NordREG
Nordic Energy Regulators

High level suggestions for common Nordic processes for information exchange- obstacles and possibilities

Report 1/2012

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Preface

The Nordic Energy Regulators (NordREG) have for some years been promoting the idea of a truly borderless free Nordic electricity market. This includes both the wholesale and the retail markets. NordREG has been given the task by the Nordic ministers for energy to intensify the work to achieve a common Nordic retail electricity market. To make this work possible NordREG set up the framework for the project organisation during the autumn of 2010. This work has now started.

During 2011 and 2012 the very important phase of determining the target market model will be carried out. In that work it is essential to develop more harmonised ways of communicating between DSOs and suppliers in all countries.

This report presents different ways of communicating between DSOs and suppliers. The report describes one model for exchanging data through a web service search tool and two models through a central database. The three different models call for differences in storage location, completely decentralised or more or less centralised. The report is trying to say something about the effects for the DSOs, suppliers and regulators by these theoretical described models. Detailed matters related to the key processes will be dealt with by NordREG at a later stage.

The purpose of this report is to present the basic ideas that have been developed by NordREG. Stakeholders from the Nordic countries have been able to give input to the report during the work 2011.

Executive summary

NordREG is of the opinion that:

- if all Nordic countries choose the same model, or very similar models, the business processes across borders will work smoother. The same solution for all countries will make the harmonisation more complete.
- there has to be a tool in each country that at least aids suppliers when they need to get relevant customer information in order to carry out a supplier switch etc.
- there should not be more than one interface in the supplier's procedure of retrieving and providing the relevant data in a business process.
- it is essential that the responsibility for customer data and processes is the same between the countries.
- Nordic countries should nationally investigate what information exchange solutions that should be implemented in each country to facilitate a common Nordic retail market. National plans should then continuously be coordinated on a Nordic level to ensure compatibility.
- the chosen data exchange models must not in any way distort competition, especially between national and foreign suppliers, in a common Nordic market
- the national solutions should ensure that only one system is required for the market actors on the Nordic market without costly country specific adjustments.
- The TSOs and industry should work together in the Nordic market to agree on a common interface for a web service search tool or/and CDBs. The regulators should have a coordinating role in this. Common rules for message format and content should be made.

There are many different obstacles to harmonisation of a Nordic end user market. A successful harmonised market is recognised by suppliers operating cross borders in fair competition with national suppliers. One of the obstacles for suppliers in cross border operations today is connected to communication with DSOs in business processes such as supplier switching, moving, billing etc. The way suppliers and DSOs communicate today vary in communication protocols, data format, content of messages and also data storage/communication partner. In Finland, Norway and Sweden data storage is decentralised in DSOs databases and thereby the suppliers have to communicate with hundreds of entities. In Denmark there will be a national datahub in 2012 collecting customer and meter data. All suppliers in Denmark will thereby only have one communication partner to choose between for certain processes.

Summary of conclusions about data exchange models

- It seems preferable to arrange communication between a few parties like central databases compared to bilateral communication between hundreds of DSOs and suppliers.
- A web service search tool seems easy to operate and may represent a smaller change from today's system than the CDB but alone it is not enough to reach harmonisation in the end user market, since it does not affect the actual business processes.
- DSO neutrality is a priority for the common market and it appears as if a central database may offer a good solution for this.
- The preferred organisation for harmonisation is if all countries go for similar models.

NordREG looks at decentralised versus centralised data storage and how information could be exchanged in order to make some of the business processes go easier. Three models are presented as examples of different organisations for information exchange. One model is based on a decentralised data storage solution, where a helping tool to search for information is introduced. The search tool helps to give the supplier relevant customer information, metering point ID in particular, by collecting the data from DSOs databases. The search tool solution is based on the Norwegian web service search tool NUBIX. Two of the models presented are centralised data storage solutions where one is based on the Danish datahub and the other is a more extensive prototype of the Danish datahub. All models are described as national solutions and are examples based on some of the already existing information exchange systems in the Nordic countries today.

The search tool model will help the suppliers and DSOs to exchange information in some business processes, supplier switching in particular. Still messages have to be sent for each business process point to point (between DSO and suppliers). In a Nordic perspective this will imply hundreds of DSOs. Still an implementation of a search tool will mean less change from today's situation and may be easier to implement than a national database. With a supplier having to deal with hundreds of DSOs in different countries it will demand a strict and detailed set of rules regarding each business process in order to have the suppliers face the same procedures everywhere. Whenever there is a decision to make changes and upgrades to procedures and systems it could be a challenge to implement these changes simultaneously in all DSOs databases and in national regulations.

The models of central databases will demand that much of the DSOs databases are gathered in a national database. The database has a function of performing some of the business processes automatically by sending messages and alerts to the involved actors and also collecting the needed data from the central database for each process. The central database will need systems for control and alerts of meter values in particular. Implementing a central database in a country will have big implications for the DSOs in the way that many of the processes that are today handled in –house will be handled by the central database. One immediate advantage of centralising data from a neutrality perspective is that the DSO's opportunity to intervene in the supplier switching process is

removed by anonymizing the suppliers. This will help ensuring that each supplier is treated equally. It seems preferable from at harmonisation perspective to arrange communication between a few parties like central databases compared to bilateral communication between hundreds of DSOs and suppliers.

Even if implementation of each model is analysed nationally it is a fact that a Nordic harmonisation process is best promoted if all countries go for the same model. National authorities should therefore have NordREG and other Nordic harmonisation recommendations in mind and make sure that decisions on changes in this regard are coordinated. Still with the same operational tools given by one model each business process have to be harmonised in sense of timeframes, content of messages and also communication protocols. It is essential that suppliers face the same responsibilities regarding customer data and processes no matter what country they operate in. NordREG recognize that the TSOs together with other stakeholders from the industry are the ones best suited for developing a common technical Nordic standard for messages and communication with the NordREG in a coordinating role.

1 Introduction

NordREG has for several years worked to promote the development of a common Nordic electricity end user market. In the last couple of years this project has become more concrete and the work has been intensified. NordREG has been asked by the Nordic energy ministers to develop the framework and details for how this common market should be designed and starting in 2011 the Nordic council of ministers has also allocated funds for the hiring of a project coordinator and for consultancy needs in order to speed up the work. NordREG are also working together with stakeholders in order to achieve as good a market as possible.

The goal of this project is to minimise the obstacles for suppliers willing to operate across the Nordic borders. The report aims at describing different solution for how relevant data can be exchanged efficiently between DSOs and suppliers, also across borders.

1.1 Definitions and clarifications

Words or expressions used in this report:

Business processes in the retail energy market could be describing *actions* taken by DSOs and suppliers, e.g. supplier switching, billing, moving, sending meter readings and data. The NordREG Market Design Report says:

To establish a well-functioning retail market the most important business processes are those where there is information exchange between the customer, DSOs, suppliers, and balance responsible parties. NordREG has determined that the main business processes in relation to the retail market are:

Making and ending contracts
Billing
Supplier switching
Moving
Balance settlement
Metering
Information exchange during supply
Access to customer data

Meter data: By this we mean information about the meter such as metering point ID, meter number, whether the meter is manually read, remotely read or just estimated, and also other relevant technical information about the meter

Customer data: customer name, meter address, billing address, birth date, customer number or ID, phone number or other contact info etc.

Consumption data: estimated data, consumption profile, manual meter readings and automatic meter readings

Central database: database for all customer data, consumption data and meter data

Information exchange system: is a description of the way information is exchanged between DSOs and suppliers in the market. Such a system can therefore consist of many different components e.g. point to point EDI messages, web service search tool like NUBIX, central databases etc.

Incumbent supplier: a supplier that is in a corporation with a DSO or is somehow an integrated company in the DSO business

Communication platform: is used for the means by which the electronic documents are exchanged

Abbreviations used in this report:
CDB: Central database
NRA: National regulatory authority
EDI: Electronic data interchange
SMTP: simple mail transfer protocol
FTP: file transfer protocol
CBA: cost benefit analysis
EDIFACT: Predefined business documents to be used in business processes, e.g. PRODAT, MSCONS, UTILTS messages
XML: is a set up of rules for encoding documents in machine –readable form
EDIEL: Message and information exchange determination for electrical engineering originally made by Ediel® Nordic Forum, now maintained by the Nordic Ediel group.
ebIX®: European forum for energy Business Information exchange

1.2 Principles for harmonising the Nordic end user markets

NordREG has found that there are some basic requirements that should be demanded from the common Nordic end user market.

The first requirement is that the common Nordic end-user market should be open for all customers. The national end user markets are already open for all customer groups. Restricting the common Nordic end user market only to e.g. hourly/monthly metered customers or commercial and industrial customers would introduce unnecessary confusion and possibly barriers of entry. To sum up, the market model for the common Nordic end user market shall provide solutions to allow all customers to take part in the common market.

Customers' confidence is essential for the development of the end user market. Thus the second requirement is that consumers must have the same protection regardless of the origin of the supplier. A lack of confidence in this regard will hinder the development of the Nordic market. Therefore customer protection must be ensured, no matter which supplier the customer chooses.

Furthermore, low entry barriers should be ensured by making it easy for suppliers to operate in all Nordic countries. Implementation of common processes and systems is vital

for creating a common market. Suppliers that are already operating in one country should also easily be able to establish their business in the other Nordic countries, having regard to the national requirements to registration and licensing of legal entities (and of course to all other national laws and regulations common to all suppliers in the country).

It is important for a supplier to be able to use a single IT-system inside the same company while operating in all Nordic countries. This objective requires that the Nordic countries decide on a standard format or a common interface for their central database (CDB) or/and for DSOs in order to communicate data between the actors. In addition the different business processes have to be harmonised in regards of timeframes and relevant data needed in each process. When designing the common Nordic end-user market it is important to keep in mind and follow the harmonisation process of the EU electricity market. The recommended market model and business process solutions should be as future proof as possible.

1.3 Benefits of the common Nordic end user market

The common Nordic market is anticipated to bring benefits for all stakeholder groups.

Competition among suppliers will most likely increase. This will improve the efficiency in the market and bring benefits for the customers, partly by increasing the pressure on end-user prices. It is also anticipated that the larger market will provide customers with a wider choice of offerings and products to meet their needs. For example, more specialised products could be offered through the expanded end-user markets.

The common Nordic end user market will also provide an opportunity for suppliers to operate on a larger electricity market, leading to improved efficiency and reduction in suppliers' unit costs. The Nordic market will also be more attractive for new entrants. A common Nordic end user market will reduce the possibility to develop end user market regulation only from a national perspective. Suppliers are as such expected to benefit from a relatively stable regulatory environment with more predictable rules as future changes have to be implemented the same way in all Nordic countries. In sum this will reduce the so-called regulatory risk for the market actors.

By introducing new players, products and business models into the national markets the common Nordic end user market will strengthen the connection between wholesale and retail markets, especially in Denmark and Finland. It is anticipated that in these markets price signals from the wholesale market will be reflected in the retail prices so that it follows the price development in the wholesale market. The strengthened connection between the wholesale and retail market will also increase the demand side response and have a positive impact on the wholesale market.

DSOs and TSOs will benefit from the common Nordic end user market through improved efficiency and automated processes. Expected improvement in data quality will reduce the use of manual work in most processes. Stable end user market regulation including clear definitions of the roles and responsibilities of different market actors will reduce the regulatory risk also for the network operators.

Furthermore the society will also benefit from increased competition and improved efficiency at all levels. NordREG believe that in the long run it is more efficient to operate one market compared to four national markets. The project on harmonising the four markets is also a golden opportunity that should be used to further develop and improve the electricity market, making it friendlier for customers while improving competition and efficiency and making sure that the DSO role is limited to facilitating a good market.

Another important aspect of the Nordic harmonisation work is that this project can be seen as a step towards a European market. The development of a Nordic market could be seen as a good example of how four countries can integrate their electricity end user markets into one common market.

1.4 Nordic market model

The focus for 2011 is to develop and design the target market model for the Nordic market. This means making recommendations on a number of issues:

Task #	Projects
A. Market Rules Task Force	
A1	Analysis and definition of *rights and obligations* of DSOs and suppliers in the supplier centric customer interface model.
A2	Description of the combined billing regime in detail and *impact assessment of the billing regime.* The task shall assess the implications of mandatory vs. voluntary combined billing, and analyze if it is possible to design a *security payment system* that is not creating a market barrier for the supplier.
A3	Analyze whether national *tax structure legislation* will allow foreign suppliers to collect taxes and fees in each Nordic country.
B. Customer Empowerment Task Force	
B1	Identify what should be defined in common legislation and what are the needs for additional *standard agreements between suppliers and DSOs on a Nordic level*.
B2	Analyze how the *contracts between customers and suppliers/DSOs* should be arranged and what should be defined in common legislation and what are the needs for additional standard agreements with customers on a Nordic level.
B3	Analyze what is needed from the *harmonized customer protection regulation*.
B4	Analyze the impact of common Nordic rules for *prepayment and payment after delivery*.
B5	Analyze if the existing *obligation to supply and the supplier of last resort schemes* includes elements that negatively impacts the market functioning and also if there is a need for a harmonization.
C. Business Process Task Force	
C1	Make high level suggestions for future common Nordic business processes for *key processes*.
C2	Make *an impact assessment* of the suggested changes in business processes.

C3	*Make an inventory of national legislation and rules* to identify best practice and what needs to be harmonized.
C4	*Make a detailed specificati*on for all common future Nordic business processes.
C5	*Prepare future harmonized legislation* for business processes.
E. Metering Task Force	
E1	Further elaborate on the *introduction of AMR* in the Nordic countries and national AMR requirements and their impacts on a common Nordic end user market. Deadline is not until December 2012, however given the importance of this task it should be started already during 2011.

This report takes a look at the issues C1-C3 above from a high level. More detailed matters related to the actual processes as supplier switching, moving etc. will be dealt with later on by NordREG task forces.

1.5 Objectives of this study

The object of this task is to describe high level suggestions for common Nordic processes for information exchange. This task could be quite extensive since there are several key points that need to be harmonised if suppliers should be able to operate in all four countries without significant obstacles.

NordREG identifies that important key points that are relevant to look at in information exchange are:

- The question of data format

Regardless of the models for information exchange chosen, there should be agreed to a common communication platform for the information exchange. Mapping of differences in message formats in the Nordic countries today has been done by Energinet.DK, Fingrid, Statnett SF and Svenska Kraftnät, in relation to the work going on in NordREG work about Nordic balance settlement (NBS).

- Differences in timeframes

There should be the same timeframes for actions by the actors within each business process, e.g. timeframe for supplier switching.

- Relevant data

What data that should be exchanged in the different processes has to be agreed upon.

- Responsibility for data and business processes

There should be rules for how the suppliers should get the relevant information for supplier switching etc. This includes who is the contact point for the supplier in giving and asking for information in a business process. Decisions should be made about to what extent this contact point should be responsible for the data quality, storage and updating, and also making the data available for the suppliers in regards of the data format.

To describe and analyse all the bullet points mentioned above in one report is too extensive a task in just one report. NordREG has decided that it is most rational to look at the superstructure of data exchange firstly and then break it up in more details in later reports. This report is therefore dealing with possible communication models to handle business processes. The report gives a theoretical description of different organisations for data storage and exchange, responsibilities and then external effects of each model. NordREG is not with this report trying to exclude other solutions to harmonised information exchange. The models described here are chosen as they have already been discussed in some of the Nordic countries as relevant.

NordREG will in this report look at different ways of storing and exchanging data. We will look at where responsibilities are placed and try to say something about consequences for regulators, suppliers, DSOs and other relevant bodies, e.g. Central database (CDB) operators or search tool operators and IT system providers.

The hope is that this report could work as a foundation for further discussion on details regarding information exchange. This work will continue in 2012.

It is not the ambition of this report to conclude on one business information exchange model for all countries. As mentioned above, this is a complex matter that needs to take into account more aspects than what is debated in this report. The report will however point to positive and negative sides to each model. The report opens up for national adjustments regarding the business models described and therefore also looks at what key elements that need to be in place in order to tie these models together if the Nordic countries choose different model solutions.

In describing the different models of storing and exchanging data the Business Process Task Force will try to take into account the following objectives:

- ✓ *Customer friendliness*. One of the objectives of the common Nordic retail market is to increase the customer friendliness of the market and to make it easier for the customer to be active in the market. The report should analyse how this objective is affected.
- ✓ *Well-functioning common market*. The goal is to have a well-functioning common electricity market (wholesale and retail). How this goal is affected by the different options should be analysed in the report.
- ✓ *Improved competition*. To improve competition among suppliers (for instance through low entry and exit barriers) is an important objective. Therefore the report should analyse how competition among suppliers is affected by the proposed solutions.
- ✓ *Improved efficiency*. Customers will benefit from improved efficiency in the market. The report should analyse what affect the different solutions would have on the efficiency for individual stakeholders and the market and society at large.
- ✓ *Compliance with EU regulation and development*. How do the recommended solutions comply with the general development in the EU and with existing and coming EU regulation? This should be analysed in the report.

- ✓ *Neutrality of DSOs*. DSOs should function as market facilitators, but how is the DSO neutrality affected by the chosen solution? This should be analysed in the report.

2 Assumptions regarding market solutions

In the work to define possible high level models for information exchange it should be noted that NordREG has worked on related business process issues before. In 2009 NordREG published the report Market Design – Common Nordic end-user market (NordREG Report 3/2009[1]) which represents the situation at that time. Among other things, the report looks at the following business processes:

- making and ending contracts
- billing
- supplier switching
- moving
- balance settlement
- meter reading

For each of the processes, the situations in all Nordic countries have been described. The deviations in rules and process have been mapped and a list of what needs to be harmonised has been made for every process. For some processes, such as supplier switching, recommendations have already been issued. For other processes, a lot of work still remains and it's also obvious that the future market model will be different from that in 2009 in each Nordic country. The report can be used as background information for the further work of NordREG.

2.1 Supplier centric model

NordREG has on several occasions stated that the customer interface model in the harmonised Nordic retail market should be supplier centric. In this model most issues from a customer perspective are handled by the supplier.

Companies operating on the free market (suppliers and energy service companies) should in the common Nordic retail market be responsible for the parts of the customer interface that concerns products and services provided on the free market. Also the customers' main contact point when switching supplier or moving should be the supplier.

The customer should rely on that the DSO provides information and resolves problems related to issues that could be classified as strictly network related, i.e. issues that concern the customers' physical connection to the grid, including meter issues, quality of supply and interruptions.

By moving more of the responsibilities from the DSO to the supplier in the customer interface the power of consumer choice will be even greater since a larger part of the customers interaction with the market will be handled by a market actor that the customer

[1] There might have been changes in the business processes since 2009. NordREG has not made any overview of these changes at present state

has the possibility to switch/change if the customer is not satisfied with the services provided. This will also simplify the electricity market for most customers. An additional argument for a supplier centric market model is that the services that the customer is able to choose from in the electricity market should not be limited by the location of the customers home and what services that the local DSO is willing to offer. The playing field will from a supplier perspective be more level.

The supplier centric model doesn't mean that all customer issues should be handled by the suppliers. There are also strictly network related issues which will remain the responsibility of DSOs. However, if the individual customer wishes, it is possible to arrange a customer interface that the customer in practice would perceive as a single point of contact. Such a regime requires a power of attorney from the customer that will allow the supplier to speak to the DSO on the customer's behalf. Development of efficient data exchange (such as central databases) would most likely aid in the development of a more vivid free electricity market.

The choice of billing regime is a key issue for the future common Nordic end user market. The combined billing regime in which suppliers are billing also the network charges to the customers is the long term vision for the billing of end users in the Nordic region.

NordREG recommends that all electricity customers in the future should receive all their electricity costs combined on one invoice. NordREG recognises that the successful implementation of a mandatory combined billing regime requires development of efficient methods for information exchange, payment systems, tax collection and risk management schemes. These and many other issues will be analysed further by NordREG.

2.2 Smart metering

EUs 3rd package, Directive 2009/72/EC, states that in all member states where roll-out of smart meters is assessed positively at least 80 percent of the consumers shall be equipped with intelligent metering systems by 2020.

With smart metering the amount of data will go up and the demand for improved IT systems to handle the increased data volume will rise. It is not only the storage capacity that will be affected but also the demand for IT systems that can arrange, distribute and group the data together in an efficient way. Additionally smart metering can improve energy reporting to customers and opens for the possibility for the supplier and DSO to offer new, various products. Installation of so called smart meters has been decided on already by some of the Nordic countries, and to a more or less extent, also rolled out. Decisions on smart metering will have implications for data storage and data exchange. Big changes have already been done and in the near future it is also natural to assume that changes to DSOs databases will occur. It is important to have this in mind in the discussion about harmonised information exchange systems and databases.

Norway

Norway has not yet rolled out smart meters for household customers. A proposal to new regulation on smart metering was decided the 1st of July 2011. The decision is to roll out

smart meters to 80 percent of the consumers by 1.1.2016 and to all consumers by 1.1.2017. Metering values are remotely read and the values will be registered in the meter at least hourly. To collect a meter value on the switching day or moving day will therefore not be a problem.

Sweden

In Sweden, a major roll-out of meters was finished by the 1st of July 2009. The roll-out was conducted in two steps. From 1st of July 2006; hourly metering for customers over 63 Ampere and from the 1st of July 2009 monthly metering for customer below 63 Ampere. The new legal demands led to a major roll-out of remotely read electricity meters to all customers except to those customers that are electro sensitive and where DSO had problems contacting customers to inform that a change of meter was imminent. Results from a survey that was conducted by EI in May 2010 indicate that 91% of the meters will be able to handle hourly read meter values.[2]

The main driver for legislation was for customers to get a greater awareness of energy consumption. By demanding monthly meter readings there would be no more yearly estimates but the customer would receive bills reflecting actual consumption. Also, estimated billing was considered to be a major problem by customers and the number one complaint, time consuming for both suppliers and DSOs.

There are no legal demands on communication systems for Swedish meters. The majority of the meters are connected to communication systems that with some adjustments[3] can transfer hourly meter values. The meters are also, in most cases, capable of two way communication.

Finland

Finland is already rolling out smart meters for household customers. All delivery sites with main fuse over 3x63 Ampere should already be hourly metered and remotely read. At least 80 % of household customers (with a main fuse of max 3x63 Ampere) will be hourly metered and remotely read by the end of 2013. They constitute close to 3 million hourly metered consumption points. Percentage of hourly metering is likely going to be much higher than 80%.

Hourly metering values are read daily and the metering data is reported to suppliers and to balance settlement unit using EDIEL the day after delivery day. Some EDIEL messages and features of EDIEL messages have already been developed to meet the requirements of hourly metering. These principles are presented as recommendations made by Finnish Energy Industries.

Denmark

In the Danish government's Energy Strategy 2050 some goals on intelligent metering systems is announced. The government will work for an agreement with the DSOs to install intelligent electricity meters when electricity consumers install heat pumps, or buy

[2] EI Report: EI R2010:22 Ökat inflytande för kunderna på elmarknaden -Timmätning för elkunder med abonnemang om högst 63 ampere, p. 24
[3] p. 25

electric cars. Furthermore, the Government will attempt to lower the limit for installation of intelligent meters in 2013 from 100 000 kWh to 50,000 kWh annual consumption. The government will also ask the DSOs to replace all electricity meters which are replaced after 2015 by an intelligent electricity meter.

It is assumed that within the coming years more than 50 % of all meters will be remotely read. Furthermore a new and third method of settling costumers of less than 100,000 kWh based on an hourly basis will be introduced in 2012.

For the common Nordic end user market it would be natural to assume that most of the market will have smart meters, even if different standards by 2015-2020.

3 The information exchange in business processes today

3.1 Denmark

Information exchange and responsibilities

Denmark is at the moment implementing a data hub. This means that after the implementation in October 2012 all the meter data and master data pr. metering point needed by suppliers are stored centrally in the data hub. All the data are also with a few exceptions stored with each DSO and supplier. Exceptions are information on the supplier/balance responsible party on each metering point and the customers' web access code to the data hub which is only stored by the data hub and the suppliers.

The DSO is responsible for delivery of all meter data and all master data with a few exceptions. The exceptions are data delivered by the suppliers, such as name of supplier and in case of moving, also the name of the customer can come from the supplier. In this case the DSO gets information about the customer via the data hub.

Apart from these few exceptions the data hub contains a copy of the relevant data in the DSO database. The DSO is responsible for the data in two databases being identical. For the future this implies that DSOs, suppliers and balance responsible parties only correspond with the hub, in difference to each other as in the point- to –point model.

Updating information which the DSO is responsible for is always done via the DSO. If customers want to update some information about themselves they must contact the DSO. If the customer contacts the supplier the supplier is responsible for sending this information to the DSO e.g. through the data hub web forms.

The data hub does not perform settlement for the customer and invoicing. This is done by the DSO and supplier.

Apart from being a communication hub between players for customer data and meter data the data hub handles all requests for metering point ID's and historic meter data, supplier switches, moving, end of supply messages, change of settlement method, dis-/reconnection of metering points, reconciliation (correction between the actual and estimated consumption in case of metering points with load profile) and aggregations of consumption by metering point to e.g. grid area etc.

Use and costs

The data hub is mandatory for all actors on the market from October 2012. The hub is run by the Danish TSO, Energinet.dk. The use of the data hub is free of charge. The costs of the data hub are collected through Energinet.dk's tariffs and thereby the data hub is initially paid by the customers through the DSOs.

Technical

The data exchange can be done in EDIFACT or XML. Each actor can choose which format he wants to use when exchanging data with the data hub. All exchange of data must be done via web services.

Regulation on information exchange

It is stated in the Danish Electricity Supply Act that the Danish TSO, Energinet.dk, should establish and run a data hub for information exchange. According to the Electricity Supply Act the DSOs are under obligation to send metering to the data hub.

In the Electricity Supply Act Energinet.dk is given the necessary power to issue market and technical regulations required for the functioning of the data hub. The market regulations concern meter and customer data information, when and what kind of data the actors are obliged to deliver and the necessary actions that have to be taken in case of e.g. supplier switch etc. The market regulations issues the guidelines necessary for the market to function, and ensures that the settlement is handled correctly. The market regulations describes in details metering, supplier change, moving, balance settlement, customer data and format etc. and thereby giving rules and deadlines for communication on the market. Some of Energinet.dk's technical regulations shall be notified to the European Commission in accordance with Article 8 of Directive 98/34/EC of the European Parliament and of the Council of Europe of 22 June 1998 (laying down a procedure for the provision of information in the field of technical standards and regulations and of rules on Information Society) and some are sent to DERA. Concerning market regulations, the methods in the regulations have to be approved by DERA.

The mandatory information exchange system in the data hub will not only commit the DSOs to the data hub, but all participants on the market such as suppliers and balance responsible players, if they wish to enter the market. The data hub will help ensuring a more efficient exchange of data and an improved administration of changes of suppliers. The access to the information in the data hub must be in compliance with the Danish Act on Processing of Personal Data.

3.2 Finland

Information exchange and responsibilities

The customer data and the meter data are stored in each DSO and supplier. A duplicate of DSO´s metering point ID information is stored also in a national metering point database. In Finland the information exchange in business processes is essentially based on point-to-point messages between market actors. However, almost all messages are routed through message operators who offer routing services. These operators are privately owned companies who centrally maintain the IP addresses and other contact info of the actors that is needed to do the information exchange.

In practice all actors use an operator as a front for their information exchange interface. They feel that this makes the data exchange process easier since they don’t have to maintain a list of all other actors’ network addresses. Operators then take care of routing the messages, ensuring data security and capacity related issues. Operators usually offer

other value adding services as well. E.g. message syntax checking and message transformation from in- house formats to EDIFACT standard format.

Technical

In Finland all the messages are transferred by FTP-protocol in contrast to the other Nordic countries which use SMTP-protocol. The message from an actor is a text file (e.g. message.txt) that is encapsulated to an FTP-packet. Routing is based on actor-specific party ID in message header information. Messages are transferred through VPN connection between actor and operator and between operators respectively. Finnish Energy Industries has defined a format for what should be the common in- house format.

EDIFACT messages can be sent one at a time or in bundles as text documents using the FTP protocol. The sending actor needs to know the party ID of the receiving actor. A list of these ID codes for EDIFACT PRODAT and MSCONS messaging is maintained on the web pages of Finnish Energy Industries in a suitable data format.

Helping tool

Finland has a national data base for metering point IDs. This database helps the suppliers to retrieve the metering point ID which they need in the supplier switching and moving processes. In the data base the metering point ID is linked to the metering point address and the DSO. Since the contracting party for network service does not have to be the same as in the supply contract, the address is the natural key to link with the metering point ID. With the metering point address the supplier can make a search to find the customers' right DSO and metering point ID. The addresses are well defined by e.g. street name, number, and apartment number and so on. Still the search can return multiple results. The responsibility then to find the right person at the address is the suppliers. This is done manually, normally by sending an e-mail to the DSO.

There are two ways to access the database and make queries; by web browser or directly with suppliers data system by a web service interface. So far most of the database queries have been done with a web browser. However renewal of actors' data systems might boost the use of the Web service interface.

Updating DSOs respective information can also be done in two ways; by FTP transfer or through Web service interface with XML messages. Each DSO has to update the metering point ID information to the database monthly. So, the information in the database is not updated real time but nor does this information change very often.

Use and costs

The use of the database is voluntary but covers 95 % of the metering points in Finland. The database is only used in suppliers switching and moving, where the metering point ID is needed. The database is maintained by Adato Energia which is a subsidiary of Finnish Energy Industries. DSOs have the updating responsibility of the information content of the database. Maintenance costs are covered with an annual charge from DSOs and suppliers. The charge is minimal and the service is totally non-profit for Adato Energia.

Regulation on information exchange[4]

In Finland the role of the DSO in point-to point communication between partners is regulated in a Government degree. Information exchange and information to be delivered are regulated in terms of responsibilities for DSOs. Information exchange related to balance settlement and switching is regulated in closer detail in a Government degree.

3.3 Norway

Information exchange and responsibilities

In Norway the information exchange is based on a point – to –point model. The messages are standardized and sent between the actors according to predefined rules. The meter data and the customer data, such as name, address, id number etc. are stored in each DSO, and most of the data is also stored with the supplier. The DSO is the responsible party when it comes to quality and accuracy of the data. In the business processes the metering point ID is an important element for identifying the meter. The supplier will need this in many of the business processes. To retrieve this ID the supplier can use a web service search tool called NUBIX (Norwegian business information exchange). This search tool provides the supplier with certain customer and meter data registered with the DSO, through forwarding a request to the relevant DSO. Power suppliers will only be able to access data on their own active customers.

NUBIX does not return information regarding prices, tariffs, consumption data or customer or installation data other than the above.

Use and costs

An annual fee paid by both suppliers and DSOs partly covers the maintenance of NUBIX. It is the TSO who has the maintenance and administrative responsibility for NUBIX, and thereby collects the fees. In addition the DSOs fund any system adoptions themselves if needed to adapt to NUBIX changes.

Technical

Information exchange in the Norwegian end user market is operated according to the Norwegian EDIEL Message Exchange Standard. The EDIEL Standard is based on the international Implementation Guide (IG) made by Ediel of ebIX. The additional Norwegian guidelines are made as a supplement to the IG, to describe the correct use of EDIEL message standards adapted to Norwegian conditions.

Furthermore, EDIEL is based on the internationally established standard EDIFACT, and defines relevant documents for the Norwegian end user market.

[4] This is not covering Åland, who has its own electricity legislation, where the information exchange mainly is based on e-mail traffic between the participants.

Regulation on information exchange

Information exchange in the Norwegian end user market is mainly regulated by secondary law. This regulation focuses on rights and responsibilities and deadlines in the business processes. On this part the regulation is quite detailed, but regarding details in content of messages or what happens if messages are rejected etc., the regulations says little. The more detailed rules for this are described in the *Norwegian EDIEL Message Exchange Standard*. This standard is a result of voluntary work from market actors. The market actors have formed a group consisting of representatives from DSOs, suppliers, interest organizations and IT- service companies. NVE has delegated the task of chairing this group to the Norwegian TSO. The chair has the power to decide on issues regarding updating and development of the rules in the standard if the group does not reach an agreement. Big changes have to be approved by NVE, who can always overrule the guidelines of the Ediel Standard.

The rules and guidelines in the Ediel standard are not regulated directly by law, but are approved by the national regulator NVE. Information exchange in the Norwegian end user market should be in accordance with this Ediel standard.

Regulation on NUBIX

NUBIX is a voluntary search tool to use for the suppliers in the business processes, but almost all suppliers use NUBIX to retrieve the metering point ID for their new customers, maybe because the cost of using the search tool is low. The DSOs on the other hand have more expenditures on NUBIX, because they have to adopt their IT-systems to correspond with NUBIX, and make the relevant customer data accessible for searches from the search tool. This obligation on the DSO is stated in the regulation. Regarding what data are the relevant data for the DSO to make accessible at any time is decided by NVE in a letter to all DSOs and suppliers. Since the starting point for NUBIX in January 2008, there have been only minor adjustments to the search tool NUBIX.

3.4 Sweden

Information exchange and responsibilities

Sweden's market model is legally based on point-to point communication between partners. This means that all DSOs can communicate directly with all suppliers and vice versa. In practice, a large part of the message exchange is done by service providers and agents.

Technical

The information exchange is based on Ediel via SMTP. The TSO is responsible for the framework of rules, based on Swedish law and regulations. Sweden uses the same test system as Norway and the cost is split between the two countries.

Some energy companies have outsourced their whole message exchange process or parts thereof to intermediaries. These intermediaries may be independent companies that offer both IT services and administrative services, e.g.. a system integrator / system supplier that mainly offer IT services (such as Logica, Tieto) or another energy company. These intermediaries have different roles, known as Ediel Service Provider or Application

Service Provider. The number of different solutions that these service providers' offers, together with a range of internet service providers makes the situation rather complex.

Regulation on information exchange

As stated earlier, Sweden has a market model that is legally based on point-to point communication between the market actors. The information exchange is regulated in the Electricity Act, in regulations and in the Ediel instructions. In addition to above mentioned rules and regulations, the industry has decided upon detailed practices regarding for instance the Ediel-message procedure. These detailed practices are documented in instructions called "Elmarknadshandboken". There are no requirements and standards for technical systems. The reason for this is that the Swedish authorities have encouraged the various techniques and that this will enable a possibility take advantage of new technologies quickly.

3.5 Communication platforms

All the Nordic countries use electronic documents based on the same framework, defined by Ediel and its successor ebIX®. All countries base the data exchange on EDIFACT documents defined by UN/CEFACT. However all countries have adapted the documents to fit their national rules and legislation. More details about these communication platforms and technical standards are to be found in the work connected to NordREG task force working with Nordic balance settlement.

3.6 Summary of Nordic information regimes

The table below summarises some of the similarities and differences of key features of the country specific information exchange regimes in the Nordic region.

	Denmark*	Finland	Norway	Sweden
Responsibly for metering data	DSO	DSO	DSO	DSO
Responsibly for customer data	DSO	DSO	DSO	DSO
Responsibility for consumption data	DSO	DSO	DSO	DSO
Data storage	Centrally and locally at DSO level	Locally at DSO level	Locally at DSO level	Locally at DSO level
Communication form	Point to centre	Point to point communication	Point to point communication	Point to point communication
Helping tool	Data hub	Data storage (for consumption	NUBIX (primarily for metering point	None

		place IDs)	IDs)	
Operator of helping tool	TSO	Adato Energia	TSO	NA
Use of helping tool	Mandatory for all users	Voluntary for all users	Mandatory for DSOs, voluntary for suppliers	NA
Market coverage of helping tool	100 %	Close to 100 %	Close to 100%	NA

*After data hub implementation in October 2012.

Table 1 Summary of communication forms in the Nordic countries

4 Towards Nordic information exchange

4.1 CDB communication in a Nordic market

In NordREG work there is the aim of harmonisation of the Nordic end user market. Harmonisation does not necessarily mean that all processes are equal in all details and that the national borders don't have any influence on suppliers' way of doing business across borders. For instance is it natural to assume that a supplier will be affected by differences in tax – and other relevant legislation between the Nordic countries and also language and currency differences. Some differences are merely not possible nor desirable to harmonise in the short run. These facts make it natural to assume that in the first face of harmonisation the supplier might want to open up a business office in the countries where he has customers. This office might be a "paper" office with little or no back office functions. But in this way the business will be registered according to the nation's rules and pay taxes and follow national laws. It also makes sense in reference to the customers that their supplier has a customer service where the service personnel speak the customer's language.

A supplier's decision to open up businesses in other Nordic countries or to have offers to customers across borders is dependent on the chances of making profit. If there are too many differences or barriers it will imply costs and lower the supplier's ability to be competitive. When NordREG speak about harmonisation, it is the aim of lowering the barriers for suppliers to such a degree that it is possible and desirable for a supplier to give offers and compete across the Nordic borders. It is desirable to introduce a level of harmonisation whereby the supplier would only need one it-system to operate in all the Nordic countries. However this will require harmonisation of all processes and timelines.

Some processes that are the focus of the retail market harmonisation work and that are important to the supplier are: supplier switching, moving, billing, making a contract and being the communicator of information to the customer. There are other processes related to balancing, and settlement between DSO and supplier. These issues are handled in the Nordic Balance settlement report and will not be a major subject here. For a supplier who wants to have offers to customers in two or more Nordic countries, it is important that the exchange of information related to the business processes mentioned goes smooth with few obstacles. Too many obstacles will be a cost for the supplier and thereby make the supplier less suited to compete with national suppliers.

The suppliers and authorized third party actors should be able to collect data about their own customers from either central or decentralized database(s). For the supplier it should be just as easy to find the relevant data on a customer and handle business processes in a neighbouring country as it is on a customer in his own country. This of course demands that there is a decision on a common Nordic interface for the search tool s, CDBs, messages etc.

If the national authorities decide to implement central databases, there are still many ways of organizing the information flow in the system. In this report NordREG has highlighted one search tool model and two central database models.

4.2 Obstacles to a harmonised Nordic market today

Data can be stored decentralized at many different actors of the retail market for electricity or centralized in one database containing all data to be used in the business processes in a given area. In this chapter a description of the obstacles in accessing data is given, as well as an overview of the possible consequences of centralizing data.

As described in chapter 3 the present data exchange systems in the Nordic countries are not identical. However, in most of the Nordic countries a great deal of data is stored at the DSO level and therefore the exchange of data is a complex process taking place between many different actors in the electricity market. Amongst other the DSO's, TSO's, suppliers, balance responsible parties, Nord Pool etc.

The information exchange in all countries is up for improvement even if the exchange of information works so that business processes such as supplier switching is doable nationally. Combining all of these ways of communicating, considering the different data formats etc., into one harmonised, Nordic market will not be efficient or maybe even possible.

To promote a well functioning electricity market and a common Nordic electricity end user market, the access to data is crucial. Although new varieties of energy supply, such as green energy, consistency in supply, service and branding is given more and more attention, the electricity supply is still a quite homogeneous product. Therefore a major way for the supplier to gain new customers is through offering lower end user prices than competing suppliers. Running a successful business with low operating costs is the key element to be able to offer competing low prices. For a supplier who wants to compete in the Nordic countries, it is essential that he faces the same opportunities as the national suppliers. Obstacles caused by problems to both give and access the relevant information for different business processes will imply considerable costs and create a barrier for the suppliers who want to act in other Nordic countries.

Basic functions in the electricity market require data on meter readings and consumption profiles from the DSO. This data can be used for the supplier's billing, combined billing etc. If the supplier cannot receive the needed data or receives inaccurate data, the billing processes will be affected, thus harming both supplier and customer. Data is also required in case of supplier switching, moving, when making analyses on historical consumption etc. Furthermore other actors more remotely connected to the retail electricity market might have an interest in metering data e.g. energy saving companies and entrepreneurs that want to examine the potential energy saving or to control projects with energy consumption restrictions.

The different kind of data needed to be exchanged between suppliers and DSOs or authorised third party actors depends on the business process. Important information required can e.g. be: metering point ID, meter address, information about the meter (if it is manually or remotely read), consumption profile (in case of manually read meter), consumption history, meter readings for billing (or directly from the customer if manually), name of supplier, name of supplier of last resort, information on the customer (name, birthday, organization number, personal or company number or other numeric customer ID).

In this section some of the barriers to access this relevant data are described in the current information exchange systems.

Data on meter readings

As mentioned above, the access to consumption data is of high importance when the supplier sends bills for consumption. If the right information is not attained at the right time, this could harm both supplier and consumer. The sources for insufficient information are plentiful, and some will relate to the storage of data. One explanation could be the great complexities of making many actors' it-systems communicate with each other. Another reason might be the many resources it requires from the DSOs to ensure a well functioning information exchange. If the sufficient amounts of resources are not given for the task of data exchange, other actors might be harmed.

Data for analytical purposes

Data can also be used for analytical purposes by energy consultants, authorities or a syndicate of consumers e.g. when considering a supplier switch. Suppliers, customers and authorized third parties may have an interest to get access to information in certain areas such as specific customer's historical consumption or customer group's historical consumption. This data may be a part of the information a supplier, consumer or agent needs for making an offer on a new source of supply.

In such a situation there can be many different actors that need to be contacted in order to obtain the required data. First of all, the actors in possession of the required data must be localized. Thereafter a request for the needed data will be provided to the relevant actors. These actors then have to process the request and provide the data within the framework of the national legislation.

This information exchange system contains a risk of both achieving incorrect data for the analytical purpose, due to the many different steps and contributors that are required in order to obtain the data as well as a time-consuming administration. Consequently the storage of data decentralized at the DSO's may be a barrier for the actors who wish to make analytical examination of a consumer's previous consumption for the purpose of offering an alternative source of supply.

Supplier switching and moving

A supplier carrying out an agreement on supplier switch with a new customer may need data on the metering point to execute the supplier switch. The data the supplier needs could be the metering point ID. The customer may not possess this information and the supplier will therefore have to find the actor in possession of the relevant data. In case the

needed information is stored at the DSO the supplier has to identify the DSO in the area of the supplier switch. Furthermore the supplier has to communicate the change of the supplier to the DSO. These actions may vary in time and format from DSO to DSO (within the legal framework given on a supplier switch) and the adjustment the supplier needs to make to the variations could be an obstacle in achieving the necessary data.

Whenever a customer is moving from one metering point to another, whether it is combined with a supplier switch or not, there is a need for data exchange in order to make a final bill for the consumer on the original metering point. The supplier will get this information from the DSO. However the access to the right information will to some extend depend on the communication between the DSO and supplier. In spite of rules for giving information in a business process, the communication time may vary to some extent due to the different ways of administrating information requests from DSO to DSO. The more DSOs that are involved in business processes the higher the chances are of variations. With DSOs divided between four countries there is a demand for stricter rules and more monitoring by regulatory authorities to ensure that procedures are handled in the same manner from all DSOs.

Moving also requires information exchange on the new metering point for the customer, and this information is needed by both supplier and DSO, no matter who gets the notification on moving from the customer. Moving calls for exchange of much data and this might be difficult when the data is requested and given in many different ways.

The obstacles the supplier faces in getting the right information related to the processes moving, supplier switching, buying electricity at the wholesale market, invoicing etc. are barriers for a supplier who wants to expand his business beyond the national border. All the relevant information exists today, mostly in DSOs databases, but the differences in data formats and standard ways of communicating messages is making it difficult and expensive for suppliers to operate in a Nordic market. In general the lack of common interfaces or ways of exchanging information is hampering supplier switching and other business processes, however, there is on-going work with a European standard within ebIX®.

Data exchange from an unbundling point of view

One of the downsides of the current situation, where a large part of the Nordic countries have data stored decentralized at the DSO's is the risk of discrimination between independent suppliers and incumbent suppliers in spite of many precautionary measures and legislative initiatives to minimize the contact between the DSO and the incumbent supplier. The DSO's incitement to quickly deliver the requested customer and metering data may be bigger when the companies are interconnected. The DSO and incumbent supplier may in some cases also have a shared database. This gives the incumbent supplier an opportunity to get relevant information about all customers in the DSO (not only their own) and he will thereby have an advantage the independent suppliers don't have. A decentralized solution with data stored at DSO level will be more prone to breaking neutrality rules than a solution with data centralized.

4.3 Possible consequences of centralizing data

The DSO will presumably maintain the responsibility of delivering the meter and consumption data to a CDB when data is stored centrally, hence the quality of the data should not be affected. The responsibility of customer data such as customer name, address and other contact information is most likely to be the supplier's responsibility as one of the implications of a supplier centric model. However the accessibility is likely to be improved. In the following, situations where access to data will be eased in case of centrally stored data will be described.

Entry into a new market

The aforementioned risk of discrimination between an independent supplier and the incumbent supplier will be limited if the supplier's identity is unknown to the DSO and a common CDB is open to every supplier. It could be chosen in the settings of a CDB to keep the identity of the supplier anonymous. In that way the supplier requesting information would not be exposed to any discriminating behaviour from the DSO because the DSO is unable to differentiate between the suppliers due to the anonymity. In case the data is stored at a CDB and the identity of the supplier is kept anonymous to the DSO, the DSO no longer has an incentive to treat data requests differently. In order to enable anonymity of the supplier there must be strict rules to ensure that we have point to centre communication also in business processes that normally would require bilateral communication between the DSO and other parties. For example should corrections and balance settlement be handled through the CDB by using the communication protocol for the relevant business processes linked to a particular metering point.

Although the existence or scope of this kind of discrimination between an independent and incumbent supplier is difficult to measure, the fact that the risk is precluded should be seen as an improvement of the current data exchange system.

Since all suppliers have equal access to the relevant data about customers, the opportunities for discrimination are smaller and competition on equal terms is possible.

Supplier switching and billing

A CDB, which contains all data, would mean that when a supplier makes a data request, the data is forwarded from the CDB within a certain time limit. These data requests are irrelevant to DSO hence the DSO should not receive information of the requests from the suppliers.

If the data is stored centralized in one database, it is an option that the CDB can handle the communication on supplier switching. Instead of notifying the DSO about a supplier switch, the supplier could contact the CDB, and thereby the identity of the supplier, at a certain metering point could be anonymous to the DSO.

A system with centrally stored data will enable a more synchronized procedure for information exchange in case of a supplier switching, since the notification of the supplier switch is given to just one actor; the CDB. Thereby the same procedure will take place in all cases of supplier switching notified by the supplier. As opposed to the procedure when

the data is stored at each DSO and the procedure might vary between DSOs in different countries.

Most importantly the data technical interface towards the supplier will be the same between countries. Receiving basic data for billing and settlement e.g. will not vary from country to country or from DSO to DSO (that sometimes is the case today), since all the central databases will have the same interface.

The burden of administrating the data

In the information exchange system today, the DSOs receive and give customer and metering data to suppliers and authorised third party actors. The DSOs have to deliver the necessary data on consumption for customers, suppliers, balance responsible parties and TSOs on each metering point. This administration will decrease when the data is stored at a CDB. The DSOs may still have the responsibility of collecting certain information for the CDB as well as updating it. However the DSOs contact with other external actors besides the CDB will go drastically down as the responsibility for contacts shifts to the CDB. Distribution of relevant data concerning more than just the functioning of a metering point will take place from the CDB and thus the DSOs burden of administrating the data will be minimized. From a CDB point of view the number of transactions will not decrease as all messages will go through the CDB. With a CDB there are transactions generated by populating and updating the CDB.

It should be mentioned that having only one communication interface will limit the expenses on it-compatibility. The company's it-systems only have to adjust to the requirement of the CDB and not several different actors, which sometimes is the case in today's point-to-point communication (e.g. in combined billing).

An unfortunate characteristic of the current system in the Nordic countries of today is that there are many different ways of getting relevant data, both nationally and between the Nordic countries. This complicates the harmonisation process noticeably. Correct exchange of information between the actors of the market is an important factor for a well functioning electricity market and a prerequisite for efficient liberalization of the market. The whole idea of centralizing the data is to simplify and synchronize the communication between actors in all the Nordic countries. As a result the suppliers and third party actors will only have one communication interface and one language[5].

The DSOs problems with communicating with new actors will be pushed forward to the CDB, and the DSO will only have to communicate with the CDB. In Denmark all communication between the suppliers and DSOs is handled by the Datahub – no bilateral communication is tolerated. Aside from particular situations where certain data is needed from particular actors, there is a static need for information exchange between the DSO and the supplier. Meter readings for billing are an example of continuous information exchange between several actors. The gains of centrally stored data will affect these continuous information exchanges in a large scale.

[5] The work within ebIX as well as in Nordic Ediel Group is about establishing a common "language" – of which a version now will be used in Denmark from October 2012. The work also describes what should be sent depending on different ways of communication (like "batch", "on-line", and web services).

These advantages will not only be favourable for the DSO but possibly also for new and established suppliers as well as other actors who wish to access this information.

Risks and challenges with centralized data

To introduce a CDB in the Nordic countries would be a fundamental change in the current Nordic retail market. Such a change would indisputably lead to many challenges both regarding the functionality and the question of financing. The challenge of implementing a system of this scale requires technically demanding installations from many actors. Financial investments for working cost and non-recurrent expenses for both soft- and hardware have to be considered.

One of the risks with gathering all the data in a centralized system is that an error in the CDB will influence many actors if it occurs and could have wide implications. An error in a decentralized database would not reach the same amount of actors, and will thereby have limited damages. However it is reasonable to assume that centrally stored data will increase synergetic effects, also on the matter of data security, and thus strengthening the data security compared to decentralized data.

Another important challenge is the security of data. Having one CDB containing data on personal contact data, energy activity maybe even by the hour would mean that a great deal of private information is stored in one database. Such a database would need a high level of data security.

Aside from the challenges the actors on the market may face, the regulators will also be affected by any changes of harmonisation. There will be a constant need for coordination work between regulators.

5 Decentralised data storage

5.1 Web service search tool

The search tool is primarily of help for the suppliers to search for relevant customer data in DSOs databases. The search tool is a web based pull service. This means that the web service routes each request for information from the supplier to the correct database and returns with the answer. The search tool is not a two way communication tool in the sense that the supplier cannot give any messages through it. This is a much more efficient way of getting relevant data fast. Instead of contacting each DSO to get relevant data by e – mail or phone the web service returns the data to the supplier without involving the DSO in the process. In this way much time and effort is saved for the DSO as well. The relevant data is used in the messages sent between the DSOs and suppliers in a business process, whereas all other communication is handled directly between the DSO and the supplier, e.g. when the actual business processes are handled.

Web service could also be the expression for a communication protocol where messages between the actors are sent. Other communication protocols are e.g. SMTP or FTP. In this chapter when we talk about web service we only refer to the search tool.[6]

5.2 Data provided by the web service search tool

When the web service works as a search tool its main objective is to provide the supplier with the necessary data[7]. This is because it is important information needed for the supplier when he wants to send a message to the right DSO about a supplier switch. This is the same using area as for model 1 described later. The amount of information returned from the web service search can be expanded to more than just metering point ID. NordREG consider that relevant information for the supplier to have returned from a search on a customer could be:

Metering point ID

Meter address

Billing address

Information about the meter (if it is estimated or manually or remotely read).

With a pure supplier centric model it is not certain whether the billing address is something that the DSOs have in their databases. If that is the case the supplier will not have this information confirmed by the search reply but will get it from his customer. In order to perform a search the supplier must know at least three search criteria that he will

[6] There are other potential models that could be assessed. For example, the EMIX system in Sweden served as a message validation and dispatch system. EMIX checked syntax and mandatory content in all messages before they were passed on to the right recipient. EMIX also allowed message tracing to follow a transaction end to end. The present EMIX solution will end after 2012-02-29.

[7] Norway has implemented such a search tool called NUBIX. The main objective of the web service in Norway has been to provide the supplier with the metering point ID but also with other information needed for supplier switching

receive from the customer. Search information points that the customer will know will typically be his name, birth date and meter address. The most relevant returned information point above would then be the metering point ID, since this is something that the customer might not know. A web service search tool will not by itself increase the quality of the data, but in the process of enabling the data to be searchable for the web service, each DSO has to make sure that the data about the customer is complete and presented the right way.

5.3 Model 1: Simple web service search tool

One possible option for a communication model for the actors of the common Nordic market is to have a web service as a search tool for the suppliers. The idea is that through this web service the suppliers can get the information they need in different processes in a more efficient way than by communicating directly with DSOs in other countries on phone or e mail. This simple search tool can help in retrieving information from DSO and other databases to the supplier. A simple search tool will not work as a two-way communication channel just as a pull service. Communication of different business processes will still be handled point to point with EDI messages between the relevant DSO and supplier. The search tool will give the supplier the relevant information that needs to be in the EDI message. The model we describe here is based on the Norwegian NUBIX solution but a different version of search tool service is also used in Finland to get metering point IDs from a common database.

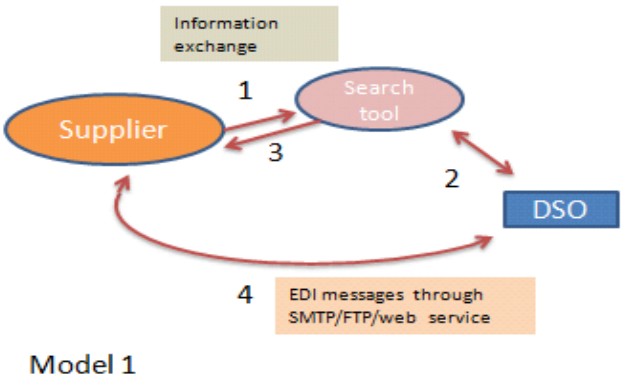

Figure 1 Simple search tool flow

In Figure 1 Simple Web service search flow, an example of different stages of information flow between the supplier, DSO and the web service is shown.

Step 1. The search tool receives a request for information about a customer from a supplier.

Step 2. From a DSO or central database code, the web service search tool will know towards which database to direct the search.

Step 3. The results of the search will be returned via the web service to the supplier.

Step 4. The business process is handled in standardized messages between the relevant database /DSO and supplier using SMTP, FTP or web service communication protocol

SMTP is an e-mail protocol widely used for exchanging electronic documents between many actors. Web service protocol is often using the open protocol HTTP. The normal way of exchanging information with web services is by packing the information in XML syntax[8].

A prerequisite for this model to work in a harmonised Nordic market is that all messages are harmonised in contents and format. Also all processes must be harmonised in timeframes and responsibility.

5.4 Information flow with the search tool

Users of the web service search tool will primarily be suppliers. The DSOs will place their relevant data at disposal and the pull web service will return data to the supplier.

To get relevant information about their new customer, the suppliers can perform a search with the web service. Such a search is done by entering a few information points about the customer in the search table as seen below. A minimum of information points should be required to start a search.

If there is one mandatory information point e.g. metering point address or DSO ID , this will tell the web service where to direct the search.

In addition the supplier must fill out a number of search criteria of his choice. There should be a required minimum number of search criteria filled out in order to send a search. This will minimize the search results and secure that the supplier has been in contact with the customer. The supplier will in most cases get the meter address, customer name, birth date/organization number and name of DSO from the customer, and thereby the supplier should not have any problems to start the search. Before a message about a supplier switch is sent from the supplier a contract with the customer must of course be agreed upon.

From the search the supplier will get a reply from the search tool with all the information about the customer and the metering point that he needs in order to send a message for a supplier switch, moving etc. In the figure below is an example of different search criteria. Not all of these have to be filled in but at minimum e.g. three criteria should be filled in. Numerical search criteria are always easier than letter criteria. Therefore the meter number (found on the meter) could be an option if the search with other information points does not work. For the letter search area there should be a wild card function to take into account misspelling etc. and thereby increase the probability of finding the right information. By having the search tool return all the information points mentioned before, this could work as a verification that the search result is on the correct customer. All the search criteria must be available in the DSOs databases (or CDB). In the table below

[8] Information is from the report “Standards for Electronic data interchange in a common Nordic Retail market”

there are some examples based on the Norwegian NUBIX solution. A search criterion like meter number is an example of data that is not in all databases in all countries today. Search criteria must therefore be agreed upon in all countries so that they are the suppliers face the same solution in all markets.

Name /company name	
Meter address	
Meter number	
DSO ID /CDB ID	
Birth date/ organization number	
Metering point ID*	

Table 2 Web service search table

The simple search tool can work both as a simple log on site or integrated with the supplier's customer information system. For the search from the web service to work, the DSOs in Norway, Sweden and Finland and the data hub in Denmark have to store the necessary data about the customer, yearly consumption and the meter in such a way that the data will be available for searches from the web service.

5.5 Functions of the search tool

The simple search tool's main function is to communicate necessary data needed for supplier switching. The search tool does not handle any of the processes by itself. All supplier switching, moving, billing and other processes will be communicated between the DSOs/central database and suppliers by EDI messages. This demands that a common standard for the messages is agreed to on a Nordic level.

If we look at the business processes mentioned earlier in the report it is clear that both supplier switching, moving and all other processes still will be handled through bilateral message exchange. Information about making and ending contracts will also have to be exchanged in messages. Access to customer data in various compositions and groupings is not as easily available to suppliers and other relevant parties when data is stored in a decentralised manner as when it is stored in one place. Sending consumption data is of course possible through EDI messages, but how often and in what way it is displayed might not always be in accordance with the demands of the relevant actors. One example of this is when energy saving companies (ESCOS) take energy saving measures to lower costs for their customers and then need consumption data frequently in order to check how well the measures are working. For some ESCOS this means gathering information at a weekly basis from many different DSOs. Decentralised data storage will also most

likely make combined billing more bothersome than in a situation with centralised data. The search tool does not make any changes to how business processes are done – these also need to be harmonised in order to achieve a common Nordic market.

5.6 Responsibilities

In this model all the data about the customers and meter readings will be stored where they are today and responsibility for data quality and updating could have national adjustments. This means that Model 1 could in theory work with either locally stored data in each DSO or data stored in a central database.

DSO/ Central Database (CDB) operator

With all information flow going through the search tool, all customer data has to be available for the search tool at a certain format. Regarding technical responsibility for making the data available for the web service search, the obligation will be either on the DSO or the CDB operator. The DSOs or the central database operator will then have the obligation to enable their database to communicate with the search tool.

In model 1 the DSO or CDB operator are obliged to customize their database and have customer data correspond to the searches from the search tool. But other than this the DSO is a passive part in that way that they don't take any action to answer the search tool requests. This happens automatically as long as the customer data is made available for searches. Supplier switching or moving would still require DSO/customer to read the meter in case it is not remotely read. Regarding sending and receiving messages the DSO has a responsibility. In case of a CDB, some messages would be replied automatically as a function of the CDB.

Sometimes there could be errors to meter, consumption or customer data that needs to be corrected. Information about the error will most likely come from the customer himself or from the customer's supplier. With the data stored in each DSO the responsibility will fall on the DSO to update, change and correct the data. To have other actors that are not responsible for the data go in and make changes to them is not a good idea. But, in order to have a more supplier centric solution market rules could be made so that the DSO has an obligation to make changes in certain customer data according to the supplier. In a supplier centric model the supplier could be a single point of contact for the customer and could communicate corrections to customer data trough a message to the DSO. Decentralised data is in this way not a hindrance to the supplier centric model.

Supplier

The supplier will have the main contact with the customer in a supplier centric model. If data is stored locally with each DSO the supplier could, depending on existing market rules, have more or less rights and obligations to make corrections to the customer data in DSOs databases. If the market rules for supplier responsibility are equal in all the Nordic countries harmonisation would be better.

Regarding communication with the search tool, there will be no obligations on the supplier in Model 1 to use it, but in practice the supplier will want to use the web service as a tool to get information since it is the easiest and fastest way. If the extended version

of the web service is decided, the supplier will have to use this also as a tool to send messages to the DSO.

Search tool Operator

The web service search tool operator will have the technical responsibility for the search tool, but will have no responsibility for the correctness of the data that is routed through the service. The system operator will have the responsibility to monitor the search activity and report any abnormalities to the NRA, DSOs or supplier. The system operator will also have to provide some kind of support and information guide and testing opportunities for all users in case of technical problems or upgrades of the search tool.

Who could be a search tool operator?

It is not obvious who should run the search tool in a Nordic market. One solution could be to have four different search tools run by national operators. This would of course be more expensive than operating just one solution. There might also be situations where the four search tools could be in conflict with each other if changes and upgrades are not coordinated well. On the other hand, four national operators will give room for national adjustments regarding rules for the operator etc. Another solution is to have just one Nordic search tool. If there is only one operator the Nordic countries have to agree to rules for the operator and also on what body or regulator that should be responsible for monitoring and punishing the operator if it breaks the rules.

Whether national or Nordic, an important criterion is that the operator must be subject to regulation of some sort since it is a monopoly. It is also an important criterion that the operator is not likely to go bankrupt or out of business, and does possess expert knowledge about the electricity market and IT systems.

Candidates for being the search tool operator could vary from country to country. In Norway, the TSO is the one running the search tool and this might be a solution also for some of the other Nordic countries. If there were to be a Nordic search tool, candidates for operating it could be the Settlement Responsible (SR) which is suggested in the Nordic Balance Settlement report made by the TSOs.

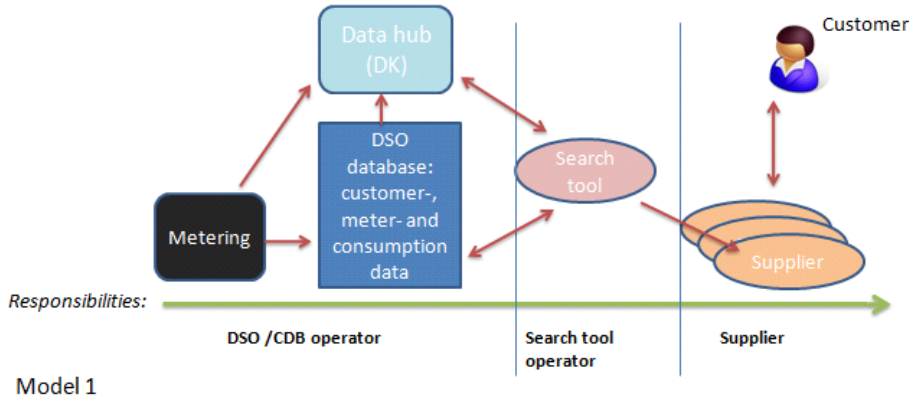

Figure 2 Responsibility flow diagram with a search tool

In Figure 2 Responsibility flow diagram with a search tool we see the main responsibilities. The DSO has the responsibility for the data being searchable for the web service in the DSO database and the data hub operator in Denmark has the responsibility for the data in the hub being searchable for the search tool. In a model with decentralised storage of data the DSO is the responsible party for making changes to all customer data. The supplier can be given rights and responsibility to notify the DSO about changes in certain data who again has to perform the changes.

5.7 Competition

Competition between IT service providers

Implementing a search tool will result in changes for DSOs and market actors in most countries. It will most certainly be an increased demand for IT services from the DSOs to make the necessary adjustments to DSO databases. There is no reason why implementing a search tool in a country should make the competitive market between service providers of IT solutions to DSOs worse. The DSO is free to pick the service provider that he thinks offers the best customized solution for a customer information system and an interface with the search tool. This is already done in Norway today even if the competing providers are not many. With a bigger market like the Nordic one and more use of search tools, the aggregated demand for IT consultants to install and adopt DSOs databases and work on the technical solutions for the web service search tool operator, will give room for more IT companies. Whether competition will be improved from this is not certain. It might be that the demand will grow and that in the short run the number of relevant IT service providers will not grow accordingly, which may result in a higher price for the buyers of such products initially. In the long run, increased demand might trigger development and interest from other IT companies to offer solutions for the energy business. For competition to improve there has to be a sufficient amount of offers to choose between.

Competition between suppliers

Regarding competition between the suppliers, the web service search tool will probably not influence much on this. The search tool solution will help the supplier in performing the business processes more efficiently and with less effort. This change will be the same for all suppliers and thereby not alter the condition for competition between them.

It could be that access to customer and meter data at equal terms will make it easier for independent suppliers to get established in the market, as opposed to where local storage of data sometimes could work in favour of the incumbent supplier. As long as the adaptation costs for the search tool and cost of use are low, a search tool will not present an entry barrier for new energy suppliers to enter the market. In Norway there has been no sign that the search tool NUBIX represents such a barrier, rather the contrary, since the web service search tool lowers the use of resources spent on retrieving relevant customer data manually.

Competition for the job of being search tool *operator*

NordREG acknowledges that the task of being the search tool operator might have to be a monopoly position. It is a large job to build up a web service search tool and to make it meet all the requirements. To have the job of running it change between companies every few years would not be very efficient. By building the search tool the operator will acquire knowledge that is important for running it. And with time the operator will collect important information that can improve the web service and customer service. By changing the operator the build up history and knowledge might disappear with the phased out company. The duty to be a search tool operator does not have to be permanent, but should at least be a commission for many years and not only two or three years. The service must be of high quality otherwise the operator could be subject to replacement or sanctions if the service does not meet the requirements.

5.8 Data security

When looking at security there are several issues that are relevant. First of all there is the issue of the data being protected from hacking or access from actors not concerned. There is also the need of back up of data in case of data virus, fire, flood or other damages to the storage location.

Since the search tool itself is not storing any data, just routing the request and answer between the supplier and the DSO/CDB, there will be no additional need of back up of customer or meter data in the web service search tool.

This means that the security risk situation is not much changed from today's situation by the introduction of a web service search tool. The national authorities should make clear rules for who should be given the right to use the search tool. This right should in most cases be reserved for the suppliers and DSOs, but national authorities could consider giving other relevant actors access. DSOs will only need to use the search tool to do tests of their own system after upgrades etc.

The additional risk might also come from misuse of data via the web service search tool. The search tool should for instance not be used for making lists of customers for marketing purposes neither for suppliers nor other companies. If detected that suppliers use the search tool as a tool to get in contact with potential new customers, they should lose their licence to use the search tool. Therefore it is important that the search tool operator supervises all the searches and report to the relevant NRA if any misuse is detected. It is also important that the supplier have to fill in a minimum number of information points about the customer in order to perform a search. This will make it harder for suppliers to make random searches.

In Norway, where the search tool NUBIX has been operative for almost four years, there has not yet been any evidence of misuse by the suppliers and no access from actors not concerned has been reported. A web service search tool like this does not exist in any other Nordic country at the moment.

5.9 Influence and consequences

Influence on Suppliers

The search process via a web service search tool will go quickly and will replace the costs suppliers have by sending e-mails, asking for metering point IDs, or other relevant customer information in a Nordic market. They might have to pay an annual fee in order to be able to use the search tool. The suppliers can, in model 1, choose to either integrate the search tool search tool into their IT system or go for a simpler log on version via the Internet. They will have use of the tool either way, but the integrated version is more efficient. The installation of an integrated solution will be more expensive than the Internet way but the gains from having a more efficient search tool might make the investment worthwhile. In Norway most suppliers have chosen to have an integrated solution.

Influence on DSOs

For the DSOs there could be gains from the search tool by reducing the time and resources spent on answering phone calls, e- mail or message inquires from suppliers about customer information. DSOs in Sweden, Finland and perhaps also Norway will have to expect some cost connected to upgrading of their databases with necessary customer and meter information. A key element in this upgrading is that the data must be stored in such a way that it can be identified and collected from the web service tool in a search. The data hub in Denmark will probably also need some kind of interface to correspond with the web service.

Influence on customers

It is likely that the costs the DSOs and suppliers have will be pushed forward to the customers, who in the end will be the ones paying most of the costs for the search tool adjustments.

The aim is of course that the introduction of a web service search tool will make the actors handle processes like supplier switching and moving more efficiently and that this could be a gain for the customers.

There has not been done any research on how the implementation of a search tool is perceived by the customers. But in Norway the time spent on a supplier switching has gone down and it could go through with less effort from the customer.

Influence on the search tool *operator*

There should be an opportunity for the operator of the search tool to take a fee from the participants (the suppliers or third party actors) that covers some of the expenses of upgrading and operating the service. The fees will probably not cover the costs to build up the service and so the operator will need budget appropriation or other income in addition to fee income.

Influence on regulation and monitoring

Regarding regulations concerning the information exchange with the web service search tool, there should be no reason that each Nordic country could have some national adjustments to the rules. In Norway there are high level regulation concerning the search

tool with guidelines that go into more details. The national adjustments should not affect how the suppliers do their business processes since this is bad for harmonisation.

It is likely that the regular authorities will get some extra work related to following up the search tool operator's, DSOs' and suppliers' use of the service. In Norway there were some extra resources spent by the regulator on following up the DSOs obligations to NUBIX the first year running. After this resources spent by the regulator following up NUBIX has probably been less than the resources that would have had to be spent if there were only manually information exchange between DSOs and suppliers.

Since the web service search tool solution will not alter the exchange regime significantly the changes in workload or costs put on the authorities/ NRAs by implementing the search tool are relatively small.

The extra work for the regulators will mostly be in relation to making national rules and regulation related to the search tool and the regulation for communicating in the harmonised point to point communication. Later the regulators' extra work will be to supervise and issue sanctions if the DSOs/ search tool operators/suppliers are not fulfilling the regulation. The workload will be less as the actors have adapted to the new requirements. Some resources might be used in taking actions against actors' misuse of the search tool or violate the regulations.

If a supplier should be able to use all search tools to get information about his customers in the Nordic countries it is of course crucial that the search tool works in the same way in all countries and that the suppliers can integrate just one solution in their customer information system to make searches in the databases in all countries. The Nordic countries must therefore make a set of rules for the web service search tool that ensures that data could be collected from the DSOs databases or a central database in the same way. Probably people from the industry, TSOs or other actors with knowledge about the platforms and interfaces used by DSOs and suppliers in message sending, should take a bigger role than the regulators in preparing a common electronic standard for message exchange and interfaces of communication tools as a web service or a CDB. Regulators should have a coordinating role.

6 Central data storage

6.1 Central databases

A central database stores all DSOs data in one central location. This could be done in different ways. In this chapter we'll have a look at two different organisations of databases, one where the actors communicate with the CDB by sending messages and one where the actors could log directly on to the CDB and be able to make changes according to their user rights.

6.2 Data provided by the Central Database

All the metering points have a unique ID (metering point ID), that will be linked with the other information about the customer and the meter. The relevant data will be all data used in business processes, balancing and other economic settlements between market actors.

6.3 Information flow with central databases

Users of a central database (CDB) are DSOs, Nordic suppliers and third party authorized parties. Also, other actors will be users of the CDB, e.g. the TSOs, Balance Responsible parties, producers etc. The database will store relevant customer data, consumption - and meter data at metering point level. By implementing a CDB in a country, the actors or users of the database will experience changes. Most of all, the changes caused by this implementation will affect the DSOs and the communication between the DSOs and suppliers. In all countries at the moment the DSOs have the customer data, consumption data and meter data stored in their databases and the DSOs are the responsible party for the correctness in most part.

The concerns of the DSOs in an implementation for a national CDB will be how the relevant data they are responsible for will be stored and updated, and what kind of responsibilities the DSOs will have for the data within the CDB model. This raises questions such as; should the DSOs continue to have their own databases with relevant data or will the CDB take over all data and responsibilities.

We will have a look at two ways a CDB could work. Below we have described a simple CDB version based on the Danish data hub and a more extensive version. The different solutions put different responsibilities on the DSOs and their databases. The simple version might be easier to implement and therefore an easier first move towards more efficient data exchange. It is important that the CDB version chosen is constructed in a way that makes it possible for expansions and improvements in the future without forcing the actors to make new large investments. Instead improvements of the CDB should be made as additional modules to the existing model making the adaption easier for the actors, and thereby making the solution long-lasting and effective. The second version is more complex but might save costs for the DSOs by moving most of the technical IT responsibilities from the DSO to the CDB operator. Again these are just two examples.

In a model with CDB in all countries there are several different organisation forms. One could be that the supplier communicates directly with the CDB of the country where the relevant metering point of the customer is stored. This means that all the CDBs must have the same interface so that the supplier is able to either log on to each CDB directly and place the message about e.g. a supplier switch or send an EDI message to the CDB. Another way is that the supplier only communicates with his national CDB and that this CDB has functions for communicating with all other CDBs.

6.4 Model 2: Simple CDB

In this model the DSOs will keep their own databases more or less as today and the CDB will upload the information from these databases. The DSOs will need their own local database for example for processing the metering data, for using the information in DSOs other data systems and operations and for e.g. storage of data that is not needed in the CDB, this could be information on the metering type[9]. The DSO is the responsible party for quality checks of the data before it is passed on to the CDB.

The DSO decides within the timeframes when the data should be transmitted to the CDB.

In case of differences in data between the DSO database and CDB, the DSOs will have to take into consideration that the data visible or transmitted to the suppliers will be that stored in the central database and therefore what will be used by the suppliers. Corrections to data in the CDB, e.g. consumption data, must be communicated to the supplier through the CDB with respect to national rules of limitation. The settlement for corrections can be handled later between the supplier and the DSO through the CDB. Common rules for this procedure are important to establish.

All business processes will be linked to a metering point ID. When the DSO or supplier uploads data to the CDB, the metering point ID will identify the relevant receivers of that particular message. This means that access to information on a customer's metering point ID is crucial for all actors. Particularly for the supplier this information can be important in the offer giving phase, if the supplier wishes to receive customer data on a potential customer from the CDB. One way of getting information on a customer's metering point ID is asking the customer. This will reduce the risk of misuse, but on the other hand cause some inconvenience to the customer and supplier. Another option is to enable a search function in the CDB. Such a search function would require certain knowledge about the relevant customer e.g. name, birthday and address, in order to prevent misuse. A search function would require strict rules to ensure that customer data is not given without the customer's permission.

[9] There is no obligation in the Danish regulation forcing the DSOs to keep their local database, however it is likely to assume that there will be a practical need for keeping the DSOs' own database, at least in the initial phase of the implementation of the CDB.

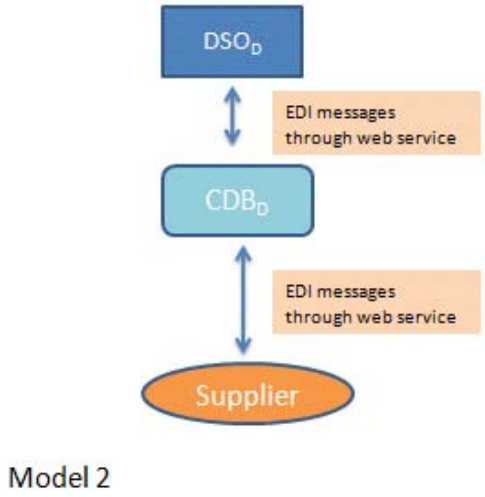

Figure 3 Communication with a simple CDB

6.5 Responsibilities in model 2

In Model 2 the DSO will receive both meter reading from the customer and meter data from automatically read meters. The DSO will perform the quality check and storage in his local database. Meter and customer data will be uploaded to the CDB.

Regarding customer data the access for the supplier to upload data in the CDB will depend on the division of responsibilities, however Model 2 can apply for any degree of supplier centric model.

If both DSOs and suppliers should be able to upload data, clear rules for updating and how to notify the relevant actors about it must be made.

If suppliers are responsible for updating the data needed to send invoices and other communication to the customers, combined billing sent from the suppliers could be seen as an advantage. As long as the DSO sends invoices for e.g. new connections, the DSO will most likely want to have its own customer database containing the information about e.g. the billing address that has been agreed with the customer for a new connection. A practical way to handle this could be to keep such data in a DSO-internal database. Once the new connection is established, however, the new customer data could then be transferred from the DSO to the CDB. After that, it could be the responsibility of the suppliers to update customer data in the CDB.

However, there are still many tasks that remain the responsibility of the DSO towards the customer (for example new connections, cable positioning, tree felling assistance, power quality assurance, disconnection and reconnection). This means that the DSO will need to keep a customer database (for example, providing SMS outage notifications to affected customers requires knowledge of affected sites, corresponding customers that have approved such notifications, and their mobile phone numbers).

If the DSO is chosen as the responsible party for customer data, he must also have the right to correct information uploaded by the supplier to the CDB, e.g. information on moving. In order to ensure that the DSO maintains knowledge of the information it is responsible of, the CDB should notify the DSO whenever data, that the DSO is responsible of, is uploaded to the CDB by the supplier. Afterwards the DSO should - within a timeframe - confirm or affirm the correctness of the data. In that way the DSO stays in control of the information in the CDB he is responsible of and at the same time the function allows the supplier to upload customer data. This illustrates the model chosen in the Danish Datahub.

If an alternative stricter supplier centric model approach is decided upon, and the supplier is chosen to be the responsible party of customer data there would be no need for the DSO to confirm or affirm the correctness of the customer data uploaded by the supplier. On the contrary, customer data uploaded by the DSO would then have to be accepted by the supplier if the supplier is the responsible party.

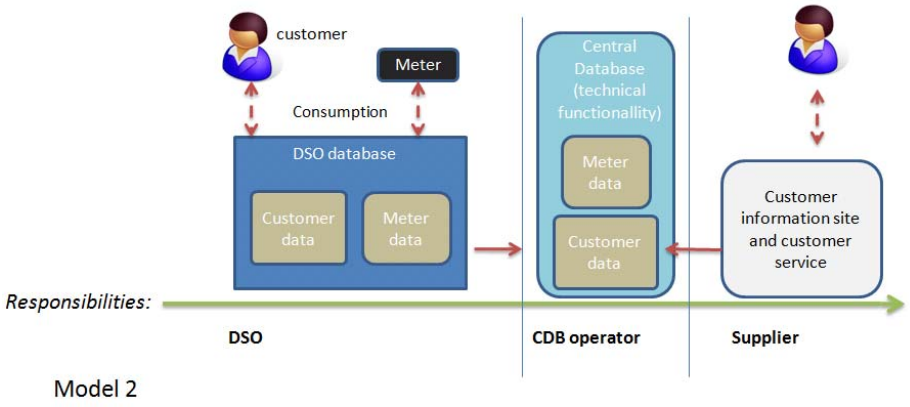

Figure 4 Responsibility flow diagram, model 2

6.6 Functions of the simple CDB

A central database should be able to contain both customer and metering data, and provide the relevant eligible actors access to metering data at any given time and at any given metering point (e.g. for the DSO to check the validation status). Both present and historical metering data should be stored in the CDB. In addition to serve its purpose, as the web service where easy access to data is provided, a CDB should be able to determine which actor a message is to be given to at each different event. The intelligence requirement for a CDB is therefore bigger than for a simple web service. The CDB should be able to combine an event with the relevant recipients for a specific message, such that when a certain event is reported to the CDB regarding a certain metering point, the CDB should react in accordance to that specific event.

When choosing the metering point ID as the central link for each process, any supplier with knowledge of the metering point ID can request a business process in the CDB without knowing who the relevant actors might be at a particular metering point. This means that the CDB should be able to select the relevant actors when informed of the metering point ID and the business process and inform the actors of the business process if necessary. An example could be, if the supplier does not know the DSO that operates on a metering point where the customer has announced moving to the supplier.

One of the most important actions for a supplier when entering the retail market is the supplier switch. A CDB should be able to handle such a process, thereby meaning that a supplier (with the sufficient prerequisite such as contract with the customer, power of attorney etc.) should announce the supplier switch at a certain metering point to the CDB. The CDB should then be able to pass that information on to the right DSO and ask for a meter reading if the meter is profiled, and also inform the previous supplier. If other market actors need information about a supplier switch this should be given through the CDB.

Other processes should be handled by the CDB such as moving etc.. If a supplier is given information regarding a customer moving, the message should be given to the CDB who then gives notice to the DSO and whomever a message may concern.

A CDB should also be able to reject obvious incorrect data reported by the actors. A notification of an error should then be given to the relevant actor if for instance a nonexistent metering point is used in a message on moving. In the same way obvious errors in metering data should be reported to the actor giving the inaccurate data. When the verification takes place centrally, it will ensure a harmonised enforcement of the rules on the market.

In case of errors another useful function in a CDB could be the ability to document every event in a given period in order to track the responsible party of the error.

The CDB should have different rules for every possible event or messages to be given between the actors, especially if the identity of the supplier is kept unknown to the DSO. In order to avoid contact directly between the actors, the system requires that every message goes through the CDB, and that the CDB back up all message flow in the current retail market for electricity.

Making the CDB a central portal, the possibility of keeping the identity of the supplier unknown to the DSO is facilitated, simply because the DSO does not know which supplier is connected to each metering point. The advantages of an anonymous supplier are described in chapter 3.

6.7 Model 3: Extensive CDB

This model is not based upon an already existing model, but is a description of a more complex CDB with much more built in functions than the data hub of Denmark. It is an extreme version of a CDB where there is no need for the DSO to keep his own database. The data in the CDB is therefore not uploaded from DSO databases. Instead all meter readings go directly from the customer (when manually read) or the meter to the right

drawer in the CDB. The DSO can log on to the CDB and do changes and quality controls to data in their own drawer. Within the CDB there must be automatic controls for consumption values etc. Meter values need to be checked, corrected and missing values have to be estimated automatically by the CDB according to predefined rules. However the DSO is still responsible for all meter values in the CDB. The DSO can to some extent perform corrections to the estimated values afterwards.

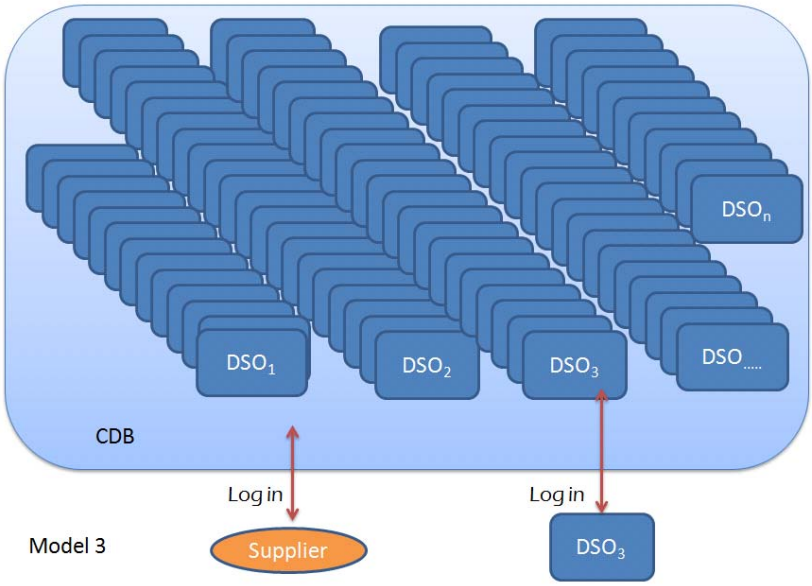

Figure 5 Extensive CDB

The CDB is like a chest of drawers, where each DSO has his own drawer with the relevant data for his grid area. This drawer is the DSO's database more or less as it is today with integrations and functionalities. The DSO only has reading and writing rights to his own drawer in the CDB.

The supplier should also be able to log on to the CDB and according to his rights be able to see relevant data and make changes and corrections. Of course there has to be strict rules about what the supplier can and cannot change. If a supplier has the rights to alter some data he is also the responsible party for this data. There should never be a situation where an actor has rights to do changes and someone else is responsible.

All manually changes to the data will be done by the DSO or the supplier directly in the CDB. This is in contrast to model 2 where suppliers send EDI messages to the CDB. In the extensive CDB no messages are sent from the outside of the CDB, only within.

In model 3 the DSO will be able to access the central database and make changes and updates directly on the data they are responsible for as today. The main difference for the DSO will be that the data is not stored locally but centrally.

The main difference with this model compared to today's system is that the technical service on the database system and computers will not be handled locally by each DSO, but centrally by the database operators. To have one CDB operator instead of e.g. 200 DSO operators will make the automation of control functions and other standardized procedures in the database the same in all drawers of the CDB chest.

Another aspect is that in this model the supplier could be given the rights to log on to the CDB and also make corrections to customer data. This will make a combined billing situation or other responsibilities on the supplier in a supplier centric model, easier.

In the figure below is shown an extended CDB version where the CDB is a collection of all the nations databases and data systems. Each DSO can log on to his own “drawer” in the CDB and perform manual operations when needed while CDB will automatically perform functions like quality checks and corrections, necessary calculations of consumption and settling of accounts.

The supplier can log on and access relevant data about their customers and place requests for supplier switching, moving and collect the relevant data for billing his customers. In addition the supplier could be responsible for correction of a few information variables about the customer.

6.8 Responsibilities in model 3

In model 3 there are no local databases or the databases are smaller and for short time storing only. The DSO will handle all his main business processes in the centrally stored database. With only one database there cannot exist two sets of data about the customer as the situation is in model 2. If the supplier does changes to customer data, and the DSO does not have his own database with contradictory customer data, chances of confusion is less. There are opportunities for the supplier to be in charge of all customer data and leave only consumption and meter data for the DSO. With a pure supplier centric model the supplier will have close to all customer contact and it is natural that manually read meter readings will go though the supplier and be registered by them in the CDB. There has of course to be generated an alert to the DSO about the new meter reading from the supplier and the DSO will be required to approve/ disapprove this meter reading. With most meters being automatically read in the future this job will limited. This situation is shown in Figure 6 Responsibility flow diagram,

In model 3 the functions of the CDB are more advanced than in model 2, and a great deal of responsibility for the technical functions, support and upgrading is moved from the DSOs to the CDB operator.

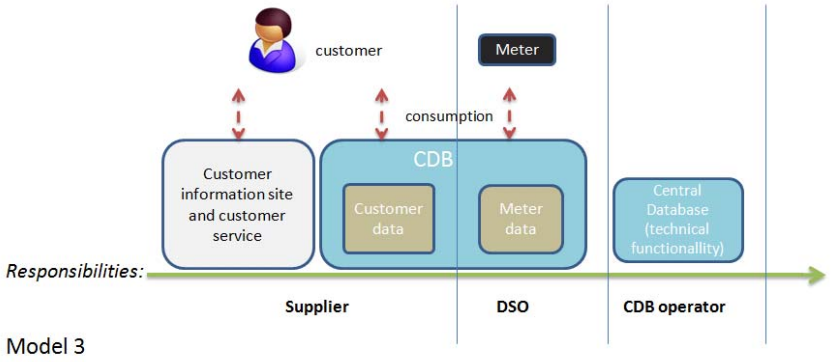

Figure 6 Responsibility flow diagram, Model 3

The CDB operators have the responsibility for the technical functionalities of the CDB in both model 2 and 3. It could also be the case that the CDB operator has the task of invoicing preparation services and other functions. If the CDB is to correspond with other countries' CDBs there have to be a gateway connecting the CDBs to each other where communication is flowing. This situation is discussed more in chapter 7. All of this will contribute to the load of responsibility for the CDB operators.

6.9 Functions of the extensive CDB

The supplier has the opportunity to make changes to customer data in all CDBs if this is allowed by the nations.

The supplier must be able to log on to all CDBs no matter what country he is stationed at, even if it is reasonable to believe that a supplier will have at least one office in each country where he has customers in the first stages of harmonisation. When the supplier places a request for e.g. a supplier switch the CDB should automatically take care of the process and generate alerts to the DSO and other suppliers in the matter. If the request doesn't fill the requirements or are wrong the CDB should reject the requests and notify the sender about what went wrong.

In this model there is no point to point communication in messages as we have today or as presented in model 1. All supplier switching, moving etc will take place inside the CDB except meter reading of the non-remotely read consumption points. The supplier communicates solely with the CDB of the country of his respective customer. It is essential for this model to work, that all CDBs have the same electronic standard and communication interface and the functions of the CDB and the operations the suppliers face for placing request are the same.

6.10 Data security with CDBs

Data security

The large amount of information collected from the customers' smart meters, with the new technology, raises both questions regarding data security and privacy issues. If this information is stored in a central database it´s essential that the data security is kept at a high level and that consumer privacy is ensured since otherwise great amounts of consumer information could be compromised. With all customer data stored in a CDB non relevant actors could get access to more information at one place compared with decentralised storage where they could only access customer data in a single DSO database.

Privacy

Information collected can be looked upon as a library of personal information. Depending on how often the customers' meters are being read one can find out if the consumer is at home, and when the consumer is at home one can even assume what he or she is doing at the moment. This is possible because consumption patterns are known for the different

household appliances. It is not only important to limit the amount of information that DSOs collect from the customers, it is equally important to find ways to protect smart meters and grids against hackers. Therefore it is very important that we take technical and legal measures to ensure security in a CDB.

On the Nordic electricity market it is the DSO first and foremost that collects metering information. At the moment the Nordic regulatory authorities are not monitoring what information the DSOs are collecting. As far as we know DSO may be collecting all kinds of information that is "nice to know". Knowing when the consumers are consuming electricity can give the party who is collecting the information quite a lot of knowledge about the consumer and even some information that is not needed. This enables e.g. consumer profiling. With data stored in one place as a CDB it is easier for regulatory authorities to monitor if common rules are followed. An important question is how to ensure that people are not subjected to unwanted targeting, profiling and marketing activity.

Europe

Through the work in CEER (Council of European Energy Regulators), regulators have addressed the issue of privacy through the Final Guidelines of Good Practice on Regulatory Aspects of Smart Metering for Electricity and Gas[10]. There it is stated that it is always the customer that chooses in which way metering data shall be used and by whom, with the exception of metering data required to fulfil regulated duties and within the national market model. The principle should be that the party requesting information shall state what information is needed, with what frequency and will then obtain the customer's approval for this. Full transparency on existing customer data should be the general principle. For instance, when a service provider is in charge of information on the customer's voltage quality the customer should in this case be able to a) know that this data exists, and b) receive information on the explicit data. Also we have to take into consideration the legislation emanating from Data Protection Directive and other existing legislation at national level[11].

6.11 Influence and consequences

It is expected that the CDB will present a reasonable cost to the electricity market. This cost however, might be at least partly balanced by the enhanced process and automation efficiencies that would result for both DSOs and Suppliers from the use of the CDB[12]. Costs associated with balance settlement, new customer registrations (customer/installation registration), customer re-location (moving), customer switching, change of customer data and other customer oriented processes would be reduced through

[10] Ref: E10-RMF-29-05

[11] The European Convention on Human Rights especially Article 8 regarding the right to show respect for private and family life. Guidelines for EU Member States ensuring privacy and data protection Recommendation of Task Force Smart Grids & Smart Meters Expert Group 2 which are currently being drafted and will likely be ready by the end of 2011. These guidelines aim at giving detailed guideline on the level of security needed.

[12] P.50-51 in Vaasa ETT report "Consideration of alternative billing regimes for the common Nordic end-user market" 26th of August 2011

the implementation of the CDB. It could therefore appear that the net cost of a CDB are negative in the longer term, especially within a highly active market, and almost certainly within the future smart European electricity market where meter data transfer volumes and costs are expected to be enormous.

Even though the up-front investment costs can be significant the CDB access fees can be quite modest, depending on requirements. The up-front costs are particularly challenging to smaller suppliers, but should be seen as a cost that facilitates future sales opportunities.

The costs can also be lowered through the use of vendors providing the CDB integration services that synergise multiple suppliers to lower the costs of integration with the CDB. The model could appear to be a cost effective solution also for small suppliers, since the standardisation of the system is done concentrated and therefore the planning costs for individual companies are relatively small.

The up-front cost will also open up all other markets linked to the CDB and such costs are lower than establishing complete sales businesses in each of the other countries. If all inter-participant transactions take place within a CDB, it would therefore provide all DSOs relatively simple access to all suppliers (and vice versa), and all suppliers with relatively simple access to all relevant customers. For the Nordic market, this inter-connectivity would be essential to link hundreds of DSOs and suppliers together.

The CDB also ensures the neutrality of DSOs as they can’t treat incumbent and other suppliers different ways regarding for example information requests.

The cost from the CDB could be spread among DSOs and Suppliers, although inevitably the customer is expected to ultimately foot the bill. In any case, if DSOs and suppliers would pay for the CDB there would also be additional motivation for them to ensure that the CDB being utilized efficiently, to ensure that DSO and supplier costs for the central database are covered by savings facilitated by the CDB. A logical way far DSOs and suppliers to pay for the CDB would be through licensing fees based on numbers of meter paints linked to the CDB.

An alternative view on who should pay is, however, that the costs should be socialized and passed on to customers via the tariffs of the TSOs, since DSOs and suppliers are not necessarily the only beneficiaries (other stakeholders may also benefit), and since it is predicted that even if the suppliers and DSOs pay for the CDB directly, they will also ultimately pass on the costs to customers.

Influence on regulation and monitoring

The implications to the regulator could be that during the starting phase regulators will have to spend more time on monitoring the database, but in the long run probably the monitoring of market actors will diminish.

The need of work with legislative tasks will increase during the starting phase but in the long run a common legislative base and principles could ease the workload.

Influence on suppliers

For the suppliers that want to compete in the Nordic market, this solution will make it easier to both search for relevant information about the customer and make changes to

customer data. To be able to log on to a country's CDB and make searches for the relevant customer and to place "orders" of supplier switching etc. is easier and probably less costly than with point to point communication. In this model there is no need for EDI messages between DSOs and suppliers.

The national authorities have to make strict rules for who should be allowed to update the data in the national CDBs. If the rules and the responsibilities of the suppliers differ between countries the suppliers have to learn the different rules and have different procedures in countries where they operate, e.g. there could be differences in the rights and responsibilities of updating national CDBs with customer data. Difference in the procedures is not a preferred situation for the supplier, but could probably be handled without too much work if the differences are not too complex.

Influence on DSOs

If the national authorities decide for a model 2 scenario in their country, there will have to be some adjustments for the DSOs.

Influence on Regulators

Challenges for the regulators in model 2 could be the work to harmonise rules and interfaces so that communication with CDBs in all countries is possible for the suppliers. The task of finding a common interface or a standard is not necessarily the job for a regulator, but the regulator will somehow have to be involved in such a process and maybe coordinate the work. Working out the standards and platforms for communication should happen in close cooperation with other actors that have detailed knowledge needed, e.g. TSOs. The regulator can make national decisions regarding their CDB and rules for the actors using it.

6.12 Competition

Implementing a CDB in a country might have some implications for competition between market actors, depending on how the CDB is set up. The most obvious is how and if competition between electricity suppliers is affected. Another issue is if competition between suppliers of IT solutions for DSOs and electricity suppliers is affected. In a common Nordic end user market the rules, regulations and processes should be the same in order to make competition between borders interesting for suppliers. Having different rules means that the suppliers need different data systems for different countries and this will harm the competition between suppliers.

Competition between IT service providers

Depending on which data exchange and storage model chosen the number of companies that will supply software solutions will probably vary. It is difficult to say for certain whether central storage of data and centralisation of maintenance, upgrades to the system etc will improve the competition between the IT service providers. It is important to open up for letting more companies offering IT services in a CDB and not give one IT service the whole "package". If the CDB operator could choose between the providers for different tasks, this will imply competition.

Competition between electricity suppliers

Regarding competition between electricity suppliers, implementing a national CDB could have a positive effect on the competition between them. A national CDB in each Nordic country will help the suppliers to perform their business processes more efficiently and with less effort. This change will be the same for all electricity suppliers and thereby not alter the condition for competition between them. However, a CDB would most likely increase the neutrality between DSOs and suppliers, ensuring that all suppliers have the same access to information that the DSOs are providing – such as access to meter data. This would take away the advantage that incumbent suppliers often have, regarding access to consumer data, when data is stored locally. This increased neutrality could also make it more attractive for new independent suppliers to enter the market, thereby increasing the competition.

Competition for the job of being CDB operator

NordREG acknowledges that the task of being the CDB operator might have to be a monopoly position. It is a large job to build up a CDB and to make it meet all the requirements. To have the job of running it change between companies every few years would most likely not be very efficient. By building a CDB the operator will acquire knowledge that is important for running it. And with time the operator will collect important information that can improve the operation. By changing the operator the build-up history and knowledge might disappear with the phased out company.

6.13 A single Nordic CDB or search tool model

In addition to the different models explained in the report, a Nordic CDB or search tool could also be considered as alternative solutions. Such solutions would indeed be a huge step towards a well-functioning common Nordic retail market. However, a Nordic web service search tool would require a very high level of cooperation between the Nordic regulators. In addition, harmonisation of rules, administration and financial questions would also need to be solved, and the choice of law should be clarified as much as possible in advance.

Likewise, a Nordic CDB would call for clarification of many circumstances that require harmonised regulation. The only mean to push through a harmonised regulation is by political will in all Nordic countries, since NordREG does not have any other instruments, like the EU institutions. Furthermore, compliance with EU regulation must be considered, particular with regards to the principle of non-discrimination.

The task force has estimated that these challenges are too demanding to overcome within 2015 and therefore unrealistic solutions. Hence the focus in the report has been on how to make national solutions work together.

7 Impact assessment

Well-functioning common market

Initially it should be mentioned that a well-functioning common Nordic retail electricity market to some extend rely on harmonisation of the business processes. Standardized messages, timelines etc. are critical for a well-functioning common market. As long as the business processes are not harmonised, these obstacles will form a barrier to enter and act in the retail market in other Nordic countries. However, deciding on a model for information exchange is an important step towards developing a well-functioning common market.

Model 1, the simple web service search tool solution is likely to ease the search for information in other Nordic countries if the alternative is to make phone calls or write e mails to the relevant DSOs to get the information. If the search tools are national, the supplier would have to adjust to the different national search tools. This might still be easier than phone or e mail as long as data storage is decentralised. Still it would be even easier for the supplier if the search tool was a common Nordic solution. Executing the actual business processes in a model 1 solution will not differentiate from today. Barriers, such as finding contact information on the right DSO, getting the right information and so on, that exists today will still limit the development of a common Nordic market. The progress towards a well-functioning common market would thus be very limited with a web service that only provides a search tool.

Model 2 and 3 will on this matter provide the same benefits of centralised data storage. A central database would limit the level of adjustment for suppliers who act in different Nordic countries since all communication will be handled be the CDB in the suppliers own country or in the other Nordic CDBs. This will drastically lower the number of communication partners from being every DSO to one or four CDBs. Aside from processing data requests, the CDB can handle the business processes automatically. Especially if model 2 or 3 is chosen in all Nordic countries and the CDBs can function together, the suppliers will strongly benefit from the simplification of acting on markets in other Nordic countries. Having only one national CDB to communicate with, the supplier would only give and receive information through the CDB. There would be no further need for communication beside the one with the CDB since it can handle both data requests as well as the business processes. The limited level of adjustment must be seen as an important reduction of the barriers for suppliers who act across the Nordic borders.

Improved competition

Model 1, the simple web service search tool solution provides an easier access to data because the supplier only has to communicate with the search tool in order to obtain certain information. As previously stated in the report, the access to data is essential for suppliers to carry out business processes concerning new customers. Therefore, the search tool could potentially increase the competition by making the initial phase of obtaining relevant data on new customers easier for the suppliers. Easier access to data will make the initiation of a supplier switch less costly and thereby lower entry barriers for new suppliers. Since communication will to some extend be brought into line through the

search tool, both functions will decrease the barriers for new entry on the market as well as smoothen the processes for the existing actors on the market.

However, the establishment of a search tool will not affect the subsequent processes, since the actors still have to handle the business processes bilateral, directly between suppliers and DSOs. On the down side, many steps are required for each process, which could imply that the model is time consuming. In addition, there is an increased risk of errors due to the high number of actors involved in each step. These side effects could have a negative influence on the competition. Thus Model 1 will only improve the search for data and not the execution of the business processes, such as supplier switching, moving etc.

Model 2 and model 3 will both provide a central database that presents an easy access to data for all relevant actors including end users, authorities and authorised third parties. Easy access to data for end users could improve the competition between suppliers since it makes the end user more conscious of his own consumption and better suited to make good decisions for himself in choosing supplier and contract. There should of course be rules to who should be able to see and do changes. It is natural to believe that the suppliers will have rights regarding his customer's data and that this is stated in the contract between the supplier and the customer. Besides the improved access to information, a CDB provides the function of handling the business processes. The CDB will handle the communication between the actors and thus decrease the barriers consisting of different communication manners.

Model 2 or 3 solutions with a CDB differentiate from model 1, the search tool on one crucial point; it ensures that it is possible to keep the supplier's identity unknown to the DSOs. This will eliminate the risk of discrimination between the independent and incumbent suppliers, especially if the DSOs do not receive information on the different data requests. If DSOs favour the incumbent suppliers this will give them an advantage compared to the independent suppliers and competition will not be on equal grounds.

Improved efficiency

All three models are likely to increase efficiency; however some to a greater extent than others.Model 1, the simple web service search tool will improve the search for information because it would no longer be necessary to collect information by making calls or sending emails or sending messages as would be the case if there was not a helping tool to provide this information. Model 1 would presumable simplify the procedures and at the same time save time and resources when searching for information.. However, consumption of time and manpower will not change in the subsequent phase where the communication on the business processes is done bilaterally between the supplier and the DSO. Model 2, a simple central database will - in addition to the improvement mentioned above regarding the search for information and handling of the business processes - also contain a time saving feature by the fact that it could handle some business processes automatically Chances of failure in a search because of data not being properly adapted to the web service search tool are bigger when data storage and adaptations are made by each DSO. With centralised data it is easier to achieve equal interface for all data. Executing business processes like supplier switching and moving will still require meter reading carried out by the DSO/customers for the manually read meters. Model 3, an extensive central database will in addition to the above mentioned

regarding the simple CDB solution, reduce the DSOs cost on storage of data. Model 3 is also likely to enable synergetic effects when reducing the number of databases to one. For smaller DSOs it could be an advantage that systems are standardised and centrally planned. For bigger DSOs with many integrated functions in their system and a high level of services, there might be that some of the standardisation that will be in model 3 is seen as a limitation to development and the service level towards customers may even deteriorate. The extensive CDB might also raise the DSOs cost on data system maintenance because of the complexity of the CDB containing infinite scale of functions.

If there are national CDBs it could be a challenge for those DSOs with grid and customers in two countries. To operate two systems for one DSO is not efficient.

Neutrality of DSOs

Model 1, the simple web service search tool, will help limiting the discrimination of suppliers when they turn to the DSOs with requests for customer information. This is because the DSO will not have any part of answering such request since the web service search will handle them automatically. A search tool will on the other hand not be able to be of assistance in the DSOs handling of business processes. Even with strict rules for neutrality and DSO behaviour, as long as the DSO is aware of the suppliers name there is always a risk that the DSO can use his power as a monopolist on relevant data to discriminate suppliers. As mentioned under *Improved competition* model 2 and model 3, a central database or another model containing similar rules for anonymous are the only solutions that truly ensures that the DSOs act neutral because of the ability to keep the identity of the supplier unknown to the supplier. This should be seen as a significant quality because of the harm that lack of neutrality can cause to competition.

Customer friendliness

Implementing a search tool in a market will affect the customers positively since the easier access to information for the suppliers will make the supplier switching go faster compared to situation without any helping tools and with fewer chances of disruption or failure. A search tool cannot on the other hand improve the customer’s access to their consumption history and profile. In a supplier centric model, adequate presentations of the customers’ consumption, energy prices etc should be presented by the supplier. Since the web service is not a good tool to gather consumption values, the supplier is dependent on the DSO to send or in other means represent this data in an adequate form.

A CDB could easily facilitate suppliers with relevant data, or maybe even present it directly to the customer himself. In a supplier centric end user market it is not natural that the obligation to provide the customer with information about consumption etc is put on the DSO, rather on the supplier.

Customers will benefit from a more efficient electricity retail market as well as an improvement of the competition. Besides the direct effect of the three different models the competition will increase as the common Nordic market is developed even more, since more suppliers will be able to act on each national market. Only downside for the customers are the costs resulting from making the common Nordic retail markets which will be pushed to the customers.

8 Combinations of different models - national solutions

We have mentioned the possibility of national decisions regarding choice of communication and storage model. The three models described in the report so far have been theoretical examples. Here we'll have a look at if they can work together, which will be the case if countries choose different model solutions without regards for the harmonised end user market.

Below is a table summing up some of the features of the models described.

	Model 1	Model 2	Model 3
Communication protocol	SMTP/FTP /web services	Web services	-
Format	EDI messages	EDI messages /XML	-
Storage location	Decentralised (DSO)	Centralised (CDB) and DSOs	Centralised (CDB)
Communication way	Point to point (EDI messages)	Point to centre	Centre to centre
Information exchange	One – way search tool (pull)	Two – way communication	Two – way communication

Table 3 Summary of aspects of the three models

The models described could in theory work half way together between countries as long as a common electronic standard and interface is decided on for communication. Model 1 is based on a web service search tool solution where messages are sent between the actors point to point. There are at the moment three relevant communication protocols for sending these messages; SMTP is the main transport platform for data exchange in Norway, Sweden and Denmark (at the moment), FTP is the main transfer protocol in Finland and web service will be the main transfer protocol in Denmark once the data hub is in place.

The search tool model 1 is able to retrieve data from databases if data formats and communication interfaces are right. This means that the function of returning information to a supplier that made the request is possible both with decentralized data storage and from a CDB. Still there has to be message exchange between DSOs, suppliers and CDBs in order to handle the business processes.

For the communication of messages to work point to point or point to centre (for Denmark) there has to be an agreement to a common communication protocol. As it is today the web service protocol and SMTP does not "speak" together. Even if the protocol is the same, as it is in Denmark, Norway and Sweden, there has to be strict rules to prevent national variations in how to use the messages (today there are national variations that require adjustments when sending messages across borders).

In addition to the same communication protocol it is also important that responsibilities of the suppliers and business processes are the same for the supplier whether the supplier is in contact with the CDB or a DSO.

For suppliers stationed in a country with CDB, it would be more bothersome to make use of a search tool to get the relevant information in all DSOs databases than logging on to the CDB. For the suppliers in a country with central data storage performing business processes in other countries will not seem so lucrative. Suppliers with customers in countries with decentralised data have to take into account the web service search function even if they have no use of it in their own country with centralised data. For a supplier to have to relate to different IT solutions is costly and not desirable. Another solution is to build in a function in the CDB so that the CDB can perform the search for customer and metering data towards all databases in the Nordic countries.

A model 3, where there is no local storage and messages are sent within the CDB by the actors when they log on to the CDB there is no need for point to point communication as with model 1. There is also no need for point to centre communication with messages as in model 2. For a supplier that originates from a country where messages and information flow all happens within the CDB, having to communicate with a point to point or point to centre message will be an extra cost. This could mean that suppliers from countries with decentralised communication are more interested to open up a business in a country with centralised communication than the other way around. If this is true it will be a hindrance to harmonisation when countries choose different models.

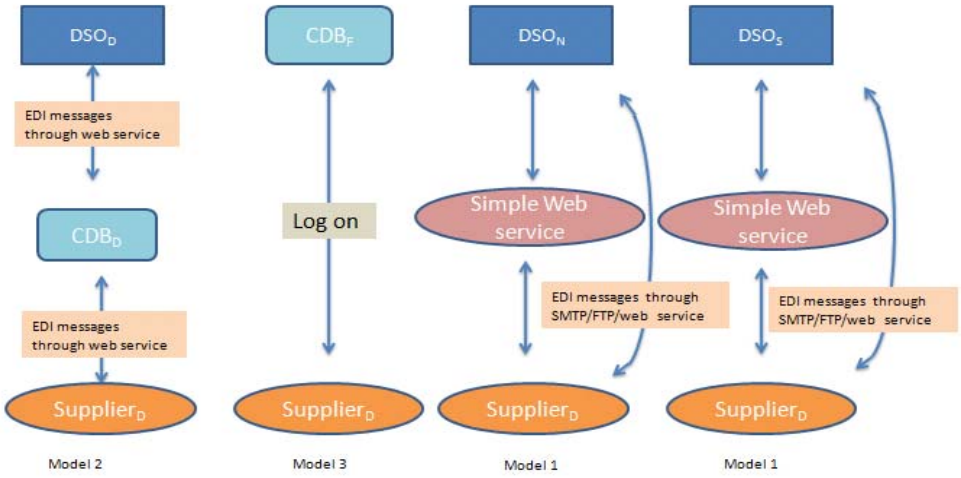

Figure 7 Combination of national solutions

In Figure 7 Combination of national solutions, we try to illustrate a market where all countries have chosen different models. A situation is described where Norway and Sweden have decentralized data storage and a simple web service search tool (model 1), Denmark has a CDB combined with local storage (model 2) and Finland has a CDB without any local storage (model 3). In the example, the supplier is originally from Denmark.

The supplier can log on to both CDBs in Denmark and Finland and easily search for information. In Finland the supplier can exchange messages within the CDB about his Finish customers. The search tools can retrieve data from all DSOs databases and make the supplier able to find the necessary data about his customers in all countries. This is not a desirable situation for the Danish supplier though because he has to install the functions for integrated web service search tool or at least use the log on site at Internet for customers in Norway and Sweden and it is likely that he doesn't want to pursue expanding his business in these countries.

We see that in theory national solutions can exist with the described models, but that this is not promoting harmonisation.

If there are national CDBs it could be a challenge for those DSOs with grid and customers in two countries. To operate two systems for one DSO is not efficient.

If all countries choose the same model the harmonisation process will go easier. One of the advantages is that it is easier to make common rules for business processes. Below there is a figure describing a situation where all countries choose a model with centralised data storage. One of the advantages of this solution is that there can be made common rules for the CDB and what processes it should be able to perform. For instance can there be put on the CDB to have a gateway or communication with the other CDBs. As we have stated earlier it is important to the supplier that his operations connected to business processes for his customers in all countries are as similar as possible. A solution for how this could work is shown in the figure below. Here the responsibility for transferring the message from one CDB to another is put on the CDB operator. If there are slight differences in message format etc this gateway between the CDBs could also work as a translator of formats and perform message controls. This organisation is to be preferred to a solution where the supplier has to communicate with all the nations CDBs.

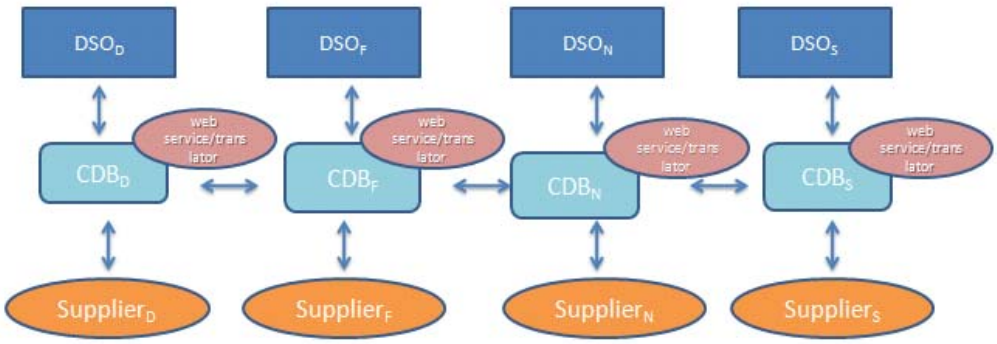

Figure 8 CDB communication between countries

9 Conclusions

The goal of the harmonisation of the Nordic end user markets is to harmonise the processes to an extent that makes it easy for suppliers to establish their business across borders. The aim is to find a solution for information exchange that allows one supplier to be able to face the same way of handling business processes, have the same responsibilities in all the Nordic countries and be able to invest in an IT system that could communicate in all countries. The aim of this report is to present some basic models for information exchange in a Nordic market. The models listed could be used as templates for developing better information exchange systems in a harmonised market.

The next step in the work to facilitate a common Nordic end user market will be to analyse the individual business processes in more detail and make recommendations on these. Specific attention should be put on the issue of roles and responsibilities in relation to back office processes in order to complement to the previous NordREG report on rights and obligations in the customer interface. Once that work has been concluded it will be relevant for NordREG to study the best way to organise the information exchange on a Nordic level.

NordREG reiterates the previous statement that the data exchange in the common Nordic retail market should be carried out according to the following principles:

1. The data exchange should be designed to support one harmonized Nordic solution for each business process.

2. The data exchange should be designed so that the best solutions are used.

3. The data exchange should be as future proof as possible with regards to all presently known technical, political and regulatory aspects (e.g. EU).

4. Data exchange rules should be coordinated on a Nordic level and regulated nationally.

5. Data exchange rules should clearly define who is responsible for the data throughout the data exchange – including data quality accountability and data creation/updating/reading and deletion rights.

6. Data exchange rules should clearly define the financial accountability for poor data quality - including actor compensation and conflict resolution method.

7. Data exchange rules should include instructions on data format and content validation of all messages exchanged.

8. Data exchange rules should include instructions on how to treat deviations so that handling of commonly occurring exceptions can be automated in IT systems.

9. Data exchange rules should be designed with IT system performance in mind.

10. The new data exchange rules should be scheduled to allow for sufficient time for process and system design, specification, coding and testing.

9.1 The need for similar models in the Nordic countries

NordREG sees that if all Nordic countries choose the same model, or very similar models, the business processes across borders will work smoother. A conclusion drawn from the work with this report is also that even if not all of the Nordic countries choose to have a national central database (CDB) where suppliers can place requests for supplier switching etc. there has to be a tool, such as a single web service search tool, that aids suppliers when they need to get relevant customer information in order to carry out a supplier switch etc.

Isolated national decisions about the future information exchange might result in a situation where we will have both national CDBs, point to point communication and a search tool on top to help in the exchange of customer data (as in Figure 7 Combination of national solutions). Isolated to a national evaluation, each solution could seem efficient given the relevant country's starting point, but if we view the market from a pan Nordic perspective, the solution might not be the most efficient and cheapest way of organising the data exchange.

Different models for the Nordic countries will imply higher costs measured at Nordic level, since this means parallel operation of many different systems that are costly.

9.2 Responsibilities should be the same

To avoid entry barriers and to facilitate a common Nordic market it is essential that the responsibility for customer data and processes is the same between the countries. This means that suppliers should have the same responsibility no matter which country they operate in. If not all countries have the same communication model it is more likely that there are differences in responsibilities.

Different models handle business processes differently. The degree of automation in the processes is one factor that will affect how long time that is needed to perform a certain process like e.g. supplier switching. If timeframes are to be harmonised in a market where there are many different models, this might lead to that timeframes are set according to the slowest model, which is not an optimal solution.

The mentioned arguments speak for one common model for communication and storage of data.

The situation today is that all Nordic countries have a system for communication that works nationally. It is likely that all of these systems will need some degree of improvement in the years to come. The Nordic countries are at different stages in development of business information exchange systems so to make all countries stop national plans and agree to one communication model for information exchange is not easy.

9.3 Reaching a common Nordic solution

There are many ways of approaching a Nordic harmonisation. One way is to negotiate and decide on a detailed model for all parties and then set a date in the future for the implementation. This is an easier method when there is one single authority to make sanctions towards the party who is not obeying the joint decision on implementation or is delayed in the process. If one or more of the countries decide not to follow up a joint Nordic decision on information exchange model there are no sanctions.

Another solution is to suggest harmonisation on smaller areas and in time get closer and closer to a harmonised market. If this solution it is chosen, it is likely that the harmonisation process will be slower compared to the previous solution and stakeholders might face a situation where there is more than one model of information exchange for a period of time. If we adjust these models or introduce helping tools in order to have a functioning information exchange between DSOs and suppliers in all countries we might end up with a situation like in Figure 7 Combination of national solutions.

Even though ultimately each country has the privilege of taking national decisions on communication regime and model, there are reasons to believe that the same solution for all countries will make the harmonisation more complete.

When making national decisions about the future setup of information exchange it is essential that it is coordinated and compatible with other national systems within the Nordic market. Each nation should look to NordREG recommendations in the developing process.

Looking at today and how information exchange is handled in the Nordic countries, we see that Denmark has decided on a central database solution, whilst all other countries have decentralised data storage and national rules regarding message exchange.

NordREG recognises that national development of efficient and automated information exchange towards common Nordic information exchange is already taking place, primarily in Denmark where a data hub will be launched in 2012 but also in Norway there are plans of making rather substantial changes to the information exchange model. This leaves Sweden and Finland without any concrete national plans on investigating a solution for a central database. NordREG recognises that there may be different prerequisites for making decisions on future data exchange in the Nordic countries[13].

NordREG therefore recommends the Nordic countries to nationally investigate what information exchange solutions that should be implemented and developed in each country to facilitate a common Nordic retail market. National plans should then continuously be coordinated on a Nordic level. When making national plans for information exchange systems one essential aspect is to allow foreign suppliers to come into the market without being affected by high costs when adapting to the national data exchange. The chosen data exchange models must not in any way distort competition, especially between national and foreign suppliers, in a common Nordic market.

[13] This is partly due to that DSOs and suppliers in the Nordic countries are at different stages in investment cycles, depending on national plans to roll out smart meters.

9.4 Suppliers should face the same prerequisites in the different countries

To harmonise the market and make it attractive and possible for suppliers to operate in all Nordic countries, there should not be more than one interface in the supplier's procedure of retrieving and providing the relevant data in a business process. In order to minimize cost for the suppliers the national solutions should ensure that only one system is required for the market actors on the Nordic market without costly country specific adjustments. This was also stated by NordREG at the beginning of the common retail market project as being one of the most important principles of the project.

The TSOs and industry should work together in the Nordic market to agree on a common interface for a web service search tool or/and CDBs. The regulators should have a coordinating role in this. Common rules for message format and content should be made.

Each country should analyse what possible ways there are of moving towards a Nordic solution for the issue of data storage and communication. The goal should be to arrange a solution that will work well in a harmonised Nordic end user market.

In addition to the same technical interface the suppliers should face the same rules related to the business processes.

For all practical purposes the best alternative might be if all countries go for the same solution, but feasibility of the solution needs to be evaluated nationally.

All models are doable, but as mentioned before, maybe not desirable all at the same time. Denmark has already decided on a data hub which is a form of model 2.

9.5 Conclusions about data exchange models

Although this report is mainly focussed at presenting some fundamentally different models for data exchange there are some conclusions that could be drawn from what we know at this stage:

- **It seems preferable to arrange communication between a few parties like central databases compared to bilateral communication between hundreds of DSOs and suppliers.** It is apparent that bilateral communication between each market actor would be very complex when considering the hundreds of suppliers and DSOs on the Nordic market. Therefore bilateral communication would not be a suitable solution to facilitate a market that is easy to operate in for suppliers.
- **A web service search tool seems easy to operate and may represent a smaller change from today's system than the CDB[14].** In Norway, Finland and Sweden the current system for information exchange is built upon the fact that data is decentralised. Thus it would appear as if the implementation of search tools in these countries would require fewer changes compared to implementing CDBs. This search tool alone is not enough to reach harmonization in the end user market, since it does not affect the actual business processes. Further

[14] This conclusion does not apply for Denmark where a CDB will be launched during 2012.

harmonisation about switch of supplier, exchange of meter data and more is needed if model 1 is chosen.

- **DSO neutrality is a priority for the common market and it appears as if a CDB may offer a good solution for this.** In order to achieve a well-functioning supplier centric market with a high degree of competition where the DSO role is limited to market facilitation it is essential that the DSOs act in a neutral way towards suppliers and energy service companies. The Danish implementation of the CDB in 2012 will mean that the DSOs will have no knowledge about which supplier each customer has chosen. From a neutrality point of view this is an excellent solution. Given the information that is available at this time it seems easier to arrange for this kind of anonymity solution within a CDB compared to other information exchange models.
- **The preferred organisation for harmonisation is if all countries go for similar models.** If all Nordic countries choose the same model, or at least very similar models, the business processes across borders will work smoother since the need for suppliers to adapt to national solutions when establishing business across borders will be minimised.

10 Annex

National studies related to central databases

Denmark

A working group consistent of representatives from the Danish Energy Agency, Danish Energy Association, the Association of Energy End Users, the Danish TSO, Energinet.dk and Danish Energy Regulatory Authority came with a report April 2009 on considerations regarding a register for master data and a datahub for administration of data in the Danish electricity market. A majority of the working group recommended a datahub as the most efficient and future-safe solution from both a national point of view as well as in perspective of the goal on a common Nordic retail electricity market.

Norway

In Norway NVE has made a report on Common IT solutions in the Norwegian electricity market. The report is written by consultants from THEMA and Devoteam Davinci.

The report is written purely from a national perspective and does not have the Nordic harmonization as a premise for the results, although the features of the different models described are also evaluated in case of a common Nordic market. The report is looking at both a search tool solution (NUBIX) and different centralised data solutions.

Sweden

During 2004 a report was written that, among other things, suggested that a central register of metering points should be established (SOU 2004:129, see chapter 7 in http://www.regeringen.se/content/1/c6/03/66/35/2979c4b0.pdf). In the following government bill and in the decision of the parliament it was decided not to establish such a register (government bill: 2005/06:158). One reason for that was the (just) started work of establishing EMIX (*Energimarknadens Informationsväxel i Sverige*).

The report from 2004 suggested that the register should have the following information for each metering point (only exit points): the DSO, supplier, balance responsible party, metering point ID, organization number or personal number of the customer and the date and time when the information was registered (see SOU 2004:129, chapter 7.2, link above, and 20.1 http://www.regeringen.se/content/1/c6/03/66/35/cc9267b4.pdf). In the report also a communication center (*kommunikationscentral*) is presented as an extension to the central register. But the suggestion was not to establish this communication center as a first step since the register was expected to solve most of the problems (in 2004) related to the change of supplier process. The communication center could be a second step. In such a system also the metered values, several functions of control and calculation modules could be added. Examples of such modules could be about losses, load profile shares, national balance settlement, settlement between actors and invoicing of customers (cit. p. 266).

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