, 2021).

The following two reports are reports of open transactions and open business transaction dossiers. The open transaction report shows the open transactions in the system related to the party, which are started by another market party and require action from the market party, here the third party. (Fingrid, 2021l; Konttinen, 2021). The open business transaction dossier report shows the events started by the party itself and require action from the counterparty (Konttinen, 2021). The following report is about non-acknowledged events. The report shows the messages which are in the message queue of the market party and have not been acknowledged. The last business report is the authorisation monitoring report. By the report, the

authorisations of the party can be monitored per event and status. (Fingrid, 2021l).

All the reports mentioned above can be utilised in the datahub user interface, and for instance, different filters can be used to the data as needed for the data analysis and utilisation. The data can also be exported to Excel, which offers extensive data analysis tools. Thus, the data analysis may be even more versatile and flexible in Excel.

In addition to the business reports mentioned above, there are several control reports that the market parties can run in the datahub user interface. Via control reports, the market parties can receive all of their certain type of data as a report. The control report types available for third parties are Customer data, Metering point data and Authorisation data. Before running the report, the user can apply filters and choose which information is desired to be exported. The form of the report is a CSV file. The parties can utilise the reports to review the information of their own customers at a certain point in time. (Konttinen, 2021).

4 Role of the third parties in other datahubs

Some other countries in Europe have already implemented datahub solutions or have plans on implementations. Norway and Denmark have their datahubs in operational use from the Nordic countries. Additionally, the datahubs have been implemented in the Netherlands, Estonia, and Belgium. This chapter discusses the datahub solutions of Norway, Denmark, the Netherlands, and Estonia, and particularly the role of third parties in the datahubs. The datahub system of Belgium is excluded from the study. In the last subchapter, some datahubs under development are also briefly discussed.

4.1 Elhub in Norway

The datahub system of Norway is called Elhub, operated by Elhub AS (later Elhub). Elhub is a wholly-owned subsidiary of Norwegian TSO Statnett SF. (Elhub, 2020a). Elhub system has been in operational use since February 2019. Elhub system covers all market processes and metering data handling in the Norwegian electricity market. (Elhub, 2020b). The market parties who utilise the Elhub system are grid companies, regulated balance suppliers, balance responsibles, energy suppliers, third parties and Statnett. The roles of these market parties correspond to the HRM role model. Additionally, there are service providers who can provide services to the aforementioned market parties. (Elhub, 2021a).

In Elhub, third parties and service providers are separate actors. Third parties (AG) are actors who can retrieve metering data via a separate web interface. Third parties provide services to the end customers and use the metering data to provide the services. Thus, the third parties need to have an agreement directly with the end customers they are providing the service, to get permission to access the metering data of the end customers. Once the agreement is made, access to data is permitted via a request addressed to the end customer. The end customer shall accept the request within 15 working days. Otherwise, the request is rejected. (Elhub, 2021b).

The access level for the third party can be full or limited. The default access level is the limited level, which gives access to metering data and minimum information of the accounting point. On the contrary, the full access level gives access to metering data, agreement information and other basic data of the accounting point. The end customers can manage the access level of the third parties they have an agreement with, giving the party full or limited access or removing the access entirely. (Elhub, 2021b).

Whereas third parties are actors providing services to the end customers, the service providers in Elhub are actors providing services to the other market parties. Service providers can act in several roles in Elhub. The different roles of service providers are as follows. The first service provider

role is EDI service provider (ESP). In the role of ESP, the service provider provides an electronic data interchange system and its operation to a market party. The second role is an Application service provider (ASP). In the role of ASP, the service provider provides an IT system as a service to the market party as a whole. The third role is a Managed service provider (MSP). The role is used in submitting metering values to Elhub on behalf of a grid company. In the role of MSP, the service provider is the juridical sender of a message. The fourth role is a Communication service provider (CSP). The CSP role is often the same as the ESP role. In the role of CSP, the service provider is the physical sender of a message. (Elhub, 2021c). The difference between the juridical and physical sender of a message is as follows. The juridical sender is the party whose information is handled in the sent or received message. The physical sender is the party who sends or receives the message and acts on behalf of another market party. (Fingrid, 2021i). That is, the juridical sender differs from the physical sender in the latter case. The last role is Agent. In the role of Agent, the service provider can access the Elhub Actor Portal. Information access of an Agent is rather limited. Agents may perform some services, such as customer service or invoicing of customers, on behalf of a market party. (Elhub, 2021c).

The terms used for such market actors thus differ between Elhub and Finnish datahub. In the Finnish datahub, a third party and a service provider mean the same actor in the market. As described earlier, the type of a third party can be an authorised party or a delegated party, who then take HRM based roles in their operation. The third party role in Elhub is similar to the authorised party role in Finnish datahub, as the third parties provide services to the end customers in Elhub. On the contrary, the service provider role in Elhub is somewhat similar to delegated party role, where some operations are performed on behalf of a market party. Some service provider roles are also similar to the operations of system vendors of market parties, who provide the systems for the market parties in the Finnish datahub.

4.2 DataHub in Denmark

The datahub system of Denmark is called DataHub, operated by Danish TSO Energinet. DataHub processes the metering data and business processes of the Danish electricity retail market. DataHub can be accessed via a B2B interface or web-based user interface. The first version of DataHub was introduced in 2013. A new version of DataHub was implemented in 2016 when a supplier-centric market design was implemented in Denmark. In a supplier-centric model, the supplier is responsible for customer communication and invoicing. That is, consumers pay only one invoice for their electricity consumption. (Energinet, n.d.a).

The market parties who have direct access to DataHub are the electricity suppliers and grid companies. Additionally, metering data administrators submit metering data to DataHub on behalf of grid companies. Metering data

administrators can receive, for instance, calculated sums from DataHub, yet such actors do not have access to any customer-specific information. Also, balance responsible parties receive data related to the settlement. They receive the consumption and generation data of the electricity suppliers of which balance responsible parties they are. However, the balance responsible parties do not have access to the DataHub system. (Energinet, n.d.b).

In DataHub, third parties can provide services to end consumers similar to Elhub and datahub. Third parties may be, for instance, energy consultants, who aim to provide the most suitable and affordable electricity deals to their customers. The end customers can authorise third parties to access their data in DataHub. The end customers can access their own data via the DataHub customer portal. (Energinet, n.d.b).

4.3 Energy data hub in the Netherlands

The Dutch energy data hub is operated and developed by Energie Data Services Nederland (EDSN, n.d.a). EDSN cooperates with the regional grid operators, the transmission system operator TenneT and the national gas transport system operator GTS, and seven regional grid operators of the Netherlands. The energy data hub covers the mentioned system and regional grid operators, 131 energy suppliers and 86 independent service providers, 64 program responsibles and 18 metering responsible parties. (EDSN, n.d.b). The Dutch energy data hub was implemented in 2007. Before the datahub solution, the information exchange model was a communication hub in the Netherlands. (EDSN, n.d.a).

The role of EDSN as the datahub operator is to develop the ICT infrastructure for the energy market. (EDSN, n.d.c). Furthermore, the target of EDSN is to facilitate the free energy market. Regulated market processes for data exchange between the market parties are provided in the data hub system, and the market processes are further developed according to the needs of the market to optimise the functioning of the markets. Another relevant matter to focus on is the security in data sharing. There are some ongoing pilots related to broader data utilisation possibilities, in which security has also been considered. Service providers, that is, third parties, have taken part in some pilots. For instance, a pilot with several energy price comparator companies has taken place, with a target to achieve a more accurate price comparison at an accounting point based on the consumption data received from the accounting point in question. The service provider company shall always have permission from the end consumer to access their data. Another example is a pilot where consumption data has been shared with financial service providers, and the data is utilised in propositions of “green loans”. In this pilot, the service providers also needed to have permission from the end customer to receive access to the consumption data of the customer. (EDSN, n.d.d). Such examples show that the services provided by different service providers have been under development in the

Dutch datahub as well. And as can be seen, similar to the other datahubs, the service provider shall always have permission from the customer to access the data of the customer.

In addition to the matters mentioned above, EDSN collects and edits metering data. For instance, the metering data is aggregated and used to better energy flow allocation. A new allocation method is being developed to receive more accurate energy volume calculations from the system. EDSN has developed a central register containing, for instance, structural data of decentralised production units, such as solar panels, storing units, such as batteries, and consumption, such as factories. The data supports the energy flow prediction and efficient grid usage. Moreover, when the data is aggregated, it can then be used for different studies to support the system and market development. (EDSN, n.d.d).

4.4 Data Hub information systems in Estonia

The datahub systems of Estonia are called Andmeladu Data Hubs. In addition to electricity Data Hub, there is also an information system for gas. The information systems are operated by the Estonian electricity and gas transmission system operator Elering AS. The electricity and gas Data Hubs contain agreement information related to electricity and gas consumption. Additionally, the Data Hubs contain consumption metering data. (Elering, n.d.).

The Data Hub systems do not contain third parties in such a way that the Finnish datahub or the other discussed datahubs do. On the contrary, the end customers can authorise electricity or gas suppliers to access the metering data of the end customer. The suppliers can make price offers to the end customers based on the data. (Elering, n.d.). The end customers manage the authorisations in a client portal. A customer can give the authorisation to multiple suppliers. (Elering, 2020).

To sum up, there are no separate third parties providing services in the Estonian Data Hub systems, contrary to other datahub systems discussed. However, authorisations exist also in the Estonian systems, and they are managed somewhat in the same way as in other datahubs. That is, the customer whose information the authorisation covers manages the authorisations. Moreover, the information needed to provide a service is only available to the market operator via authorisation.

4.5 Datahubs under implementation

Datahubs have been planned to be implemented in some other European countries as well. For instance, the datahubs are being planned in Sweden and Poland. The two cases are briefly discussed next.

The project of developing the Swedish datahub, Elmarknadshubb, had already been running, but the project was paused in autumn 2020 due to delays in the required legislation. The delay prevents the project to proceed

until the required changes are implemented. The required changes in legislation will be finished at the earliest in the second half of 2022. (Svenska kraftnät, 2020). The forthcoming implementation of Elmarknadshubb will enable new services of service providers to enter the market. The services could be related, for example, to energy efficiency and flexible electricity consumption. (Svenska kraftnät, 2017).

In Poland, the datahub solution Central Energy Market Information System (CSIRE) is also to be implemented. The system shall be in operation starting from July 2024. The Polish transmission system operator Polskie Sieci Elektroenergetyczne SA will implement and manage the CSIRE. (Polskie Sieci Elektroenergetyczne, 2021a). CSIRE will also enable the market participation of service providers with new services (Polskie Sieci Elektroenergetyczne, 2021b).

5 Research material and methods

So far, the study has covered general aspects of datahub, the legislation behind the implementation of datahub, and the roles of different market parties in the electricity retail market and the datahub system. The third parties have been discussed in more detail than other market participants. Additionally, datahub systems in some other European countries were discussed as well. Once the basics have been discussed, the next step is to discover prospects of the service development of the third parties.

This study aims to discover what kind of services the third parties will develop and provide to the end customers and the electricity retail market parties. Additionally, the target of the study is to discover what is the role of datahub operator in supporting the service development.

5.1 Motivation for the research methods

The research is conducted by questionnaires and interviews with third parties. The research method of questionnaires and interviews was chosen amongst others for the following reasons. At the beginning of the study, the datahub project had a somewhat unclear picture, who the third parties are and what kind of services they are providing now and in the near future in the market. The starting point for receiving required information to support the service development of the third parties was to discover who the third parties are in the first place. A questionnaire to reach a larger set of market participants was considered a possible way to understand better the current service providers and their services. Moreover, a questionnaire supported with further interviews seemed to be the most suitable way to find answers to all the research questions set for the study.

In addition to the advantages of the research method to find answers to the research questions, the method has its disadvantages as well. First, the set of third parties who could benefit from the datahub system is not a definite set of parties. The challenge is whether the questionnaire reaches the relevant parties in the market. Secondly, receiving many answers to the questionnaire is rather challenging, and the researcher has little to affect the answer percentage. Even if the questionnaire was published in several sources, there is no guarantee of a large answer percentage. And finally, the number of interviews to be arranged and included in one study is quite limited and does not offer quantitative but qualitative results. Therefore, the results of the research are not entirely unambiguous.

However, the services to be developed are aimed to serve a purpose. By arranging party-specific interviews, a better understanding of the concrete needs of the third parties towards the datahub system can be reached. Moreover, the market parties are being listened to, and the service development support of the value-added services, which was an obligation

written in the legislation, is being executed in practice. Despite the disadvantages, the method of questionnaires and interviews supports the purpose of the study the most suitably, and thus, the method was chosen as the research method.

5.2 Questionnaire for the third parties

As described above, the research was started with a questionnaire targeted at as many market actors as possible. The set of market parties to be contacted was defined based on the contacts from market parties to Fingrid Datahub during the datahub implementation project and based on the customer contact list of Fingrid. The market parties chosen to be contacted were those who potentially would act as third parties in datahub and could benefit from the datahub system when providing the services to end customers and other market parties.

Once the set of market parties to be contacted was defined, a link to the questionnaire was sent by email. Additionally, the information about the questionnaire was published on the Fingrid Datahub website. The questionnaire was conducted with Surveypal and was available in Finnish and English. The questionnaire included the following questions:

1. What kind of services are you providing to your customers at the moment?
2. What kind of customers do you have at the moment?
    a. What are the concrete benefits of your services to your customers?
3. What kind of data do you need to provide your services? For example metering data.
4. Are you going to utilise the datahub system in your services once the datahub goes live?
    a. If yes,
        1. what kind of services and service development you have planned to implement after the datahub go-live?
        2. do you have any ideas or proposals regarding the service development, which the datahub operator could support by developing the datahub system?
        3. do you see any constraints for your service development with regard to the datahub system?
    b. If no, are you yet familiar with the possibilities the datahub system may offer you, or is this out of the scope of your business?
5. Are you going to provide services related to demand response?
    a. if yes, how the datahub system could be developed to support such services?

In addition to the questions given above, the name of the answering company was asked at the beginning of the questionnaire. After the questionnaire, the contact details of the respondent were asked. By giving their contact details, the respondents gave their permission to be contacted to arrange an interview. The target of the interviews is discussed later in this chapter. It was voluntary for the respondents to give their contact details. That is, if a market party was not willing to participate in an interview, the contact details could have been left blank.

The target of the questionnaire was to reach a larger set of potential third parties than had been reached during the implementation phase of the datahub project. Receiving answers from a larger set of market parties provided new points of view about the services of the third parties and widened the potential scope of the interviews.

The questionnaire can be found in appendix A. The results of the questionnaire are discussed in Chapter 6.

5.3 Interviews of the third parties

Based on the results received from the questionnaire, some of the parties were contacted again to arrange an interview. Party-specific questions were prepared for each interviewed party based on the scope of their business and the answers they had given in the questionnaire. Interviews offered more detailed answers and support to the research questions, and issues could be broader discussed compared to a questionnaire.

In addition to the interview questions, information about the datahub system was provided for the parties in the interviews. Moreover, if the parties had any questions regarding datahub and its operation, the questions were answered during the interview. Datahub is a new system to all market parties and thus, relevant information must be provided to the market parties in the best possible way from the side of the datahub project. All in all, the interviews provided good knowledge to both the datahub project and the interviewees. The results of the interviews are discussed in Chapter 6.

6 Results of the study

The research methods of the study were presented in Chapter 5. The methods chosen for the study were a questionnaire targeted to a large scope of potential third parties in datahub, followed by interviews. The interviewees were chosen based on the questionnaire results. The results received from the questionnaire and the interviews are discussed next in this chapter. The research questions were presented already in the previous chapter as well, being the following. This study aims to discover what kind of services the third parties will develop and provide to the end customers and the electricity retail market parties. Additionally, the target of the study is to discover, what is the role of the datahub operator in supporting the service development.

Before finding answers to the research questions, the target was to discover, who the third parties are in the first place, and what kind of customers they have. The questionnaire provided answers to these preliminary questions. Both the questionnaire and the interviews provided a more profound understanding, what the services the parties are providing now are, and how the parties are going to develop the services. Additionally, the data requirements were clarified already in the questionnaire but were also discussed in the interviews. The questionnaire results provided a reasonable basis for the research results. Furthermore, the interviews provided a more concrete understanding of what kind of development the third parties are planning and how the datahub operator can support the service development.

To start the discussion of the results, the results from the questionnaire are covered in the first subchapter. Next, the results of the interviews are discussed in the following subchapters. The answers of each interviewed market party are discussed separately. Once the results have been discussed, the conclusions are drawn. Additionally, any issues arising from the research are discussed. Finally, the following steps are considered. That is, how the datahub operator will proceed in the service development and whether the needs and ideas of the third parties are implementable in datahub.

6.1 Results from the questionnaire

A total of 16 parties answered the survey. The number of answers was somewhat what was expected. Despite the relatively small sample, the answers varied and provided decent results. The questionnaire results provide higher-level results than the interviews discussed in later subchapters. The results of the questionnaire are discussed in this subchapter.

To start with, the current services in the market were examined. Most companies who had answered the survey offer reporting and monitoring services and various optimisation services. Additionally, some other services

were offered and detected in the results. The detected sectors of services are discussed next.

The first sector of services detected in the questionnaire is the reporting and monitoring services. Several parties offer energy consumption monitoring and reporting services. In addition to electricity consumption, district heating and water consumption and the amount of waste produced at a property can be reported. That is, any utilities consumed or produced in a property can be metered. The metering of a utility can be conducted with submetering instead of having only one meter for the consumption monitoring of a utility. For instance, electricity consumption can be metered in several locations within a property. The monitoring and reporting help the customer and the property owner monitor their utility consumption and detect potential energy-saving locations. In addition to the utilities, reporting services are available for other measures. For instance, CO_2 emission reporting and cost reporting are also provided in the services. All such reports mentioned support efficient management of the business activities of the customers of the service providers.

Some service provider parties offer Software as a Service (SaaS) solutions, in which all reporting and monitoring, which the service provider offers to the customer, is conducted. Such solutions support the later monitoring of the data conducted by the customers, as all relevant information is available in one place. Such solutions support the recognition of saving potential in the properties as well. Some monitoring services also provide specific actions taken if, for instance, pre-set limit values are exceeded in the consumption of the utilities.

In addition to the property-owning company customers, the metering services can also be provided to electricity market parties. Remote reading and quality control services of metering data are provided to grid operators. Metering data management services can also be provided for grid operators and electricity suppliers. Such services are, for instance, metering data reception and delivery to different systems, metering data inspections and further processing. The customers save time and costs when they outsource the metering data management to a service provider and can focus on the core business activities instead.

The second detected sector of services is optimisation services. Energy consumption optimisation and derivative services are conducted based on the reporting and monitoring, which was detected as the first segment of the services. The optimisation services are related to heating, electricity consumption, peak power, distribution service fee, electric vehicle charging, and local production, most likely solar power production. First, the optimisation of heating and local production optimisation is discussed. The heating optimisation services are related to controlling direct and reserving electric heating and heat pump systems. That is, heating optimisation is a type of electricity consumption optimisation. The heating is optimised based

on electricity spot prices and local production if the accounting point has its own production. In the electricity spot price optimisation, the heating is directed to the hours when the electricity spot price is low. And vice versa, the heating is decreased during the hours, when the price is higher. The optimisation of local production means that the power flow to the grid from local production is minimised, and the consumption of the local production is maximised. It is more economical to maximise the local usage of locally produced electricity instead of selling the production to the power system. The optimisation of local production and consumption and the optimisation of heating benefits the customer financially, as the customers earn savings in their electricity costs.

As discussed, the local production can be used for heating, but also other consumption on the property, for instance, for electric vehicle charging. The optimisation of electric vehicle charging occurs in multiple levels, thus offering different customers variable benefits. The first type of customer is household customers. As was mentioned, the power generated by local production can be utilised for electric vehicle charging. Additionally, the household customers benefit from price optimisation in the charging, when the charging is directed to cheaper hours based on the electricity spot price, similar to the heating optimisation. Furthermore, the fuse size can be optimised and not be increased due to flexible consumption instead of high power peaks.

The second type of customer is company customers. The electric vehicle charging infrastructure and software of company customers can be managed by a service provider, enabling the company customers to provide the charging services to their customers. The third customer segment is the distribution system operators. The distribution system operators benefit from the electric vehicle charging optimisation via the demand response of the charging stations.

One way to realise the optimisation services of electricity consumption is by using machine learning and artificial intelligence. Machine learning and artificial intelligence can be utilised to support customers to recognise their saving potential in energy usage and thus, offer a financial advantage to the customers.

Besides monitoring, reporting and optimisations services, some other services were also detected in the questionnaire answers. The other services that arose in the questionnaire were services related to invoicing, electricity acquisition, electricity tax auditing services, customer information systems (CIS), Enterprise Resource Planning (ERP) solutions, consulting, and load offering to the balancing markets.

The invoicing and acquisition services are discussed first. There are two different types of invoicing services that were detected in the questionnaire results. First, invoicing services can be related to the monitoring of receivables of customers and electricity disconnections related to debt

collections. Another detected example of invoicing service is that the energy invoicing of a property tenant can be outsourced to a service provider.

In electricity acquisition services, the acquisition is outsourced, which saves the time of the customers and can enable lower electricity prices to the customer. Additionally, such centralised electricity acquisition lowers the risk of significant price volatility of electricity prices. The customer can benefit from the electricity spot prices if the prices are low, but the risk of too high prices is relatively moderate. Another service related to the electricity acquisition and cost of electricity is electricity tax auditing services. With electricity tax auditing services, the customer receives correct taxing treatment and thus, does not pay too much for the electricity.

The CIS and ERP solutions, in turn, support the efficiency of the operational activities of the customer companies. Furthermore, the solutions provide support in managing the statutory obligations of some companies.

Additionally, a tool to support the understanding of sustainable and responsible development of companies arose in the questionnaire. The tool to support the understanding of sustainable and responsible development is built for companies to help them shift to carbon-free electricity production and thus lower their emissions. The tool and its purpose are linked to the UN sustainable development goals, especially to goal number seven, “affordable and green energy”.

The last type of the other services detected in the questionnaire results is load offering to the balancing markets. The load offering to the balancing markets supports the operation of the markets. An aggregator can conduct the load offers. An aggregator supports corporations, grid operators, balance responsible parties, owners of electricity production and consumption units, and other energy stakeholders to participate in electricity markets. The aggregators were discussed already in Chapter 3. More information about aggregators is provided in one of the interviews.

In addition to the services described above, for small electricity suppliers and closed distribution system operators, a service provider can provide a complete service to cover the entire datahub operation of the market party. The parties benefit from such service as they do not need to control, maintain, and update the different interfaces, for instance, the datahub interface, which the company needs to use in its operative activities. Additionally, other services related to operation in the electricity retail market can be provided to such market parties as a service. All services discussed above are summarised in Table 3.

Table 3 Detected services in the questionnaire.

Service types	**Examples of the services**
Reporting and monitoring services	1. Monitoring of electricity, heating and water consumption, and waste production of a property 2. CO_2 emission reporting 3. Cost reporting 4. Software as a Service (Saas) solutions
Optimisation services	1. Electricity and heating consumption optimisation based on the monitoring 2. Electric vehicle charging optimisation 3. Optimisation of the usage of local production
Other services	1. Invoicing 2. Electricity acquisition 3. Electricity tax auditing services 4. CIS and ERP solutions 5. Support tool for sustainable and responsible development 6. Load offering to balancing markets 7. Datahub operation service to small market parties

The services described above are provided to different types of customers. The customers of the service providers are divided into three different segments, which are electricity market parties, company customers and household customers. Nine out of 16 service providers who had answered the questionnaire provide services to market parties, 13 out of 16 provide services to company customers, and four out of 16 provide services to household customers. Additionally, some parties offer services also to the public sector. However, in the datahub system, public sector customers are comparable to company customers. Even though the services provided to the public sector may differ from services provided to other company customers, the information available in datahub about both customers for their service providers is the same. Here, public sector customers refer to, amongst others, municipalities and cities. Based on the result, the most significant customer sector to the current service providers is the company customers.

The parties who provide services to market parties and act on behalf of the market parties in datahub are delegated parties, as has been extensively discussed in Chapter 3. Correspondingly, the parties providing services to the company and household customers are authorised parties.

The service providers need different types of data to provide the services described above to the customers. The data required for the services is an essential matter to be considered. The different types of data needed for the services are discussed next. First, the metering data of an accounting point is

very relevant data for the services. The metering data is mostly consumption data, but also some parties need production data of local production for their services. Metering data should be hourly metered data and also preferably real-time data. Real-time data means that the meter is read in even faster frequency than once per hour, close to real time. The metering data is not absolute real-time data but close to it. Such metering data, which is read from a meter several times per hour, is referred to as real-time data in this study.

For now, the meters of accounting points in the distribution grids must be read once per hour (Government Decree on the settlement and metering of electricity supplies 767/2021). The hourly-metered metering data is delivered to the datahub once a day. The obligation to deliver metering data once a day to datahub is given in the Decree of the Ministry of Economic Affairs and Employment on the information exchange of electricity trade and the settlement of electricity supplies (839/2021). Thus, real-time data is unavailable in datahub, at least for now. Starting from 2023, the metering data will be metered in a 15-minute time step instead of a one-hour time step, and the 15-minute imbalance settlement will be implemented in May 2023. The change in time step thus affects the metering data handling as the resolution becomes more accurate. The changes have already been discussed previously in this study. Besides the hourly metered data, some services also require cumulative consumption data.

In addition to the metering data, other information is also needed for the services. Based on the questionnaire results, weather data, electricity price data, including energy and distribution prices, customer data on accounting point level, accounting point identification numbers, and origin information and production type of electricity are needed for the services. Furthermore, information about the fixed term of an agreement may be needed for some services.

However, some of the data listed above is not available in datahub. The datahub system does not contain any weather data. Electricity spot prices are not available in datahub either. Sales agreements of customers contain information about the electricity price of the customer, but the agreement information is not available for third parties, as was discussed in Chapter 3. The product information of distribution system operators, including distribution prices, is public in datahub. The third parties can access the distribution prices of accounting points but not any other price information. Due to the inaccessibility of the sales agreement information, the electricity invoicing information and information on whether an agreement is a fixed-term agreement is not available for the third parties. Another desired piece of information, the origin information and product type of electricity, is not available in datahub. However, the customer data and accounting point information including accounting point identification numbers are available in datahub via authorisation.

The services related to properties also require some real estate data. Information, whether the accounting point is connected or disconnected, is also relevant for some invoicing services. For the invoicing services, some other electricity invoicing information may be required. Some services may also require imbalance settlement data.

When it comes to real estate data, information about controllable loads may be available in the accounting point information. The controllable loads are loads in which energy can be reserved for later use, for instance, hot-water tanks in properties. The accuracy of the information depends on whether the distribution system operator, whose accounting point is in question, has given the information in the accounting point information. Information, whether the accounting point is connected or disconnected, is also available in the accounting point information. Changes in the connection status are not automatically forwarded to authorised parties of the accounting points in question, yet an authorised party can receive the connection status via accounting point information retrieval in datahub. The last desired piece of information, the imbalance settlement data, is unavailable for third parties in datahub.

Once the current services and data requirements have been covered, the next step is to discuss the services and service development once the datahub has gone live. Additionally, the potential restrictions of the datahub system related to the services are discussed. Some service providers have no remarkable service development in sight once the datahub goes live, but the target is to ensure that the current operation and services can continue normally after the go-live. Furthermore, the service providers aim to further develop their current services, for instance, the consumption reporting services, once the datahub has gone live. Also, the current customer portals are planned to be developed. Additionally, the datahub is planned to be utilised in the internal processes of the parties, which would not be directly visible to the customers of the service providers.

The transition to a 15-minute imbalance settlement period which will be implemented in May 2023, will be the next remarkable change in the market that may affect the service development of some parties. The service development of some service providers may focus on that change in the markets. Additionally, other upcoming changes in the market are likely to steer the service development of service providers to enable them to offer their customers the services in which the upcoming changes are acknowledged. Some parties declared in the questionnaire that the tight schedule of the datahub implementation project has restricted the development project of other services. However, the matter is not directly related to the datahub system itself but to the legislation behind datahub, which sets the schedule for the implementation.

Despite the detected resource issues related to datahub implementation, several market parties already have some service development planned for

the operational activities of datahub. There are service development plans related to value-added services for different ecosystems. Such services are related to, for instance, transportation, construction, energy efficiency, land use planning and CO_2 emission mitigation. For example, from datahub, the load and production profiles of electric vehicle charging station customers could be retrieved if the service provider is authorised to the data, and the service provider can then utilise the data. However, based on the questionnaire, it remained unclear which data the electric vehicle charging operators would retrieve from datahub and which data they would receive from other sources. Additionally, the changes between the current operation and operation once datahub has gone live remained somewhat unclear. The matters were discussed in more detail in one of the interviews, which provided more accurate information on the matters mentioned above. The results are discussed later in this chapter.

Some other advantages and possibilities of datahub arose in the questionnaire as well. Once datahub has gone live, the information provided by the service provider to their customer is considered better and more accurate than in the current information exchange model. Additionally, the distribution prices per accounting point are available in datahub, which supports the operation of the service providers by decreasing the manual work required in the data processing. Regional balancing possibilities of distribution system operators are under development as well. Some parties plan the consumption calculation of properties by own metering if a property has solar power production. The data of own consumption is not directly available once local production is installed to property but is mixed with the production. The datahub version 2.0 will conduct the netting calculation of local production and consumption. However, the production values are metered based on the power output to the grid and not the total production of the accounting point. Thus, the issue related to the mixing of local production and consumption is not fully overcome with datahub 2.0. The issue is also related to the metering and decrees related to it, rather than to the operation of datahub.

Additionally, some development ideas were given in the questionnaire. One larger-scale idea which arose from the questionnaire is an innovative ecosystem model which would cover a large set of market actors. Different actors would be gathered together to discuss the problems throughout the whole value chain in the energy sector. The optimisation of the hydrogen industry would be one segment in which such joint development would be required. Additionally, electrified transportation would need such discussion and planning. The data in datahub is at the centre of such discussion, and the datahub could even be the master system for such services.

Another matter which arose in the questionnaire is that the data in datahub should be as up-to-date as possible. Light and fast data transfer methods are suggested for that. As an example, the MQTT protocol is being

mentioned. However, the way the data is being processed and forwarded in datahub will not be changed anytime soon. It would require remarkable reasons for such changes.

Also, forecasts of the load for load control planning are considered a potential development idea for the datahub system. However, any forecasts are not planned to be implemented in datahub. Additionally, the following issue was raised related to data maintenance. The production data of the own production of a customer and the calculation of the consumption being in datahub would be needed. By such a procedure, the production data of the customer would be kept in one place and would not disappear if the customer changes their service provider. Nowadays, the property owner is rather locked to the service provider they had chosen when purchasing the production equipment. As was discussed above, the datahub 2.0 will conduct the netting calculation of local production and consumption, the production time series being the production fed to the grid and not the absolute amount of local production. The netting calculation in datahub will partly support the issue of a customer being locked to one service provider, but not entirely, as for now, the absolute production is not delivered to datahub.

In addition to all the suggestions and ideas mentioned above, real-time or close to real-time data transfer is considered highly important. For now, the metering data is delivered to the datahub once per day. Thus, real-time metering data is not available in datahub. The issue is not directly related to the datahub system itself but rather to legislation and the requirements for the used metering equipment and metering data delivery.

All in all, most of the detected issues were rather not related to the datahub system but the legislative restrictions and regulations were considered the primary cause of the issues. Additionally, some issues and challenges that emerged in the questionnaire were related to the lack of information and understanding of the datahub system and its operation. Such issues are important to be detected. The issues indicate that the activities of datahub are not yet clear enough for the service providers and require more informing of the third parties about datahub. Some issues were detected also related to how some datahub business processes function and how the notifications of the transactions are sent to the relevant market parties. However, the issue cannot be solved, at least for now. In further development, it may be discussed whether it would be possible to change the principle of the functionality of the processes.

Demand response was covered as a separate question in the questionnaire. First, the parties informed whether they would provide demand response related services. And then, as the last question of the questionnaire, the development ideas related to demand response and towards datahub system were asked. 11 out of 16 market parties answered that the party would provide services related to demand response. Several parties notified that the services are still under development, and thus, there

are no specific development suggestions towards datahub related to demand response. Furthermore, some parties had already mentioned their development ideas in the previous questions.

However, some new ideas and suggestions still arose in this last question of the questionnaire. In some answers, preliminary data analytics and forecasting were mentioned. The preliminary analytics of the consumption of properties would help to detect controllable loads. The detected load potential could then be utilised in load control and demand response of the properties. The analytics and forecasting would utilise the historical data in datahub. Such service in the datahub system could be realised by using, for instance, artificial intelligence. As was previously discussed, no forecasting is planned to be implemented in datahub. Furthermore, data analytics will not be developed either, at least for now. The information about the controllable loads may be given in the accounting point information, as mentioned, and the distribution system operator is in charge of the information. There has been discussion if the responsibility of the controllable loads should be moved to suppliers or service providers. However, the issue is that the controllable load is part of the accounting point information, and thus, the information should be detached from the accounting point information. As an outcome, the controllable loads are kept in the accounting point information. Moreover, the locations of controllable loads would not be available to other market parties other than the authorised parties who have received an authorisation from the customer of the accounting point. For instance, the information of controllable loads could not be utilised in a way that a service provider would receive information from controllable loads in a particular area to discover a demand response potential of the area.

Additionally, the availability of open data was detected as a possible way to find new loads which could be utilised in demand response. There has been discussion about the availability of open data. The datahub system already has technical readiness to produce and import open data. However, any service through which the open data would be available to be utilised has not been implemented yet. Moreover, even if open data were available, the information would be aggregated. Thus, it would not be applicable to use the data to detect potential demand response loads.

Partly linked to the open data, well-functioning and open interfaces were mentioned in the answers related to demand response. Required data could be received via the interfaces, and it would be possible to build machine learning models based on the data to optimise demand response assets. The interface specifications were wished to be published well in advance to have enough time for integrations and to test the systems. The interface specifications have been published well in advance for now, and any changes or updates are planned to be published correspondingly in advance.

6.2 Results from the interviews

A total of six parties were interviewed in the study. The results of each interview are discussed in the following subchapters.

6.2.1 The interview 1

The first party to be interviewed was an energy service provider company, which is part of a larger group of companies with over 40,000 customers in the Nordics. The customers of the company vary from small customers, such as limited liability housing companies, to industrial customers. The annual energy consumption of the customers varies from 10 MWh up to 100 GWh. Most of the customers are small and medium-sized enterprises (SMEs). However, the public sector is the largest customer segment in energy volume. The services are limited to company customers, which include the public sector. That is, household customers are not within the scope of the services. (Eerikäinen & Salonen, 2021).

The services of the company are divided into three different types. The first service type is energy acquisition. The target group of such services is SMEs, the public sector, property owners and holders, and agricultural and industrial customers. The service includes energy acquisition to the customer with hedging or joint acquisition. The service includes competitive tendering of electricity suppliers. The advantage of the service is that service supports the risk management of the customer. The volume of such service is approximately 8000 GWh in the Nordics, of which 5500 GWh is located in Finland. That is, such service is used in significant quantities in Finland.

The second service type is electricity bill inspection. The target group of the service is SMEs, mainly producing industrial customers. In the service, for instance, the tax class of the customer is checked. If a wrong tax class has been used in the invoices of a customer, a refund is applied as part of the service. The customer potentially receives a financial benefit from such service, as the taxing of the electricity consumption of a customer may decrease.

The last service is smart metering. The target group of the service is buildings including several tenants, such as shopping centres and office properties. In the service, the electricity supply and management of a property are managed on behalf of the property-owning customer. The volume of such service is 600 GWh in total in the Nordics. (Eerikäinen & Salonen, 2021).

Certain types of data are needed to provide the services mentioned above to the customers. The company needs, amongst other things, up-to-date accounting point information, customer information and metering data to provide its services. Before the implementation of datahub, the data collection has required remarkable effort both from the interviewed company and from the customer service of distribution system operators and electricity suppliers. For new customers, the required accounting point and

supplier information is requested from the distribution system operators, followed by contacting the suppliers. The information is received using power of attorney. In addition to the issue that the information is not available in one place, the information may not always be up-to-date if the information of current customers is later kept in the systems of the service provider after receiving the information from the electricity companies. (Eerikäinen & Salonen, 2021).

The implementation of datahub supports the operation of the interviewed company in terms of data collection, as the accounting point and customer information is kept in one place and is always up-to-date in datahub. Additionally, the metering data is received from datahub closer to real-time as the metering data is delivered to datahub once a day, enabling more accurate consumption forecasts and leading to better risk management in hedging. The implementation improves the service experience of the customers as well, due to the improvements mentioned above in the operation of the company. In addition to the improved efficiency, the company can develop their current customer portals, for instance, by providing the metering data to the customers (Eerikäinen & Salonen, 2021). The development of the customer portal is likely to improve the customer experience. To sum up, the implementation of datahub does not bring any new services as such yet enhances the operation of the company and improves the customer experience of its customers.

Even though datahub offers remarkable improvements for the operation of the company, some issues related to datahub have been detected. Some issues appear in the current operation and are not resolved with the datahub implementation. One issue is related to providing service to the customers who have several, for instance, dozens of accounting points, and the number of accounting points may change at times. If the number of accounting points increases, the service provider does not have visibility or receive the information about the new accounting points if the customer does not inform the service provider of the changes (Eerikäinen & Salonen, 2021). The issue is not resolved with the implementation of datahub, as the authorisations are accounting point specific. The accounting point identification number must be known to report the authorisation to the system, and there is no list of the accounting points of the customer available for the service provider. For the interviewed company, it would be a remarkable advantage if such lists of accounting points of its customers, based on the business ID, were available in the datahub system (Eerikäinen & Salonen, 2021). With such lists, the service provider could detect which accounting point it already has authorisation and whether accounting points are missing an authorisation. The inaccuracy of the accounting point information affects the tendering and hedging of the customer (Eerikäinen & Salonen, 2021). Thus, the service quality would be improved by such feature described above.

Another restriction related to the authorisation is the limited information that the authorisation covers. As discussed in Chapter 3 of this thesis, the authorisation covers accounting point information, customer information and metering data. Agreement information is excluded. Therefore, the authorised parties do not, for instance, receive information about the switching of suppliers of their customers. Some of the operational activities of the interviewed company could be comparable to operations of distribution system operators or suppliers, which differentiate the operation of the company, for instance, from service providers who only offer services related to metering data management (Eerikäinen & Salonen, 2021). The company would benefit from having visibility to the information of the suppliers of its customers to ensure that the suppliers and other matters are correct when the company has run the tendering for the customer (Eerikäinen & Salonen, 2021).

The interview provided a more accurate understanding of the operation of such a service provider. The object of the study was to discover service development ideas, and thus the object was fulfilled for this one. The issues which arose in the interview were valuable. Whether such changes in authorisations were implementable are discussed in Subchapter 6.3.

6.2.2 The interview 2

The second party to be interviewed was a company that acts as a wholesaler of solar power systems for company and household customers (Huoman, 2021). The target of the services of the interviewed company is to dimension the solar power systems properly for each new location. That is, the size of a new solar power plant is chosen based on the consumption of the customer. Via such optimisation, a maximised benefit of the local production is enabled to the customer. The customer benefits most from the power plant if the local usage of the production is maximised and the flow into the power grid is minimised. The interviewed company has approximately 200 retailers in Finland. The retailers vary from large electricity supplier companies to small installation companies and utilise the systems of the interviewed company to offer solar power services to the end customers. (Huoman, 2021).

The customers of the company can be divided into company customers and household customers. In quantity, the largest customer sector is the household customers, holding approximately 80 % of the power plants. However, the size of the power plants of household customers is, on average, smaller than the size of the power plants of company customers. The smallest company customers own power plants of the same size as household customers, being approximately 10 kW, but the largest units may exceed even size of 500 kW. As most of the customers are relatively small in size, the customers are primarily located in distribution grids and thus, are within the scope of datahub services. In practice, only the manufacturing industry is out of the scope of the services of the interviewed party. Due to the lower tax rates

of the large industry, the advantages of local solar power production decrease remarkably, and thus, the manufacturing industry does not benefit from the solar power plant solutions. (Huoman, 2021).

In addition to solar power plant systems, the interviewed company offers consumption optimisation services for their customers. For company customers, few customers participate in consumption optimisation. Consumption optimisation is more common in the household customer sector than in the company customer sector. The optimisation is conducted based on the amount of local production and consumption and the electricity spot prices. The most remarkable and typical controllable loads in the properties are hot water tanks. Recently, the loads participating in consumption optimisation have been increasing in size. Even the heating of the property is more often becoming a part of the optimisation system. In addition to the increased size of controllable loads, another development trend is the increased size of the power plants. (Huoman, 2021).

The interviewed company considers that they can benefit from the datahub system remarkably once they join it (Huoman, 2021). As mentioned previously, the company aims to dimension the power plants to match the consumption of customers. As for now, receiving the historical consumption data of the customer for the dimensioning has been a challenge (Huoman, 2021). From datahub, the historical metering data for the last six years can be retrieved if the customer has authorised the service provider. According to the company, six years of metering data suits very well for the power plant dimensioning (Huoman, 2021). After the power plant has been installed and running, the metering data from datahub will also show whether the dimensioning succeeded. Additionally, the self-utilisation rate of the power plant can be calculated based on the metering data. (Huoman, 2021).

In addition to the challenges related to the lack of metering data available, the calculation of absolute consumption has been challenging when there is local production in the accounting point (Huoman, 2021). At least in datahub 2.0, the metering data of power input and output between the grid and the accounting point are available in datahub, as the netting calculation will be conducted by datahub. Based on the time series in datahub and by metering of the absolute production of the power plants conducted by the interviewed company, the absolute consumption of the customer can be calculated. The company can provide the information to the end customers, and thus, the end customer also benefits indirectly from the datahub.

Despite the remarkable advantages of datahub, some issues are not resolved by datahub, at least for now. Some of the issues are related to metering. Even though consumption data is available in datahub, an own consumption meter of the interviewed company is needed for the accounting point to receive real-time data from the accounting point (Huoman, 2021). The real-time data is used for consumption optimisation. However, it would be sufficient that the company installed a current meter for the optimisation,

and an own energy meter would no longer be needed. Additionally, the company will have its own metering to monitor solar power production in the future as well. The need for own meters of service providers somewhat locks the consumer to the service provider they have chosen when purchasing the power plant. (Huoman, 2021). However, datahub improves the situation partly, as the consumption data and the production, which is fed into the grid, will be stored in the datahub system, and thus, the dependency of the service provider is diminished. A solution to fully resolve the problem would be if submetered, non-validated data could be delivered to datahub (Huoman, 2021). Such data would not be used for invoicing and imbalance settlement, yet the purpose of such data delivery would be to enable storing all metering data of an accounting point in one place and therefore remove the dependency of a customer on a service provider. For now, such data delivery is not permitted. In Subchapter 6.3, it is discussed whether such data delivery could be implementable in further versions of datahub.

Another issue that emerged in the interview is related to the datahub service agreement and certification. It was discussed in the interview whether it was efficient that the interviewed company conducts datahub certification and signs the service agreement or should the retailers certify and sign the agreement as well. It would be simpler if the interviewed company would conduct the required procedures and receive the authorisations from the customers, and the retailers would then utilise the system and customer information of the interviewed company. The feasibility of such a course of action is discussed in Subchapter 6.3.

The interview provided new development ideas to be further discussed in the study. Additionally, the interview focused more on the household customers, which have been in less focus than company customers, when it comes to the results so far. Therefore, the interview can be considered successful.

6.2.3 The interview 3

The third party to be interviewed was a company offering SaaS energy management services to its customers. The services are offered to company customers, such as actors in the trading sector, property owners, public sector, housing management companies and telecommunications companies. The customers vary in size. A remarkable number of the largest companies in Finland uses the services of the interviewed party. Most customers are owners of large properties where energy usage requires management. The largest customer segment is the trading sector. On the contrary, some customers do not have a remarkable number of properties yet consume a significant amount of electricity and thus need management services. (Huuhtanen, Iltola & Paappanen, 2021). However, such customers are industrial customers who are not within the scope of datahub services.

Thus, the focus of the discussion is kept on the other above mentioned customers.

The energy management services of the interviewed company are primarily focused on energy reporting. The services utilise metering data. In addition to the reporting services, the company is developing its services related to improving the energy efficiency of the customers. In the future, the services will increasingly utilise machine learning. That is, the services are becoming more proactive instead of reactive. Such development requires more real-time and accurate data. (Huuhtanen, Iltola & Paappanen, 2021). At least for now, datahub cannot provide such real-time data. However, the interviewed company has its own metering and submetering in properties to enable real-time monitoring of metering data (Huuhtanen, Iltola & Paappanen, 2021). Most of the meters of the company in the properties are submeters, by which the electricity consumption of different electricity applications within a property are monitored (Huuhtanen, Iltola & Paappanen, 2021).

The introduction of datahub benefits the interviewed company remarkably in terms of received data. As was already discussed, metering data plays a significant role in the services of the company. The metering data availability in datahub is sufficient for the energy reporting services of the company, at least for now (Huuhtanen, Iltola & Paappanen, 2021). Additionally, the company can utilise the historical metering data available in datahub to understand better the consumption patterns of a new customer. Before datahub, it has been somewhat challenging to access the historical data. (Huuhtanen, Iltola & Paappanen, 2021). As was mentioned above, the company also needs close to real-time data to run its monitoring services, yet such data is received via its own meters. In addition to metering data, the interviewed company needs, for instance, location and weather data and property-related data to run its services (Huuhtanen, Iltola & Paappanen, 2021). However, such data is received from other sources (Huuhtanen, Iltola & Paappanen, 2021). Thus, the needs of the company towards datahub are met even though not all data required to run the services are found in datahub.

In addition to the data availability, datahub offers some other advantages to the interviewed company as well. First, the company can better estimate how fast it can provide its services to new customers, which appears as better customer service (Huuhtanen, Iltola & Paappanen, 2021). Secondly, the metering data can be retrieved continuously, one metering data message at a time, instead of receiving large amounts of data at once. In such a way, the load in the systems of the company can be evened out, and the system is not overloaded. Furthermore, the authorisation processes are considered clear and straightforward by the interviewees. All in all, the unified and standardised operation is considered an advantage of the datahub system. (Huuhtanen, Iltola & Paappanen, 2021).

To sum up, the changes that the implementation of datahub brings are considered beneficial, and datahub offers the data and functionalities which the interviewed company needs. A more real-time metering data availability would be advantageous, yet not essential for the company. Once the datahub system is implemented, the company first focuses on managing and running its current services (Huuhtanen, Iltola & Paappanen, 2021). Later on, new services could be developed (Huuhtanen, Iltola & Paappanen, 2021). However, for now, any other development ideas did not emerge in the interview.

The interview provided yet another aspect of the services already running in the markets. Not any clear development ideas towards the datahub system itself appeared in the interview. However, real-time data availability came up in the discussion. The real-time data availability is further discussed in Subchapter 6.3. Even though such development does not depend on the datahub system, the data availability is at the very centre of discussion in the development of the services, and thus, worth considering in the discussion of the study.

6.2.4 The interview 4

The fourth party to be interviewed was a company providing electric vehicle charging solutions to its customers. The customers include both company and household customers. The household customers are the most extensive customer sector in quantity, yet the company customers form a larger sector monetarily. The size of the company customers varies from large electricity companies to limited liability housing companies. Both customer sectors, the company and household customers, are considered equally important. (Karppinen, 2021).

The services that the interviewed company provides to its customers related to the charging solutions are as follows. The customers can purchase price optimisation services related to the charging from the company. That is, the charging is directed to cheaper charging hours based on the sales and grid agreements of a customer. Any customer can buy such a service. However, such service is mainly purchased by household customers, who typically have their vehicles plugged into the charger for long periods, during which the price optimisation can be implemented. Additionally, the charging infrastructure of the interviewed company participates in demand response. The flexibility potential of the chargers is approximately 1 MW in Finland. (Karppinen, 2021).

To provide the services to the customers, several types of data are needed from the customers. The required information for the charging system dimensioning, such as fuse size, is received from the customer (Karppinen, 2021). Electricity spot prices are received via an interface, but the required data is mainly gathered manually (Karppinen, 2021). The historical metering data, distribution product information, and accounting point information,

including fuse size, can be retrieved from datahub. The availability of such information decreases the manual work in the information gathering and improves the customer service experience of the customer (Karppinen, 2021). All the information mentioned above is essential for the interviewed company to provide as good services to its customers as possible. For instance, the charging solution dimensioning and price optimisation depend on the abovementioned information. (Karppinen, 2021).

Even though the implementation of datahub benefits the interviewed company, the company had some development ideas towards the datahub system, which were discussed in the interview. At least for now, the authorisations of household customers can be reported only by the customers themselves to datahub. The authorisation reporting must be conducted by the customer themselves in the datahub end customer portal. The authorisation cannot be reported, for instance, in the system of a service provider, from which the authorisation would be transferred to datahub via an interface. Such authorisation reporting is not implementable even if strong identification was used in the login to the system of the service provider. From the perspective of a customer, it would be more straightforward if the authorisation could be given via the system of a service provider (Karppinen, 2021). In such a way, the customer would not need to log in into separate systems, but all required actions could be taken in one place. Therefore, the customer experience would likely be improved. (Karppinen, 2021). Whether such development could be implemented in later versions of datahub will be discussed in Subchapter 6.3.

Additionally, similar development ideas related to metering data emerged in this fourth interview, which have already come up in other interviews as well. First, real-time data delivery to datahub would benefit the company (Karppinen, 2021). Currently, the company has its own meters in the accounting points for more real-time metering data monitoring. As the services related to consumption monitoring and optimisation are increasing, the customers may have several metering equipment installed to their accounting point because all the service providers need their own metering at the moment. If the metering data were delivered to datahub in a faster cycle, separate meters would not be needed in such volume as for now. Such change in data delivery would potentially decrease the overall costs related to metering due to decreased amount of metering equipment required for the services. (Karppinen, 2021). As discussed previously in this study, the metering data is delivered to datahub once a day. Later in this study, it is discussed whether it would be possible to deliver the metering data more often.

Another development idea related to metering data is whether other metering data than the accounting point main metering data could be delivered and stored in datahub (Karppinen, 2021). Such a development idea emerged in previous interviews as well. Several service providers have

submeters in the accounting points, and the metering data could benefit different market actors in the field. Every service provider would not need to have their own metering equipment in every accounting point of their customers, but several actors could utilise the data. Moreover, a customer would not be locked to one service provider, and the data would not disappear if the customer changed their service provider. Such idea of storing other metering data in datahub in addition to the main metering data is discussed in Subchapter 6.3.

The service provided by the interviewed company differs from the services discussed in the previous interviews, and thus, the interview provided new aspects to the discussion in the study. Thus, the interview was valuable for the research conducted in the study.

6.2.5 The interview 5

The fifth party to be interviewed was a company that offers invoicing services to its customers. The services cover the invoicing lifecycle starting from the invoice forwarding until the invoice has been paid. The services also include, for instance, receivables management. Over half of the electricity invoices in Finland are forwarded by the interviewed company. Both electricity suppliers and distribution system operators and service providers of the electricity companies utilise the invoicing services of the company. (Mönkkönen, Olkku & Räsänen, 2021).

The interviewed company plans to utilise the datahub system in disconnection requests related to debt collections. Utilisation would simplify the disconnection processes compared to the current process. (Mönkkönen, Olkku & Räsänen, 2021). The company would act as a delegated party when conducting the disconnection requests. All the required data for the operation is available in datahub. However, the functionalities of the datahub processes do not fully support the planned operation (Mönkkönen, Olkku & Räsänen, 2021). For now, the connection and disconnection requests cannot be delegated based on the request type. The interviewed company would like to conduct disconnections related only to debt collections, but as said, the connections and disconnections of debt collections cannot be separated from other connections and disconnections in datahub. One development idea for further discussion is whether the delegations could be given not only process-specifically but based on process type or such, or that the debt collection connections and disconnections were separate processes from other connections and disconnections. The ideas are further discussed in Subchapter 6.3.

In addition to the functionalities of the processes themselves, the flow of information is also an issue. Both the delegated party and the delegating party should be updated about the connection situations of the end customers. If a delegated party conducts the disconnection requests on behalf of another party, the delegating party does not receive information

about the connection status. The issue of information flow is another matter to be discussed in Subchapter 6.3.

In addition to disconnections, the interviewed party could utilise invoice row information forwarding in datahub to support their operation. For instance, if the company had not received all required information via invoicing systems, the company could retrieve missing information from datahub. For now, the company has access to all required information. However, if a single invoicing model becomes increasingly common, the information needs to be retrieved from several sources, which can generally change the situation related to data availability. (Mönkkönen, Olkku & Räsänen, 2021). Datahub could be then the source of missing information. If statutory obligation for a single invoicing model came into force, the invoice row information in datahub would play an important role.

Nevertheless, another advantage of the datahub system is the availability of up-to-date end customer and accounting point information. Some debt collection processes may last for a long time (Mönkkönen, Olkku & Räsänen, 2021). During this time, changes related to the information and the situation of an end customer may occur. The interviewed company needs to receive up-to-date information about the customer, to enable as good customer service as possible for the end customer. Additionally, contacts related to debt collections are often conducted via mail. Access to correct address information is thus rather essential. (Mönkkönen, Olkku & Räsänen, 2021). In datahub, the up-to-date address information is available for the end customer contacts. Moreover, the interviewed party can utilise up-to-date and extensive data to provide better reporting to their customers (Mönkkönen, Olkku & Räsänen, 2021).

This fifth interviewed party was the only delegated party to be interviewed in the research of the study. Additionally, it was the only interviewed party that provides invoicing services to the customers to such an extent. Thus, the interview provided essential aspects to the whole discussion of the study.

6.2.6 The interview 6

The sixth party to be interviewed was a company that acts as an aggregator in the reserve markets, enabling its customers to participate in the reserve markets via its services. That is, the interviewed company is the actor in the market, but its customers own the reserves used. The company participates in FCR-D (Frequency Containment Reserve for Disturbances), FCR-N (Frequency Containment Reserve for Normal Operation) and FFR (Fast Frequency Reserve) markets. Typical customers of the company are greenhouses and industrial actors. The size of the power reserves of the customers varies from some hundred kilowatts to several megawatts. (Gyllenberg, Nordström & Saari, 2021).

When providing such services, the customer must benefit from the reserve market participation instead of being negatively affected by the participation.

For instance, greenhouses can provide flexibility without negative effects on their primary operation. Thus, a remarkable number of the customers of the interviewed company are greenhouses. In addition to the reserve market participation services, the company offers electricity control services based on the electricity spot price. (Gyllenberg, Nordström & Saari, 2021).

The interviewed company has its own metering equipment in the accounting points of its customers. For industrial customers, the meters are installed separately for each device, which are part of the portfolio of the interviewed company. No other data than metering data is required for the company to provide its services to the customers. (Gyllenberg, Nordström & Saari, 2021). Most customers are not located in distribution grids but are modelled as separate metering grid areas. Therefore, most of the customers of the interviewed company are not within the scope of datahub services. Moreover, the company does not necessarily need any data from their customers stored in datahub. That is, at least for now, the company does not benefit from datahub, as most of the customers of the company are out of the scope of datahub services, and the company itself gathers the data required for the services.

For now, it is also not feasible to provide the services to smaller customers, for instance, household customers. However, if the reserve market prices were to rise remarkably at some point, the situation would be different. If the services became feasible for households and other small customers, then the interviewed party and other such actors could develop their services and begin to provide the services to the smaller customers. (Gyllenberg, Nordström & Saari, 2021). In that case, the company would benefit from datahub, as the historical metering data of their potential customers were available for the company via authorisation. As also discussed in the previous interviews, the historical data can be used for analysing the consumption behaviour of the customer and for system dimensioning.

All in all, the interviewed company is not going to join the datahub system, at least for now, because most of the customers of the company are not within the scope of datahub services, and the company does not need any data from datahub. However, datahub may become an essential part of the business of the company if it decides to expand its business to smaller customers located in the distribution grids. Even though the business of the company is not entirely within the scope of this study, the situation might change in the future. Furthermore, the interview provided interesting points of view and different aspects compared to the previous interviews. Based on the interview, new actors may be joining the datahub if such balancing and aggregation services were to shift towards smaller loads located in distribution grids and thus within the scope of datahub services. Therefore, it was beneficial to include such a market actor in the research part of the study.

6.3 Discussion of the results

The results of the questionnaire and the interviews have been covered in the previous subchapters. Next, the main findings and the main development ideas that arose in the interviews are discussed, and the research questions of the study are answered.

To sum up, the third parties consider the implementation of the datahub a good change in the electricity retail market. Some main detected benefits of the implementation are as follows. First, the standardised operation of all market parties is considered an advantage. Additionally, the data availability is improved remarkably compared to the prior situation. The data in datahub is up-to-date, and the accessibility to historical data is improved, as the third parties receive access to historical data of their customers via authorisations. In the interviews, several third parties stated that obtaining the historical data has been somewhat challenging for now.

All in all, the improved data availability decreases the need for manual work required for data collection and saves time for all involved market parties. All the advantages mentioned above result in improved customer experience of the customers of the third parties. Good customer experience is considered a fundamental matter.

Despite the numerous advantages that the datahub brings, some challenges and development ideas were also detected. First, there are some issues and development ideas related to authorisations. Secondly, some issues and development ideas related to metering data were detected. And lastly, issues related to delegations was detected. The issues and development ideas are covered next.

First, the issues related to authorisations are covered. For now, the authorisations are accounting point specific, and the authorisations are reported to datahub separately for each accounting point. Some company customers may have even some hundred accounting points, and an authorised party may not have an up-to-date list of the accounting points of its customer. As a result, some accounting points may end up missing an authorisation, and the missing accounting points may stay unknown to the authorised party. In the interviews, an idea arose that information about the accounting points of company customers could be received from datahub per business ID, as a list of accounting points, if the company customer had authorised the third party to such information. Such practice would support the operation of the third parties, whose customers are company customers with several accounting points.

Suppose an authorised party provides service to all the accounting points of the company customer, and the company customer is willing to give such a list of the accounting points to the authorised party. In that case, it can be assessed that there would not be any restriction from legal point of view to implement such accounting point lists in the datahub system. If a need for such development is wider identified, it could be possible to develop such a

feature to the datahub system from a legislative point of view. From a technical point of view, the development idea would also be implementable. The implementation would require a new request event created in the datahub system. If the request event was implemented, attention should be paid in the operation that if an authorised party were not to provide its service to all accounting points of the customer, the authorisations should then be reported only to the accounting points, which shall be within the scope of the provided service. No other issues related to the discussed development idea were detected at this point of this study.

Another emerged issue of authorisations is related to the authorisations of household customers. Household customers, or private consumer customers in general, must report their authorisations to the datahub via the datahub end customer portal. At least for now, there are no other channels through which the authorisations could be reported. A development idea related to the reporting of the authorisations is that the authorisations could be permitted in the system of the service provider to whom the authorisation is given by using strong identification. From the system of the service provider, the authorisation would be forwarded to datahub via an interface. If the authorisation could be given via the service provider, the customer would not need to log in to several systems but could complete all required steps to purchase the desired service in one system. The customer experience could be improved through such practice.

It is a rather challenging question whether it would be possible to report the authorisation in other systems than the datahub end customer portal even if strong identification was used. The issue can be discussed from legislative, risk management and technical point of view. The legislative discussion begins with Electricity Market Act and GDPR. According to Electricity Market Act section 75f, an electricity company needs to have a certain consent from the end customer to give information of the end customer to another company (108/2019). The information in question includes, for instance, the metering and consumption data of the end customer. In the recital (32) of GDPR, it is stated that consent to the information of a person shall be given by "a clear affirmative act establishing a freely given, specific, informed and unambiguous indication of the data subject's agreement to the processing of personal data relating to him or her" (EUR-Lex, 2016). Additionally, according to recital (42), the controller has to be able to show that the person whose data is in question has given their consent to the data processing operation (EUR-Lex, 2016).

Based on the legislation described above, the consent, that is, the authorisation, needs to be in a specified form, and Fingrid Datahub needs to be able to verify that the customer has given their consent to the discussed information. If the authorisation were not given in the datahub end customer portal, it would not be that straightforward to verify that the end customer themselves has given the authorisation and whether the end customer has

realised what information they are giving the consent to. The primary target of personal data processing regulation is to secure the rights of the data subject. Therefore, the issue is, how it can be verified that the consent has been collected correctly in the service of the third party and the rights of the data subject are met. To minimise the risks related to the issues of verifying the authenticity of the consent of the end customer, the authorisation reporting is possible only in the datahub end customer portal, at least for now.

From a technical point of view, the authorisation reporting could be conducted in a system of a third party and then be forwarded to the datahub system. However, the technical feasibility does not remove the issues related to the authenticity verification of the authorisations. Thus, the arguments against the possibility to report the authorisations in another system than the datahub end customer portal rely more on the legislative and risk management points of view than the technical point of view.

To sum up, the considered perspectives in the authorisation reporting issues were the rights of the data subject, the risk management of the datahub operator and the technical feasibility. The authorisation reporting in another system would be technically feasible. However, to ensure the realisation of the rights of the customers and due to the risk management of the datahub operator, the current course of action where the authorisation can be reported only in the datahub end customer portal is considered preferable.

One solution to resolve the issue related to the reporting of authorisation, which potentially could satisfy both the third party and Fingrid Datahub as a controller, could be as follows. There could be a link in the system of the third party to the datahub end customer portal. The end customer could click the link and give the authorisation in the datahub end customer portal. It would be easy for the end customer to access the portal and give the authorisation, and there would then be no issues related to the authorisation verification.

The third issue related to authorisations is related to the certification and the service agreement of an authorised party. One of the interviewed parties acts as a wholesaler of their service, and their system is used by a significant number of retailers who provide the service to the end customers. It came into the discussion whether it would be possible that only the wholesaler service provider conducted the certification and signed the service agreement, and the retailers would then utilise the certified system. The authorisations would be permitted to the wholesaler, but the retailers would access the information when needed.

From the perspective of the datahub operator, a relevant matter is that the authorisations are given correctly to the wholesaler service provider by the end customers in the datahub end customer portal. It does not concern the datahub operator, whether the wholesaler forwards the customer information to their retailers, but it is related to the agreement between the wholesaler service provider and its customer. It is appropriate that the

wholesaler gives all relevant information related to the information management to the end customer. However, the datahub operator does not supervise how the information of the end customer is managed by the service provider outside the datahub system. On the contrary, if the retailers need access to the datahub system itself, they need to register to datahub similar to any other market party. In that case, the retailers would need to sign the service agreement and conduct the datahub certification.

Next, the issues related to metering data are covered. Several parties who answered the questionnaire or were interviewed need real-time or close to real-time metering data from the accounting points of their customers. If the metering data were delivered to datahub closer to real time, the need for several meters in one accounting point due to several service providers could be decreased, as the service providers could use the metering data of the main meter. However, metering data is delivered to datahub only once per day for now. The delivery cycle is independent of datahub but is determined in the Government Decree on the settlement and metering of electricity supplies (767/2021). Changes to the delivery frequency would require changes to the current decree. Whether the metering data should be read and delivered more often than once per day has been discussed by the Smart Grid Working Group of the Ministry of Economic Affairs and Employment. The increase in the need for closer to real-time metering was detected, but the real-time information exchange is considered essential only for demand response participating in the reserve markets (Pöyry Management Consulting, 2017). That is, the need for real-time metering of end customers and electricity suppliers was not considered remarkable. Instead of the current reading model, the metering reading could be conducted several times per day, which was considered sufficient by the working group. (Pöyry Management Consulting, 2017). However, no changes have been conducted to the Government Decree (767/2021) for now.

Even though the Government Decree (767/2021) defines the frequency of the metering data delivery for grid operators, the decree does not prohibit the grid operators from delivering the data more frequently than the requirement is, that is, once per day. However, the datahub system is not dimensioned for more frequent metering data delivery than the current decree requires. Thus, the metering data message processing would most likely not function optimally. Changes related to metering data delivery frequency would also affect the systems and operation of the grid operators, which shall be considered if any changes were planned to be implemented. The potential adjustments should at least be examined before shifting to a faster metering data delivery cycle could take place.

Another development idea related to metering data arose in the interviews. For now, only validated metering data, which is used for imbalance settlement and customer invoicing, is delivered to datahub. However, other data may be metered on an accounting point as well. The

other metering data can be, for instance, the metering data of local solar power production. An accounting point may also have several submeters which meter the consumption of different areas within the accounting point. The development idea is that such other metering data could also be delivered to datahub. The advantage of such other metering data delivery would be that all metering data of an accounting point would be kept in one place. Nowadays, customers are locked to the service provider they have chosen in the purchasing moment of service, and the historical metering data is lost if the customer changes their service provider.

From a technical point of view, the management of the other metering data would be possible in the datahub system. However, new types of metering data would require new metadata to be registered in the datahub system, which probably would require an extension to the current data model. Changes to the interfaces could be required as well. Validation rules for the other types of data shall also be considered. In addition to the technical point of view, the costs of the potential changes should be considered. The introduction of submetering in the metering data delivery would cause development costs and licence costs. That is, the services fees of datahub were likely to be increased.

Moreover, it should be determined which party would deliver the submetering to datahub. That is, would a third party be responsible for the data delivery or the distribution system operators. Alternatively, could the end customer themselves deliver the submetered data. Furthermore, the responsibility of the datahub operator in monitoring the delivery and quality of the submetered data should be considered as well. Before any changes are implemented, it shall be assessed whether the management and storing of submetered data in datahub is allowed from the legislative point of view.

The legislative framework for the operation of datahub is given Electricity Market Act, as has been discussed in Subchapter 2.2.1. The services of datahub are stated exhaustively in the Electricity Market Act. Datahub operator charges market parties of using the datahub system based on the services given in the act. The operator would not have a right to increase the fees for using the datahub system if the costs were increased due to system development which was not based on the mandatory services of datahub but for some other development. Developing the datahub system to support the management of other metering data could require changes to the current legislation.

All in all, there are several matters which shall be considered before any changes in the scope and responsibilities of metering data delivery are to be implemented. A relevant issue is whether the other metering data could be delivered and managed in the datahub due to the defined scope of operation given in the Electricity Market Act. Thus, the data delivery of other metering data is not likely to be implemented, at least for now.

The last development ideas covered in the discussion are related to delegations. For now, delegations in datahub are granted based on events or entities. The delegation covers the whole event, and the delegation cannot be granted only for a particular type of the concerned event. For example, one of the interviewed parties would like to handle disconnections and connections only related to debt collections of the end customers. Debt collection related disconnections cannot be separated from other disconnections in datahub. A solution to resolve the issue would be that the debt collection-related disconnections and connections were separate from other disconnections and connections. Alternatively, delegations could be granted on a more specific level than based on an event. That is, the delegation could be granted, for instance, based on an event type, reason code or such.

When it comes to connections and disconnections, the debt collection related connections and disconnections could be separated from other disconnections and connections as entirely new events. However, if the need for new types of events starts to increase, it is not reasonable to create new events for all new types of events if the basic functionalities of the events were the same and only the reason for conducting the event differed. Instead, it would be clearer if the events had different reason codes, and the delegations could be granted based on a reason code of an event. The entirety of processes would stay clearer, yet the delegations of events would function better and thus, the requirements of the delegated parties were met. The information returned to delegated parties in processes would also be returned based on the reason codes.

In addition to the functionalities of the delegations, an issue related to the information flow in the datahub system arose in the study. In the case of the interviewed delegated party, both the delegated party and the delegating party should be updated about the connection situations of the end customers. If a delegated party conducts the disconnection requests on behalf of another party, the delegating party does not receive information about the connection status. A solution to solve the problem would be that it would be possible to determine in the delegation whether the acknowledgements in the conducted events were sent to only the delegated party or both the delegated and the delegating party. The discussed changes related to delegations require remarkable changes to the datahub system. However, the changes are considered feasible.

The discussed development ideas and their feasibility are summarised in Table 4.

Table 4 Detected development ideas.

Development ideas	**Potential**
Accounting point information available for authorised parties per business ID	Could be implemented
Authorisation to be given via the customer portals of the third parties in addition to the datahub end customer portal	Not likely to be implemented
Access for retailers of a third party to the information to which the third party has an authorisation	Is possible if the access is realised in own system, and authorisation is received from end customer. For datahub system, service agreement is required from all connecting parties
Closer to real-time metering data availability in datahub	Requires broader discussion and examination
Metering data delivery of other (such as submetered) metering data to datahub	Not likely to be implemented
Granting delegations on a more specific level than based on an event	Could be implemented
Possibility to determine whether acknowledgements were sent to delegated and/or delegating party	Could be implemented

All in all, the results can be considered reasonable and reliable, and the research questions can be answered based on the research results. Thus, the research can be considered successful. The first research question was, what kind of services the third parties are going to develop and provide to the end customers and the electricity retail market parties. Another research question was, what is the role of the datahub operator in supporting the service development.

The services and the service development of the third parties have been widely discussed in this chapter. A more extensive scope of third parties was reached during the study than had been reached before the beginning of the study, and thus, the comprehension about the third parties and their services has increased during the study. The results support the understanding of the datahub operator about the operation of the third parties, and thus, support the further development of the datahub system related to the operation of the third parties. Therefore, the role of the datahub operator in service development has been clarified, and both research questions are thus answered.

6.4 Further development

As was widely discussed in the previous subchapter, some feasible development ideas arose in the research. The new feasible development ideas are added to the development request backlog of the datahub development team. Via the backlog, development ideas are considered in the further development of the system.

Additionally, communication and cooperation towards the third parties can be developed based on the study. Based on the research, the role of the third parties is likely to be increased in the near future, as several parties are still developing their services and new parties are joining the market and expanding their business. The datahub operator needs to find the correct balance between the obligation to develop the datahub system in cooperation with the industry and to ensure and keep the focus on the current statutory obligations, which mainly apply to suppliers and distribution system operators.

During the writing process of the study, several remarkable changes in the electricity markets and the legislation are in progress. The changes, for instance, the implementation of 15-minute imbalance settlement and the role of aggregators in the market, have been discussed in this study. Additionally, a more frequent metering data delivery cycle, amongst other potential changes in the future, has been discussed. Some of the potential changes which have been discussed but have not been planned to be implemented yet, could require some further research in the near future. All the discussed changes are likely to affect the further development of the datahub system in the upcoming years as well. That is, the changes may also affect the discovered development ideas related to third parties. Thus, the contemporary market situation shall always be considered when implementing new development ideas in datahub. However, the feasible development ideas, which arose in the study, will potentially come into implementation in the near future.

7 Conclusions

In the previous chapters of this study, the background for the research and the research results have been widely discussed. This chapter summarises the key points, main findings and conclusions of the study.

This study aimed to discover who the service providing third parties are, what kind of services they have, and what kind of service development is planned by third parties. Moreover, the role of the datahub operator in supporting service development was studied. The target was met, and thus, the research of this study can be considered successful.

Before conducting the research of this study, the background for the topic was covered. First, the starting point and arguments for implementing the datahub system were covered. Next, the legislation related to datahub was covered. The most relevant acts that define the operation of datahub are Electricity Market Act and GDPR, and Finnish Data Protection Act. The statutory obligations and the services included in the datahub are given in the Electricity Market Act. The datahub operator is obliged to provide electricity suppliers and distribution system operators with the services described in the act. Furthermore, the act obliges the electricity suppliers and distribution system operators to use the datahub system in the electricity retail market information exchange. The act does not directly oblige third parties to utilise the datahub services. However, if the third parties are willing to provide services for the market parties and end consumers, the third parties benefit from joining the datahub. Fingrid has an obligation to develop further the information exchange and services of the electricity retail market and the datahub system. For instance, the act obliges the operator to develop the possibilities for implementing value-added services, which third parties likely provide. The GDPR and Finnish Data Protection Act determine, together with the Electricity Market Act, how personal data is processed and managed in the datahub system. Therefore, the examination of the legislation was very relevant in the study.

Once the legislation was covered, the changes between current information exchange and information exchange in datahub were discussed. Additionally, all market roles of electricity retail market participants were covered. The roles and operation of the third parties in the datahub system were discussed in more detail as an own chapter. The third parties can act as delegated or authorised parties in datahub. Relevant market processes and examples related to the operation of delegated and authorised parties were covered. After discussing third parties in the Finnish datahub system, the roles of third parties in other datahubs were discussed as a comparison to the Finnish datahub.

Once the matters described above were covered, the research part of the study was conducted. The research did consist of two parts, a questionnaire and interviews. The target of the questionnaire was to reach as many market

actors as possible and receive answers to the research questions on a more general level. Based on the questionnaire answers, six parties were chosen for the interviews. The interviews provided more detailed information about the operation of the third parties, their needs and their service development. Generally speaking, the third parties consider the implementation of datahub a good change in the markets. The advantages of the implementation of datahub are the standardised operation, the up-to-date data availability and the availability of historical metering data of the potential customers in datahub. The data availability decreases the manual work required to gather relevant information to provide the services to new customers, which saves time for both the third parties and the electricity market parties from whom the information has previously been gathered. All the improvements mentioned above show to end customers as better customer experience.

Despite the advantages, some challenges related to the operation of the third parties in datahub were detected as well. Several development ideas to improve the operation of third parties in datahub arose in the interviews, and the ideas were widely discussed in this study. The new feasible development ideas are added to the development request backlog of the datahub development team. Via the backlog, development ideas are considered in the further development of the system.

Additionally, the communication and cooperation of the datahub operator towards the third parties can be developed based on the study. Based on the research, the role of the third parties is likely to be increased in the near future, as several parties are still developing their services and new parties are joining the market and expanding their business. The datahub operator needs to find the correct balance between the obligation to develop the datahub system and to ensure and keep the focus on the current statutory obligations, which mainly apply to suppliers and distribution system operators. Additionally, the markets are going through remarkable changes now and in the near future. Thus, the contemporary market situation shall always be considered when implementing new development ideas in datahub. However, the feasible development ideas, which arose in the study, will potentially come into implementation in the near future.

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A. Questionnaire for the third parties

As part of the research, a questionnaire to potential third parties was conducted. The research methods were described in more detail in chapter five. This appendix includes screen captures taken from the questionnaire to visualise the questionnaire used in the survey.

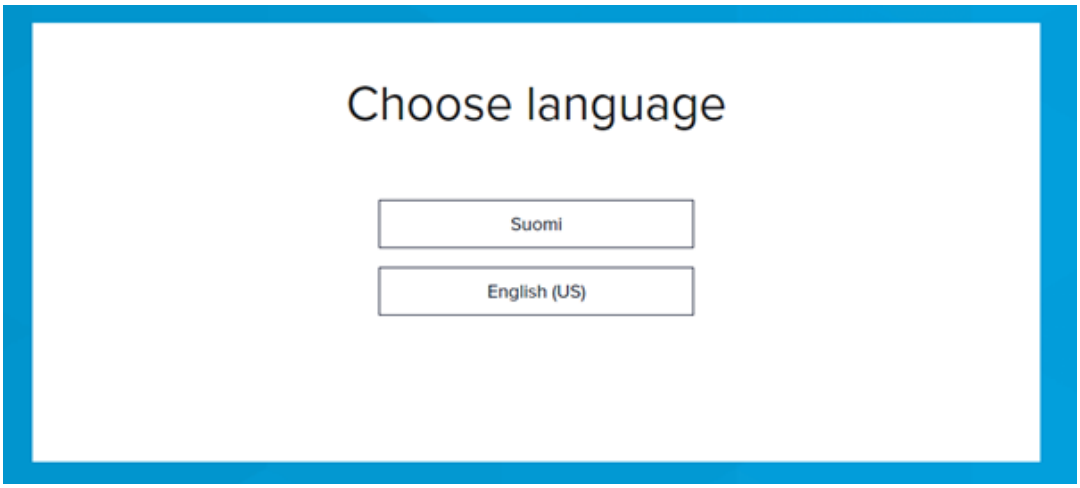

Figure 4 Choice of language.

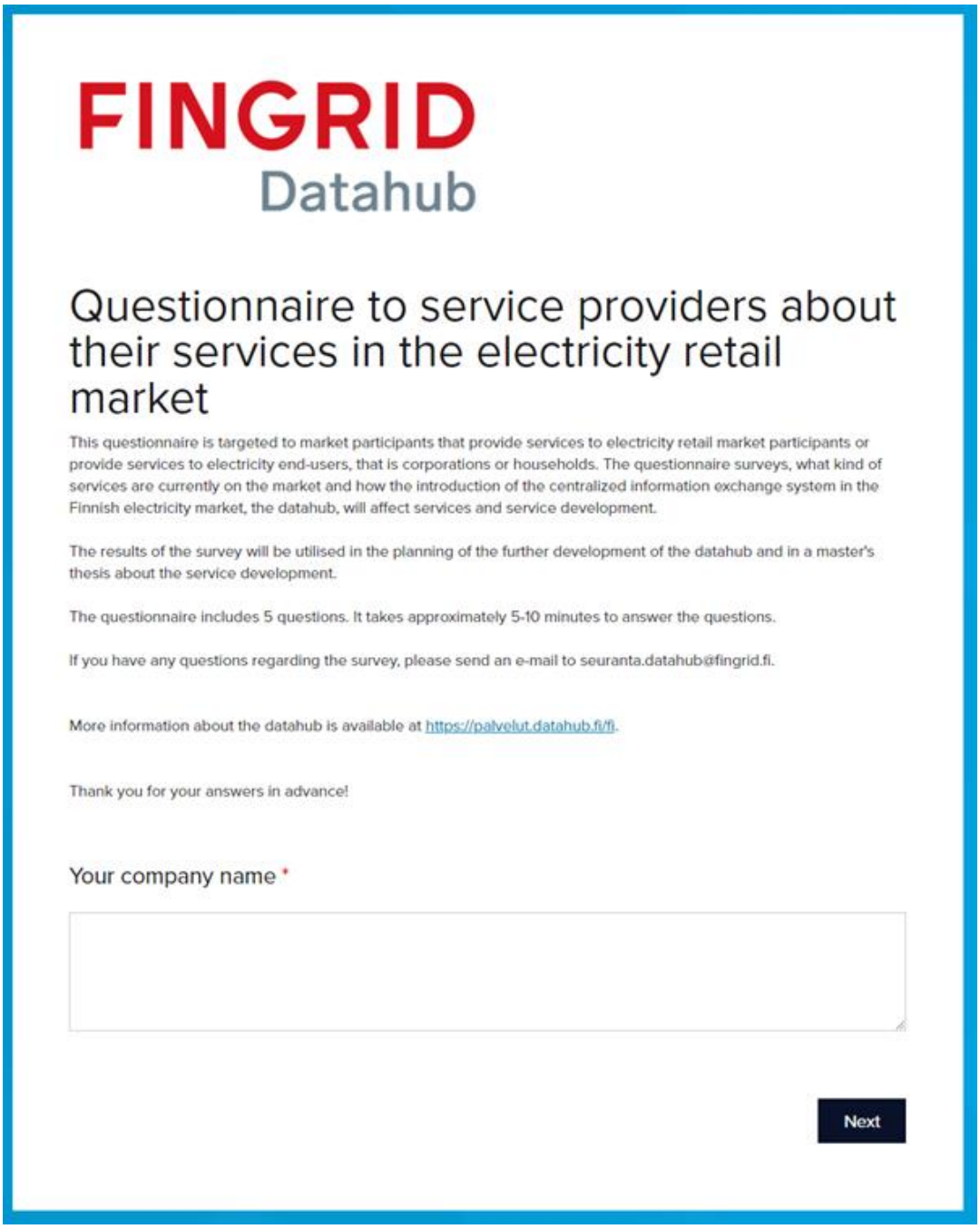

Figure 5 Company name.

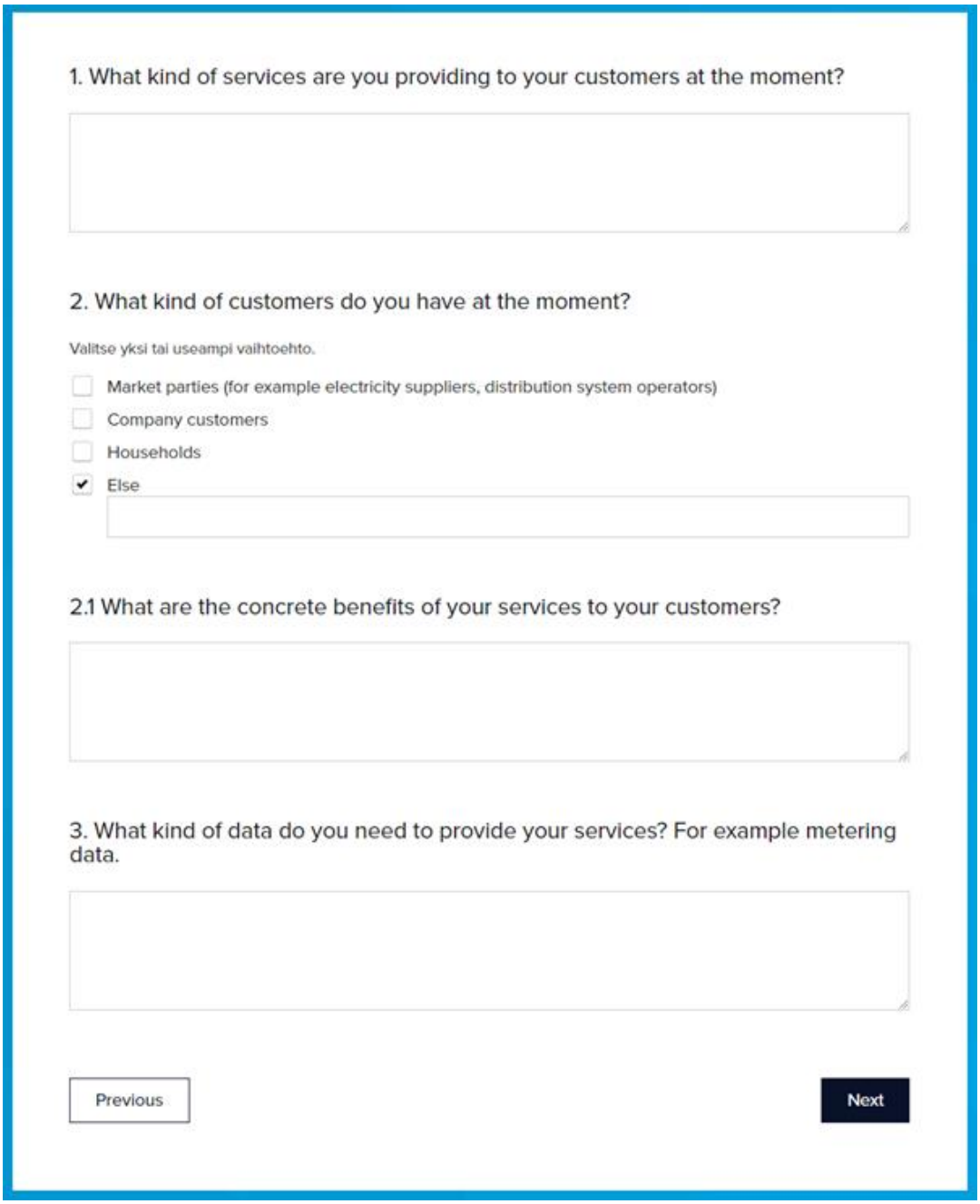

Figure 6 The first question page.

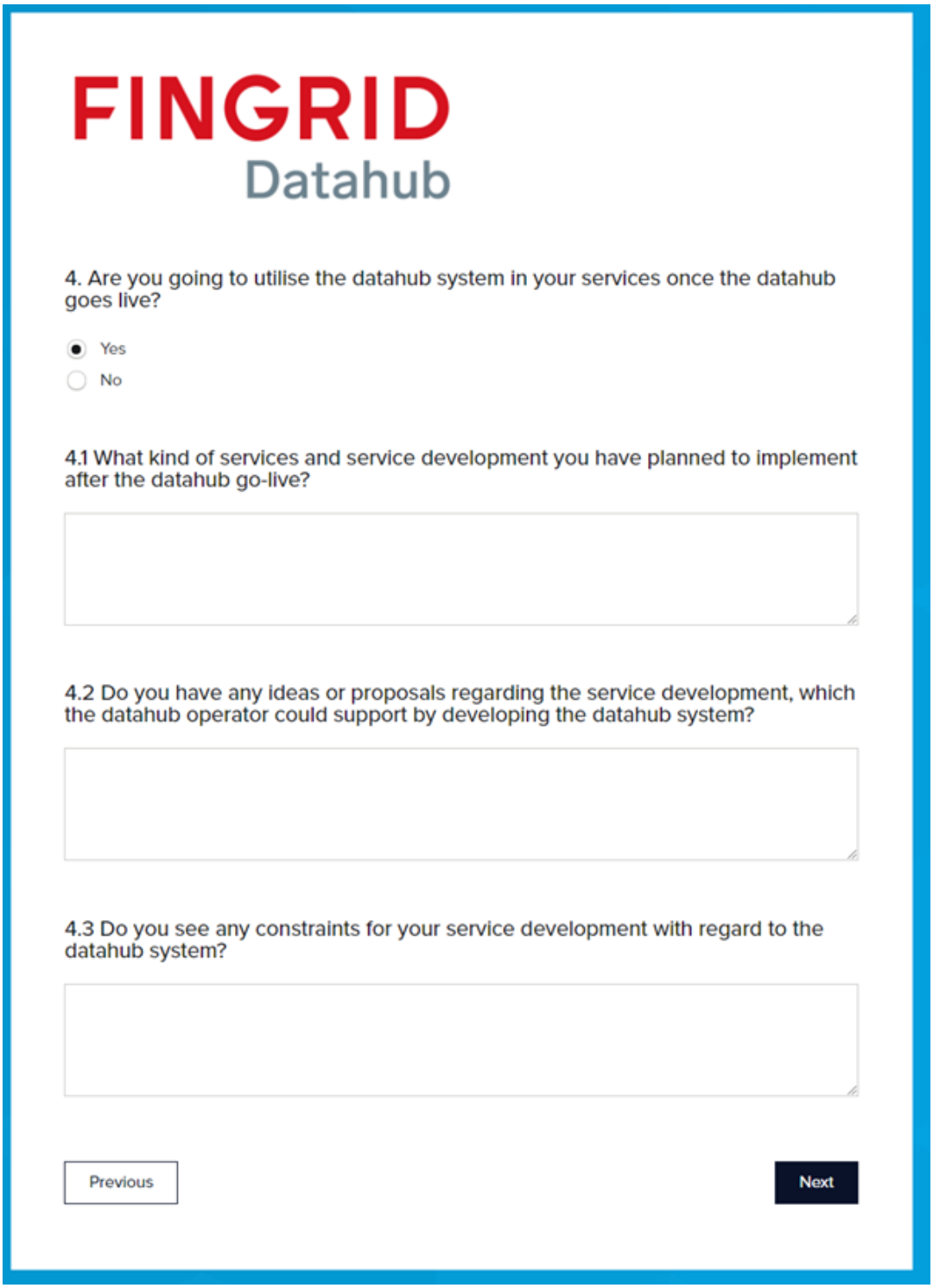

Figure 7 The second questionnaire page if the answer was "yes" in question 4.

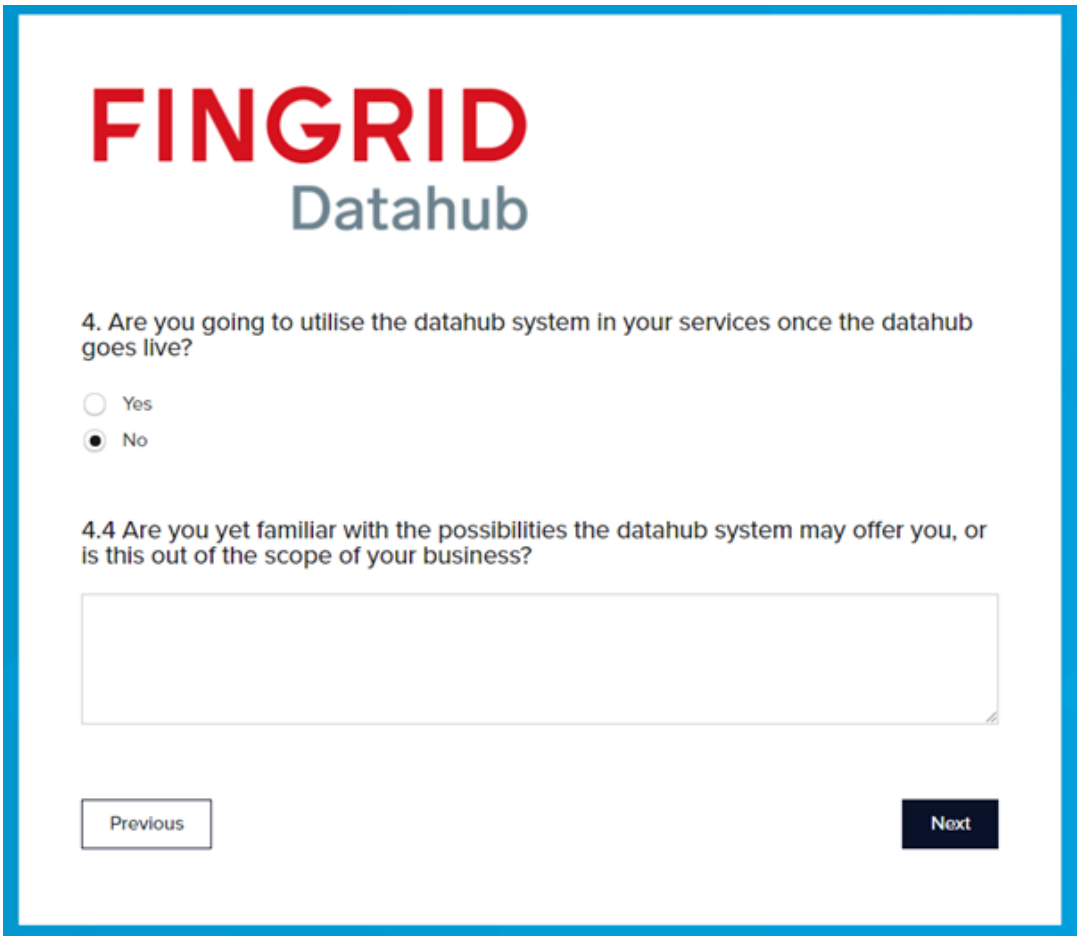

Figure 8 The second questionnaire page if the answer was "no" in question 4.

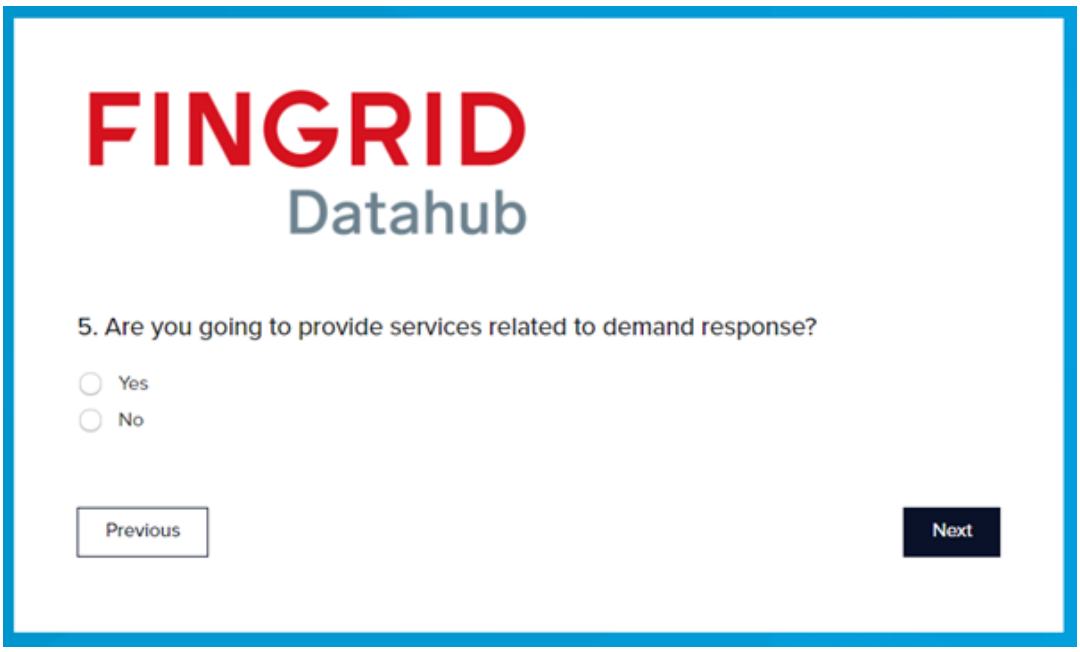

Figure 9 The third questionnaire page.

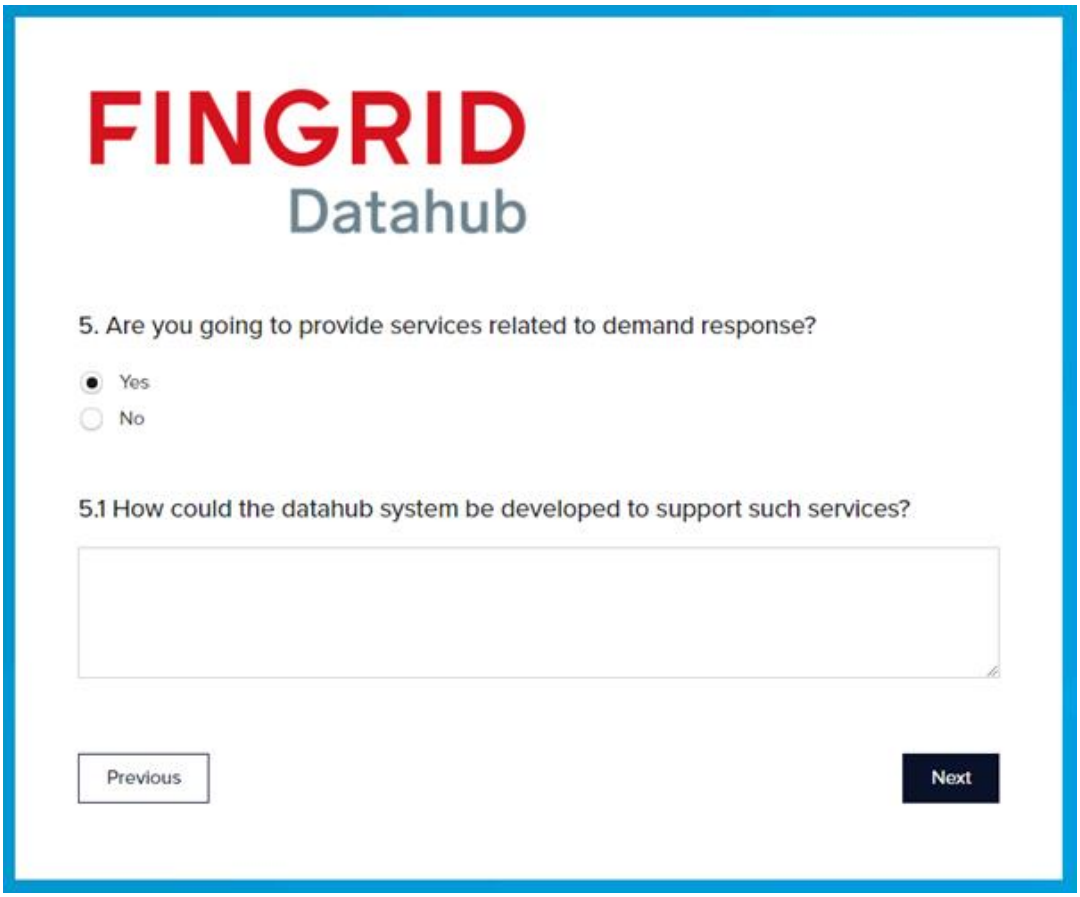

Figure 10 The questionnaire page if the answer was "yes" in question 5.

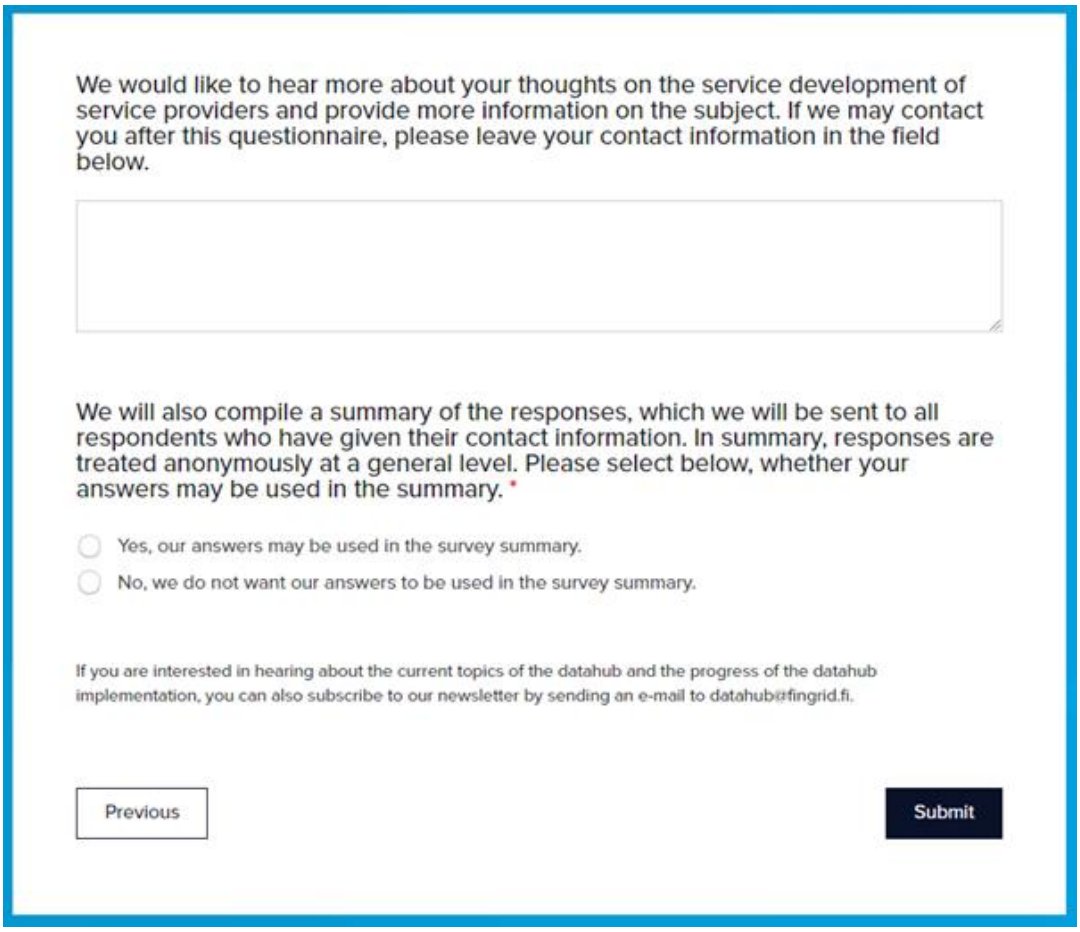

Figure 11 The contact details and consent to use answers in a survey summary which was delivered to the respondents.