

Ei R2015:15

# An information management model for the future Swedish electricity market

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The Swedish Energy Markets Inspectorate R2015:15  
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# Foreword

The Government has decided that the Swedish Energy Markets Inspectorate (Ei) is to propose a general framework for an information management model that it considers the most suited to future conditions in Sweden.

The functioning of the electricity market is dependent on effective information management and information exchange between the actors on that market. The flow of information, the actors involved and their roles and areas of responsibility determine which information management model we need, and the choice of information management model very much defines the basic conditions for the end-user market.

The proposal that Ei submits in this report entails Svenska kraftnät's establishment of a central information management model, a service hub, for the Swedish electricity market. The exact design of the hub should be investigated further by Svenska kraftnät. One important issue to investigate in this context is whether data should be stored centrally at Svenska kraftnät or decentralised among the actors.

As part of the work, Ei has obtained the views of representatives for Svenska kraftnät, the Swedish Energy Agency, electricity grid operators, electricity suppliers, consumer organisations, energy service companies and IT suppliers.

The introduction of a central hub will to some extent alter roles and responsibilities on the electricity market. For this reason, it is important for Ei to investigate the extent to which current regulations may need to be amended so as to allow the introduction of a hub.

Eskilstuna, June 2014



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# Summary

The Swedish Energy Markets Inspectorate (Ei) has been tasked by the Government to propose a general framework for the information management model that it considers suited to the future Swedish electricity market. This commission directs Ei to propose an appropriate division of responsibilities between actors and whether the model should be regulated. The choice of future information management model is crucial to meeting future challenges on the electricity market. An important part of this is how and at what pace the regulations for an electricity supplier-centric model will be able to be implemented.

The information management model and its processes determine how information is made available among the various actors on the electricity market. It controls what information is sent when a customer chooses to move or switch electricity supplier. Furthermore, it determines the accessibility of meter values and other information. The information management model is thus central to the functioning of the electricity market.

## **Developments on the electricity market place increasing demands on information management**

The Nordic and European electricity markets will see increasing harmonisation and integration. The work towards a Nordic end-user market and Nordic Balance Settlement are concrete projects that are imminent. In the longer term, harmonisation will also take place at the European level. It is reasonable to assume that the EU's fundamental rules on free trade will also apply to the end-user market for electricity.

As a result of a greater need and increased demand, the market will also see development in the form new types of actors, such as energy service companies, entering the market and offering services to electricity customers. This will contribute to increased demands regarding the accessibility of meter values and other information. It is therefore important that actors gain efficient access to relevant information. Communications and processes will have to be much faster than today in order to support more services and to allow an electricity supplier-centric market model where electricity suppliers will be able to provide the customer with more and more information. At the same time, the requirements to protect customer privacy will probably increase, as will the requirements for IT security.

Furthermore, there will be increased demands to the effect that only the actor needing a certain type of information should have access to that information. Meanwhile, there is discussion on the future role of electricity grid operators and on increased demands on separation between monopoly activities and competitive activities in order to ensure competition on equal terms.

## **Today's information management model is not sustainable in the long term**

Despite certain problems, today's *all-to-all* model for information management functions relatively well under the conditions that prevail at present. However, today's model will not satisfactorily correspond to future demands that will be placed on the electricity market.

In that the all-to-all model is based on bilateral communication between market actors, there is also a built-in risk of discriminatory behaviour on the part of grid operators vis-à-vis operators on the competitive market. In addition, today's model does not sufficiently support an electricity supplier-centric model. The information that electricity suppliers need to act in an electricity supplier-centric market model is not sufficiently easy to access. The many contact points in the all-to-all model represent an unnecessary barrier to entry for new actors, which impedes the integration of end-user markets. Over time, it will be far too costly to develop the all-to-all model for future needs.

## **A central service hub will yield significant economic gains**

The investigation has included a cost-benefit analysis that compared the introduction of a service hub with central storage of information with the further development of today's all-to-all model. The analysis shows that a service hub has significant economic gains. 16 different outcomes were developed, all showing a significant economic surplus over a ten-year period if a hub is implemented. The mean value shows a surplus of SEK 1.9 billion. The span between the lowest and highest gain ranges from a surplus of SEK 330 million up to a surplus of SEK 3.5 billion. Ei assesses the results to be sufficiently robust to conclude that the implementation and operation of a service hub over a ten-year period is far more economically advantageous compared with developing today's information management model.

Large parts of the cost savings in a hub solution compared with the further development of the all-to-all model derive from the fact that much of the management of grid settlement, customer service, moving, supplier switching and, to some extent, billing can be managed centrally, rather than being performed by each individual grid owner.

## **Ei proposes a service hub – a future-proof choice**

A central service hub is the information management model that is most suited to future Swedish conditions and should therefore be introduced.

### **The hub ensures non-discrimination**

The hub serves as a firewall between monopoly activities and competitive activities and ensures non-discriminatory behaviour on the part of the grid owners vis-à-vis electricity suppliers and energy service companies. This means competition-neutral access to meter values and other customer information.

### **A service hub facilitates the efficient implementation of an electricity supplier-centric market model**

A service hub facilitates a Nordic and, eventually, a European end-user market by making it possible for electricity suppliers to obtain quick access to all relevant electricity market information via one contact point. It lowers the entry barrier for electricity suppliers and energy services companies wishing to establish themselves in Sweden.

A service hub also reinforces an electricity supplier-centric market model by providing the electricity supplier with quick and efficient access to customer data, such as electricity consumption and installation information. It enables the electricity supplier to give better service to the customer, for example, by implementing moves and supplier switches in real time.

### **Use of the hub should be mandatory**

To ensure competition on equal terms and to ensure society's streamlining of the electricity market, there should be regulations requiring electricity grid operators, electricity suppliers and balance responsible parties to use the service hub to implement the basic processes on the electricity market.

### **More effective supervision**

A centralised management of central electricity market processes (such as meter value reporting and supplier switching) allows continuous monitoring of compliance with the regulations. Compared with other information management models, it is easier to set requirements regarding information provided to a service hub (including frequency and quality) and to verify compliance with these requirements. Centralisation allows Ei to pursue a more effective supervision of compliance with the regulations governing the market's central processes, something which is important to the functioning of the market.

### **Customers should have access to information about their consumption and their contract**

The hub should make it possible for customers to go to the electricity supplier's website to view their own meter values within a reasonable time, access information about the existing electricity supply contract's expiry date and whether customers will suffer a penalty fee if they break their contract prematurely<sup>1</sup>.

### **Improved management of power of attorneys**

The service hub should make it possible for customers to access and manage (register, update and delete) active power of attorneys that the customer has given to actors on the electricity market. There should be regulations requiring all electricity market-related power of attorneys from customers to electricity suppliers, energy service companies, etc. to be registered in the hub. Such requirements ensure that customers are kept informed about which actors can gain access to their information.

### **No customer interface in the hub**

Access to power of attorneys and other information should in the first instance

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<sup>1</sup> However, information on the actual cost of breaking the contract need not be visible to the customer.

take place through customers logging in on their electricity supplier's website, which in turn has a direct connection to the hub. A solution of this kind reinforces the electricity supplier-centric market model compared with creating a customer interface directly in the hub.

#### **Nordic Balance Settlement facilitated**

The introduction of the proposed service hub means that Nordic Balance Settlement can be implemented without the grid owners needing to make costly investments in their IT systems. The reconciliation settlement can be done in the hub instead of by each grid owner.

### **Svenska kraftnät should develop and operate the hub**

Svenska kraftnät (SvK) should be commissioned by the Government to develop and operate a central information management model, a service hub, for information management on the Swedish electricity market. SvK's commission should take place in consultation with Ei. At the same time, the Government should commission Ei to investigate what regulatory amendments are needed to enable the introduction of a service hub in an electricity supplier-centric market model with the functionality described in Chapter 6.5. Ei's commission should take place in consultation with SvK.

Ei assesses SvK to be an appropriate principal for a Swedish hub because SvK is an impartial market actor that also has an authority role. SvK is also well placed to take stock of current and future market changes, giving it opportunity to coordinate parallel changes on the Swedish electricity market, such as an electricity supplier-centric market model, Nordic Balance Settlement and also, if so decided, the introduction of a service hub.

#### **Central or decentralised storage of meter values and other information**

Ei's assessment is that SvK should be commissioned to investigate the design of the hub's technical specifications, including whether it is most appropriate to organise the storage of meter values and other information centrally at SvK, or if the information should continue to be stored in a decentralised manner, and to guarantee access through the central service hub.

### **The hub will manage the basic processes**

The service hub will manage and perform the basic processes and functions on the electricity market; installation start-up, moving in and out, supplier switching, updating installation data and customer data, service requests from electricity suppliers to electricity grid operators, meter value management, disclosure of meter values to energy service companies with which the customer has a contract, settlement data for Nordic Balance Settlement, correction settlement, billing and compilation of statistics and reports on the aggregate level.

Furthermore, the hub should also manage information that helps customers to be active on the market and have confidence in it. This includes access to historical meter values, centralised management of customer power of attorneys as well as information on the expiry dates of electricity supply contracts and fees for breaking

them. This information will be available via the website of the customer's electricity supplier.

## **Implementation will involve the actors concerned**

As with the future development of a service hub, Svenska kraftnät's investigation should be performed in close dialogue with the relevant authorities<sup>2</sup> and with industry and customer representatives.

Ei estimates that, after a decision, it will take three to four years to establish a service hub in Sweden. If further investigation reveals that it is possible for Svenska kraftnät to connect to an existing service hub, it is Ei's assessment that Swedish implementation will probably be able to be speeded up considerably.

A transition to the combined billing of electricity supply and electricity grid should be coordinated with the implementation of a hub.

A decision to introduce a service hub for the Swedish electricity market means that Nordic Balance Settlement can be implemented according to the plan developed by the Nordic system operators.

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<sup>2</sup> The Swedish Energy Markets Inspectorate, the Swedish Data Inspection Board, the Swedish Energy Agency, the Swedish Consumer Agency, Statistics Sweden and the Swedish Competition Authority

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# 1 Introduction

The functioning of the electricity market is dependent on effective information management and information exchange between the actors on that market. The flow of information, the actors involved and their roles and areas of responsibility define which information management model the market has. Today's information management model on the Swedish electricity market can be termed an all-to-all model, in which the actors involved have direct communication with each other.

At present, there are many parallel projects and initiatives aimed at bringing change to the electricity market. We are moving towards an electricity supplier-centric market model, Nordic Balance Settlement and greater Nordic and European market integration. At the same time, demands are being made regarding more efficient energy use and more frequent metering of consumption. Another important and increasingly discussed question, especially at the European level, is that of separation between grid operations and competitive activities.

In all these issues, the question of information flow and who has access to what information is central. Consequently, the choice of information management model and the way in which information is made available among the various actors on the electricity market is crucial.

In Sweden, this question has largely arisen due to the planned transition to an electricity supplier-centric market model and greater Nordic harmonisation, whose aim is a common Nordic end-user market and common balance settlement. It is in light of these developments that Ei has been commissioned to propose a general model for information management.

## 1.1 Commission

In its appropriation directions for 2014, the Swedish Energy Markets Inspectorate has been assigned the following commission:

In the work towards a Nordic end-user market and its implementation, the choice of a future information management model is crucial to how and at what pace the regulations for an electricity supplier-centric model will be able to be implemented. An electricity supplier-centric model demands efficient access by electricity suppliers to the information they need to provide fast and accurate information to their customers. A central information management model, to which actors report and refer relevant information, facilitates and reduces costs for electricity suppliers wishing to act on the market. In addition, an information management model makes it possible for new market actors, even outside the energy industry, to enter the electricity market. The Swedish Energy Markets Inspectorate is to propose a general framework for an information management model that it considers the most suited to future conditions in Sweden. The proposal shall include an appropriate division of responsibilities between the

electricity market actors as well as recommendations regarding the extent to which the model should be regulated. A report on the commission is to be submitted to the Government Offices (Ministry of Enterprise, Energy and Communications) no later than 13 June 2014. The report may, by special agreement between representatives of the Government Offices (Ministry of Enterprise, Energy and Communications) and the Swedish Energy Markets Inspectorate, be presented on a date other than that stated here.<sup>3</sup>

## **1.2 Project organisation**

The project was implemented by project manager Daniel Norstedt and project members Marielle Liikanen, Johan Nilsson and Kenny Granath.

## **1.3 Implementation**

The Swedish Energy Markets Inspectorate's investigation is based on information from a variety of sources, including a cost-benefit analysis by the consulting firm Sweco (see Chapter 5), a questionnaire survey via the Ei website in February-March 2014 and bilateral meetings with industry representatives.

### **1.3.1 Criteria**

Ei has set a number of criteria for assessing the information management model that is most appropriate. The criteria are presented below:

The chosen information management model must support good competition on the electricity market. An effect of the chosen model should be guaranteed competition among both electricity suppliers and energy service providers. The model must also facilitate the entry of actors that are not currently active on the Swedish electricity market.

Competition on the electricity market may not be distorted by the chosen information management model. Actors within the same group as the data owner (grid operator) may not be favoured. Similarly, actors choosing only to act in Sweden may not be favoured at the expense of foreign actors wishing to operate in Sweden. It must be easy for new actors to establish themselves on the electricity market.

The model must lead to cost-effective processes. All costs and the costs of all actors must be taken into account.

The chosen information management model must be flexible. The model may not prevent actors from developing new services on the electricity market. As the electricity market develops, the model must be easily adaptable to new conditions. The model must be "built for the future". The model must support the emergence of new business processes on the electricity market – e.g. micro-generation, energy efficiency services and demand management.

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<sup>3</sup> Commission 2 of Appropriation directions for the budget year 2014 regarding the Swedish Energy Markets Inspectorate in expenditure area 21 Energy

The chosen model must ensure good opportunities for the relevant regulators to exercise supervision over existing and future regulations.

At present, there are a number of requirements on market actors that are directly linked to their information management. There is reason to assume that in addition to current requirements, the future may see the introduction of further regulations covering how and at what speed information management on the electricity market must take place.<sup>4</sup> To ensure compliance with these regulations, it is important that the relevant authorities can exercise fast, efficient and proper supervision.

The chosen model must ensure that it is easy for actors to gain access to high-quality data in a usable form.

The chosen model must ensure that all customer information that is collected, stored and distributed is under the customer's control. It must only be possible to disclose this information to actors if the customer expressly consents to this. However, short of disconnecting from the electricity grid, customers will not be able to prevent a certain limited dissemination of basic data needed by electricity suppliers and other actors for billing purposes. Customers must be kept informed about what kind of data is collected, how it is used and the actors that can access it.

### **1.3.2 Commission focus and delimitation**

The starting point of the project is the assessment made in the Swedish Energy Markets Inspectorate report *Easier for the customer – proposals to improve the conditions for a Nordic end-user market* (Ei R2013:09). In the report, Ei notes that

*"... the current bilateral information management model will not be fully capable of meeting the demands that will be placed on the future electricity market. In light of this, and supported by analysis from Denmark and Norway, Ei believes that there are reasons in favour of centralising the information management model."*

With reference to this assessment and the government commission, the project is limited to encompass only a centralised information management model. Consequently, the project will not investigate decentralised information management models, with the exception of the cost-benefit analysis in Chapter 5, where comparison is made with today's decentralised information management model.

The report refers throughout to the term *service hub* for what in many cases is termed *data hub*. A service hub acts as a central point for the exchange of information between the electricity market actors. Market actors implement moves, supplier switches and other central processes directly in the hub. A service hub may have central or decentralised data storage. In the case of decentralised storage, it is primarily electricity grid operators that are responsible for storing meter values and other information. In the case of central storage, market actors supply

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<sup>4</sup> See Chapter 3 for a more complete description

meter values and other information to a central warehouse organised by the body in charge of the service hub.

## 2 Information management on the electricity market today

Today's information management model on the Swedish electricity market can be termed an all-to-all model, in which the actors involved have direct communication with each other (see Figure 1). This information management is characterised by a high degree of decentralisation in which data is primarily stored and managed in the actors' own IT systems.

It is very important to the functioning of the electricity market that the flow of information between market actors operates efficiently. The actors on the competitive part of the market, such as electricity suppliers and energy service companies, are dependent on having access to relevant information on their customers' electricity consumption from electricity grid operators. This may, for example, relate to information on historical consumption in order to advise customers on their choice of electricity contract or as the basis for other energy services such as helping customers to make smarter use of energy. Timely access to accurate meter values is also important for billing customers.

### 2.1 Information management is central to the functioning of the electricity market

At present, information management on the electricity market is built around a solution that uses the EDIFACT standard<sup>5</sup>. Communication between actors takes place via e-mail messages sent directly to each individual actor in a system called EDIEL. Information flows between the actors and is stored locally by the party needing that information in its operations. However, the vast majority of original data is stored by the grid owners, which are thus the primary source of all information that needs to be exchanged between the parties in order to perform the processes of the electricity market.

Locally, the grid owner only holds data relating to customers, installations and meter values within the grid owner's grid area. For this reason, electricity suppliers operating across the entire country have more than 160 parties to communicate with in order to manage their customers. Similarly, most grid owners have a large number of electricity suppliers and balance responsible parties to which they must supply meter values. Quality and accessibility in today's information management model are therefore largely controlled by how well the different systems of the actors and their agents function and communicate with each other.

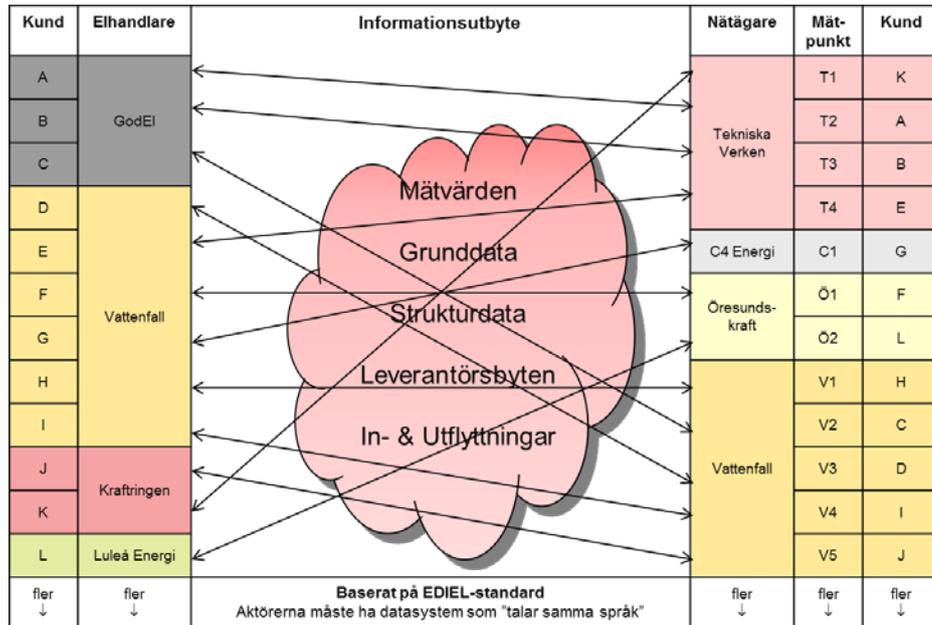
For example, a supplier switch begins with the electricity supplier sending a message to the grid owner that it has agreed an electricity supply contract with a customer. The grid owner checks the information (installation ID, etc.), and if this

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<sup>5</sup> An international standard for the exchange of electronic information developed by a United Nations body

is correct, the grid owner sends a message back that the switch has been registered. This message also contains some basic information about the customer's installation, name and address, meter details, settlement method, reporting frequency, etc. At the same time, a message is sent to the previous supplier that its supply is to cease.

Figure 1. An information model based on all-to-all communication



Source: Sweco

The corresponding also applies when a customer moves to a new home. The grid owner currently has primary responsibility for managing moves. For this reason, the moving customer contacts the grid operator, which registers the move. This might solely relate to moving out or to moving in if customer moves from/to the grid owner's grid area. In many cases, however, the move is within the same grid area, which means that both moving out and moving in are normally managed on the same occasion. The grid owner then sends a message to the electricity supplier that the customer is moving out, which normally also means that the electricity contract ceases. A customer signing a new electricity contract in connection with moving in means a message from the electricity supplier that it will be starting up supply to the installation in question from the date of the move. This message has to be checked and answered by the grid owner in the same way as for a supplier switch.

If the customer does not sign a new electricity contract before the date of the move, the supply is passed on to an assigned supplier. The grid owner then sends a message to the assigned supplier that it has a new customer. The message is in principle the same as those to other suppliers, the difference being that it has not been preceded by any incoming message from a supplier. All these events also require the grid owner to send the meter reading for the day of the switch to the electricity supplier.

In practice, reality is not so streamlined that everything works perfectly. Sometimes customers change their mind about switching supplier, about the moving date or about moving completely. These are examples of situations that complicate the flow of information because the process has to be reversed and the information withdrawn among several parties. Relatively often, this leads to errors, creating quite a lot of work that has to be done by hand.

There are also other events entailing the exchange of information between grid owners and electricity suppliers. These include meter changes, changes to installation data, a customer's death, the electricity supplier switching balance responsible party and when the electricity supplier cancels a contract.

The vast majority of the message flow consists of meter values for individual metering points sent from the grid owner to the electricity supplier to enable it to bill the end user. For hourly settled metering points, this is normally sent every 24 hours, while for profile-based settlement, it is sent once per month.

The grid owner must also report data for balance settlement to Svenska kraftnät.<sup>6</sup> This means that the grid owner must aggregate total consumption per hour for hourly settled customers per balance responsible party and supplier. Total consumption per balance responsible party is sent daily to Svenska kraftnät (eSett). Both the total per balance responsible party and per supplier is sent to the balance responsible party. Reporting is in principle the same for volumes produced.

The grid owner calculates the basis for profile-based settlement in the form of preliminary load profile shares per balance responsible party and supplier. These are sent once a month to Svenska kraftnät and balance responsible parties with the same distribution as for hourly settled volumes. Two months after the current month, the grid owner then calculates the final load profile shares, which are sent to Svenska kraftnät that implements the final settlement with balance responsible parties, known as reconciled energy.

The grid owners also normally manage the reporting of volumes produced, which forms the basis for the allocation of electricity certificates and guarantees of origin. This is also reported to Svenska kraftnät, but parallel to the settlement data to another system (Cesar). However, for some production plants, this reporting is performed by service providers. Electricity suppliers declare consumption that is linked to their electricity certificate obligation directly in Svenska kraftnät's system, Cesar.

Under current regulations, end users have the right to be sent meter values per hour if they have a contract for electricity supply per hour. The grid owners are therefore required to send the hour series that customers request to be sent to them. Most commonly, these are sent to a service provider, which processes and refines these meter values in some way for the end user.

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<sup>6</sup> In the future, eSett Oy will manage balance settlement in Finland, Norway and Sweden

## 2.2 Division of responsibilities

Today's reporting requirements are linked to the electricity grid operators' statutory obligation to carry out metering on behalf of a third party. This includes:

- a) Basic data collection: Metering and collection of meter values, quality assurance and onward delivery of meter values.
- b) Basic electricity market services (services that must be exercised in order for the electricity market to function): Data for balance settlement, data to electricity suppliers for billing and the supplier switching process.

Today, meter value management is regulated in Acts, Ordinances and regulations. Ei's metering regulations<sup>7</sup> set requirements regarding the information that electricity market actors are to exchange with each other, for example, in supplier switches and when an electricity customer moves. There is also a requirement for information management to take place electronically using the Ediel message format, which is a common EDI standard<sup>8</sup> developed by Svenska kraftnät in cooperation with system operators in the other Nordic countries. The metering regulations govern the overall information to be exchanged, but not the specific content of all messages. Information to be exchanged can be found at the end of this report in Appendix 1.

### 2.2.1 The public utility Svenska kraftnät

The system operator Svenska kraftnät (SvK) monitors the Swedish national electricity grid and ensures that there is always a balance between electricity consumption and production. SvK is responsible for balance settlement and thus has the opportunity to place some general requirements for how reporting is done in practice. This includes the fact that reporting is done in accordance with Ediel protocols and that all metering points have been fitted with a unique installation ID in the form of an EAN code. Svenska kraftnät also manages a limited register of actors via [edielportalen.se](http://edielportalen.se). This register consists of information about electricity market actors using Ediel protocols for communication. The public information published is actor type (grid owner, supplier, system supplier), Ediel ID, SvK ID, contact and address details, and whether the actor is a balance responsible party and for which company.

### 2.2.2 The Swedish Electricity Market Manual

The regulations for information management using Ediel are developed by the electricity market actors and published in the Swedish Electricity Market Manual, which describes procedures and work methods on the Swedish electricity market. The manual serves as a supplement to Acts, Ordinances and regulations and is updated twice a year.<sup>9</sup>

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<sup>7</sup> EIFS 2011:13, the Swedish Energy Markets Inspectorate's regulations and general advice on metering, calculation and reporting of electrical power transmitted

<sup>8</sup> Electronic Data Interchange (EDI) is a system for electronic communication with a standardised interface for data exchange.

<sup>9</sup> Swedish Electricity Market Manual p.8

Work on the Swedish Electricity Market Manual and its publication is undertaken by the organisation Elmarknadsutveckling, which is a collaboration between Svensk Energi, the Association of Independent Electricity Traders in Sweden and Svenska kraftnät. Issues of technical standardisation and formats are prepared by Elmarknadsutveckling, and formal decisions on format changes are made by SvK.

### 2.3 Obligation to meter, calculate and report

A network concessionaire has to register a number of details at each metering point, which might be an outtake point, infeed point or boundary point. The details to be reported are currently governed by the Swedish Energy Markets Inspectorate's regulations and general advice (2012:2) on metering, calculation and reporting of electrical power transmitted.

The network concessionaire owns the electricity meter at a metering point. Meter values from the electricity meter are read by the network concessionaire, normally via remote communication, and are quality assured. After this, the meter values are sent to electricity suppliers, balance responsible parties and Svenska kraftnät.

It is also possible to read meter values directly from the meter for use in applications that do not require quality-assured data. This is not governed by any Act or regulation. The reporting of meter data from network concessionaires takes place electronically to electricity suppliers, balance responsible parties and system operators in the Ediel message format. The recipient of Ediel messages is to acknowledge these within 30 minutes.

For outtake points, a large number of details are to be stored and reported:

- installation identity (installation ID),
- installation address,
- annual consumption
- meter identity of the electricity meter(s) installed at the outtake point,
- identity for meter values,
- period of meter values (e.g. hour or month),
- frequency of meter value reporting,
- times of connection, disconnection and reconnection,
- settlement method,
- area identity (area ID) to which grid settlement area an outtake point belongs,
- electricity customer's identity (e.g. corporate identification number or personal identity number) for the outtake point,
- electricity customer's name and address,
- electricity supplier and
- balance responsible party's identity (EDIEL ID).

Of the details above, it is in principle meter values and customer information that are to be passed on to other actors. Meter values are to be passed on to electricity suppliers, balance responsible parties and Svenska kraftnät, while customer information and dates are to be communicated to an electricity supplier in the event of a supplier switch.

The network concessionaire also has to report meter values, meter readings, annual consumption and monthly consumption statistics to the customer. In addition, there are reporting obligations to the Swedish Energy Markets Inspectorate regarding certain meter values per outtake point, such as energy transmitted, electricity outage information and other information linked to the customer. These details are governed by the Swedish Energy Markets Inspectorate's regulations and general advice (EIFS 2013:2) on the obligation to report electricity outages for the assessment of supply quality in the electricity grid.

For boundary points, the energy flow, i.e. energy transmitted and direction, is reported to the adjoining network concessionaire.

For infeed points, the energy fed in is metered and reported to the electricity supplier and to the electricity producer.

## **2.4 Managing customer information**

The quantity of information collected from customers' electricity meters and other personal data demands consideration for customer privacy. Examples of risks regarding the information collected are information dissemination, inadequate control and an insufficient idea of what information has been collected. It is possible to find out whether or not a customer is home depending on how often the customer's electricity meter is read. When customers are at home, it is also possible to suppose what they are doing at a given time due to varying consumption patterns for different household appliances. It is therefore important to limit the information collected and used by grid operators and to have high data security to protect it from hacking.

### **2.4.1 The Swedish Personal Data Act**

Through its supervisory activities, it is the Swedish Data Inspection Board that contributes to prevent personal data processing from leading to undue intrusion into the personal privacy of individuals. By personal data is meant all information that can directly or indirectly be attributed to a living person. The Personal Data Act is based on a number of fundamental principles: do not collect more information than necessary, do not retain information longer than necessary and do not use information for anything other than what it was collected for.<sup>10</sup> For example, it is only permitted to register data for specified purposes that may not be changed afterwards. The customer/individual must receive information about the data processing and is entitled to check that the information is correct. Any errors are to be corrected.

It is always the one deciding how personal data is managed that is responsible for compliance with the Personal Data Act. This responsibility involves ensuring that the IT support used does not entail any risks to privacy. For this reason, the supplier of the IT support must be given explicit requirements. Even if the supplier of an IT product is not normally responsible for the privacy problems that might arise in connection with the product's use, it is important that it has the necessary functions for the protection of privacy.

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<sup>10</sup> <http://www.datainspektionen.se/press/nyheter/2012/battre-integritetsskydd-med-ny-vagledning/>

Even if it is a service that is delivered (such as outsourcing or cloud services), rather than software or hardware, the client is responsible and must ensure that the supplier meets the security and privacy requirements.

#### **2.4.2 Power of attorneys**

Using a power of attorney, customers may allow someone else to retrieve information, map energy consumption or retrieve historical data on their own consumption. Today, it is quite common for an electricity supplier to approach a new potential customer and obtain a power of attorney. The new electricity supplier then turns to the customer's grid owner to, for example, withdraw information or carry out a supply switch. This means that the grid owner needs to check that there is a power of attorney and that it is valid. This is often a time-consuming task, and it is sometimes necessary to listen through hundreds of recordings of oral power of attorneys or the equivalent number of written power of attorneys.

There are many customers who do not fully understand the meaning of a power of attorney. There are power of attorneys that are valid even though they might have no expiry date and they might encompass all information at the outtake point, even though in many cases this is not necessary.

#### **2.4.3 How does the management of privacy function on the market today?**

Today, electricity grid operators and electricity suppliers have access to information on the customer's electricity consumption and other personal information. The questionnaire survey conducted by Ei in spring 2014 indicates that there are a few actors that adopt an unscrupulous approach to try to withdraw customer information from electricity grid operators and electricity suppliers. According to market actors, the central problem with the improper disclosure of customer information is the management of power of attorneys. This management is time-consuming because it is difficult to assess the quality of the power of attorney. Management is complicated by the presence of actors on the market that, in some cases, pose as customers wanting information on contract expiry and installation ID. There are also forged power of attorneys and situations where customers are misled to approve or sign documentation that they do not know is a power of attorney.

Electricity grid operators and electricity suppliers point out that one problem is that a power of attorney is not normally time-limited. In this way, an unscrupulous actor can withdraw information, such as a customer's electricity consumption, for a long time. There have been instances of customers requesting a block on the disclosure of their information to outsiders. In order to curb this abuse, some electricity grid owners contact customers when they suspect that the customers did not understand what they were agreeing to. Overall, the questionnaire respondents believe that the management of information with reference to customer privacy functions well, but that the management of power of attorneys must be made more effective.

## 2.5 Separation between grid owners and electricity suppliers

To ensure that electricity grid operators act objectively and do not unduly favour any actor on the market, they must establish monitoring plans.<sup>11</sup> These must state the measures that will be taken to prevent discriminatory behaviour against other actors on the market.

In the questionnaire survey conducted by Ei in spring 2014, the majority of respondents stated that electricity grid owners act in a neutral and non-discriminatory manner as regards information management. However, suppliers of computer software and visualisation services for the electricity market pointed out that there is room for improvement in the area if this management is to be considered non-discriminatory. The questionnaire survey shows that there are large variations in how easily actors can gain access to customer meter data. Some respondents report that there are grid owners showing a reluctance to disclose this information. The respondents assess this as being partly due to deliberate action and partly due to ignorance of the regulations governing information management. According to the respondents, it is important for information to be according to the principles of neutrality and non-discrimination if companies other than electricity grid operators are to develop various energy efficiency services and mobile applications for smart homes.

Competition on the electricity market may not be distorted by the chosen information management model. Actors that are vertically integrated and have electricity supply and data owners (grid operators) within the same group may not be favoured at the expense of other actors. The same principle applies in situations where actors choosing only to act in Sweden may not be favoured at the expense of foreign actors wishing to operate in Sweden or actors wishing to operate both in Sweden and other countries.

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<sup>11</sup> Grid owners that are part of a group whose combined electricity grid has less than 100 000 customers, and whose lines mainly feed in electricity from plants producing renewable electricity, are not required to establish a monitoring plan.

### 3 Increased demands on information management on the electricity market

The electricity market is under constant development. New services and products are brought on by technological developments in combination with political demands for a stronger consumer position, greater competition<sup>12</sup>, more efficient energy use and reduced carbon dioxide emissions. This means that regulations on the electricity market are also under constant development, which becomes particularly clear when developments are viewed from a European perspective. Since the adoption of the third energy market package<sup>13</sup>, developments have had an impact on the functioning of the energy markets in Europe.

There is nothing to indicate that the pace of developments will subside, whether with regard to technical progress, political demands or customer needs. Rather, most indications suggest an increasing pace of development.

A key function of today's electricity market is information management between actors and access to information on the customer and the customer's consumption. The model for information management and the way in which actors can gain access to consumption information are crucial to the future functioning of the electricity market and to the development of innovative services and products in the energy services market.

The development of services and products that help electricity customers to streamline and reduce their consumption helps to reduce costs for individual customers and to make resource utilisation more efficient in society as a whole.

The electricity market is one of the markets in Sweden and Europe with the lowest consumer trust scores.<sup>14</sup> Quite apart from the reasons for this low level of trust, it is vital that it is not further diluted by regulatory amendments. Without consumer trust in the market, the development of products and services aimed at smarter energy use will have difficulties in gaining an impact on a broad front.

The purpose of this chapter is to provide the reader with a picture of a possible development of the electricity market in the coming years until 2025, with a focus on developments linked to information management on the market. It is, of course, difficult to predict what will happen in the future, but the selection of a 2025 time horizon limits us to a period for which we venture to assess what might take place with some degree of certainty.

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<sup>12</sup> Demands for greater competition are mainly put forward at the European level

<sup>13</sup> Directive 2009/72/EC

<sup>14</sup> 8th Consumer Markets Scoreboard, European Commission, December 2012.

### 3.1 Future scenario for smart grids

In May 2012, the Government appointed the Swedish Coordination Council for Smart Grid. Its task is to encourage, inform and plan for the development of smart grids to bring about more efficient and more sustainable energy use. The Council has 15 members from central agencies, organisations, the business sector and various research communities. A number of reference groups, made up of experts and key stakeholders in different fields, are affiliated to the Council in order to facilitate cooperation. The Council shall submit proposals for a national action plan for smart grids by 1 December 2014.

The Council has identified a number of definite future trends.<sup>15</sup> These are:

#### *Demographics and lifestyle*

- Aging population increasing
- Interest in collective solutions to citizens' conditions increasing
- Consumer products more user-friendly
- Privacy issues increasing in importance
- Everyday mobility increasing

#### *The electricity industry*

- Dependence on electricity increasing
- Intermittent electricity production increasing
- Micro-production and personal production of electricity increasing
- Integration with Europe increasing
- Interest in electric and hybrid vehicles increasing
- Electrification increasing as a result of greater automation in business and industry

#### *Policy*

- Emancipation from fossil fuels is central
- Focus on energy efficiency (including effective use of the electricity grid)
- Greater focus from central agencies on improving the quality of systems and treating customers equally
- Error tolerance decreasing
- Development of new energy storage solution

#### *Environment and sustainability issues*

- Interest in environment and climate issues increasing
- Concrete environmental requirements increasing, e.g. classification systems
- Company branding – sustainability increasingly important

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<sup>15</sup> Report on the Council's future scenarios, <http://www.swedishsmartgrid.se/wp-content/uploads/2014/03/Rapport-framtidsscenarioer-till-webb-slgk-140326.pdf>

- Information and communication technology (ICT) increasing
- Information/data quantities increasing
- Proportion of ICT users increasing.
- Automation of the home.
- Data collection via sensors generally increasing
- Demand for comprehensive solutions increasing

### *Uncertainties*

The Council has also identified a number of strategically important uncertainties

- Future electricity production – continued high element of stable base production/greater proportion of intermittent electricity production
- Nuclear power – phasing-out of nuclear power/decision made to invest in existing nuclear power
- Fossil fuel prices – slow increase/rapid increase in prices
- Political climate – continued liberalisation/greater focus on regulatory solutions
- Electrification of the transportation sector – weak and slow/strong and rapid
- Automation of home environments – rapid development/slow development
- Electricity market expansion – national or Nordic markets/European market
- European industry – fading/flourishing
- Privacy stance – suspicion/trust

## **3.2 Future scenario from a European perspective**

At the time of writing, there is intense discussion at the European level on what the future electricity market should look like and what these changes mean for market actors and the need for amended and new regulations. The European Commission is working, as are ACER (Agency for the Cooperation of Energy Regulators) and CEER (Council of European Energy Regulators), to investigate the changes that might be required in the regulations to ensure an effective and well-functioning electricity market in the coming years. This is indicated by the ongoing development of network codes and various types of initiative from the European Commission concerning the end-user market and demand flexibility.<sup>16</sup>

In the text below, Ei describes the main features of this ongoing work and also reports assessments of what this European work might entail in terms of regulatory amendments and changing roles in the future.

### **3.2.1 Development of new network codes**

The third internal market package for electricity and gas contains provisions enabling the European Commission, together with national grid operators and regulators, to develop new and more detailed regulations for cross-border

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<sup>16</sup> Inter alia, Commission Staff Working Document. Incorporating demand side flexibility, in particular demand response, in electricity markets and the European Commission's open survey on end-user markets, published in spring 2014

electricity and gas markets.<sup>17</sup> At present, the regulations are being developed for the wholesale market, the balancing market, hedging and a large number of technical rules and conditions regarding connection to the electricity grid. Moreover, regulations are being developed that aim to ensure that national grid operators can fulfil their system operator role in pace with the connection of more renewable production to the grid and with the greater interconnection of electricity grids in different countries. The new regulations will mean that the market actors concerned, primarily national grid operators and electricity grid owners, but also power exchanges, producers, major consumers and balance responsible parties, will need to cooperate and share more information in the future. This will place greater demands on efficient and neutral information management between these actors.

### **3.2.2 Smart grids are the electricity grids of the future**

Smart grids will give grid operators better control over their grids. This will help them to manage changing production and consumption patterns at a lower cost than before.

Smart meters are an important part of these smart grids, being able to meter and send more detailed information on what customers consume and what micro-producers generate. This is particularly important when micro-production is increasing in scope and can be found in many households. Smart meters can also be used to gauge rapid and/or periodic changes in consumption patterns, which is important for being able to give customers financial gains from applying flexibility in their consumption.

### **3.2.3 Managing a greater quantity of information**

More frequent metering of electricity consumption will generate greater quantities of data. Today, the electricity consumption of the average consumer is read monthly, generating 12 meter values per year. This is a small quantity of data compared with a customer whose electricity consumption is metered by the hour, generating 8 760 meter values per year. A future scenario in which all customers<sup>18</sup> have hourly meter reading will mean a total data quantity of about 46 billion meter values.

Since 1 October 2012, it has been possible for electricity customers in Sweden subscribing to a fuse of at most 63 amperes, who have an electricity contract requiring hourly metering, to have their electricity consumption metered by the hour at no additional cost. Towards the end of 2012, a few – about 8 600 electricity customers – had chosen to sign an electricity supply contract requiring hourly metering. However, the number of electricity customers that grid operators actually meter by the hour is considerably greater. In Ei's survey<sup>19</sup>, a majority of electricity grid operators stated that on their own initiative they meter about one million electricity customers by the hour, which is equivalent to just over 20 per cent of all outtake points in Sweden.

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<sup>17</sup> Directive 2009/72/EC

<sup>18</sup> 5.3 million outtake points

<sup>19</sup> Follow-up of the hourly metering reform (Ei R2014:05)

This development will gradually generate increasing volumes of meter values, which in turn will affect meter value management due to greater volumes of meter values having to be reported from grid owners to electricity suppliers. It will be possible to use these meter values to design services and products tailored to individual customers. But the meter values also have the potential to reveal a great deal of information about customers and their behaviour. Since it is the responsibility of grid operators to collect and manage information from the customer's electricity meters, the grid operators have a role that demands responsible action and IT systems and processes to ensure that the information is managed effectively and does not fall into the wrong hands. This will place greater demands on how electricity grid operators manage meter values and the increased quantity of information.

#### **3.2.4 A changing grid owner role**

In addition to the traditional role of grid operators to run, maintain and develop efficient electricity distribution, a large part of the market developments relating to smart grids, demand flexibility and the expansion of micro-production will require grid operators to shoulder a new and more active role. Because grid operations are a monopoly, it is important to minimise their impact on the market and for other actors to be given the opportunity to develop and sell energy services.

On a future, smarter market, access to meter values will be very important to the market actors wishing to offer smart services to electricity customers. Grid operators will therefore have a competitive advantage through their direct access to historical and present meter values and through the unique information and knowledge they have about their customers. It is true, however, that this will be offset somewhat through the introduction of an interface from which customers, or the parties they engage, gain access to meter values. The grid operator has gained access to meter values and knowledge through its role as a monopolist. For this reason, monopolists entering a competitive market have the opportunity to utilise the information, knowledge and position acquired through being monopolists and to compete on the open market with an additional competitive advantage over other actors.

### **3.3 More actors on an integrated end-user market**

Compared with the national markets of today, a common Nordic end-user market will involve a greater number of contacts between more actors. Electricity suppliers have the choice of establishing themselves in an area on a commercial basis, while the grid owner must communicate with electricity suppliers choosing to establish themselves within the grid area.

The Nordic Energy Regulators (NordREG) believe that effective information management between electricity market actors is central to an effective Nordic end-user market. Therefore, one of NordREG's recommendations is that all members should examine how well the national information management model functions on a Nordic end-user market.

To manage this increased communication flow between market actors, Denmark has chosen to implement a central contact point for actors in the form of a service hub with central storage. Norway has also investigated this issue and decided to

introduce a similar solution. Both these hubs will be run by each country's national grid operators. In Finland, parliament decided in 2013 that it is the Finnish national grid operator, Fingrid, which is responsible for the issue of information management on the electricity market. Fingrid is conducting an investigation into the future of information management expected to be completed in late 2014.

Given today's market structure, this means that electricity suppliers wishing to establish themselves on the Nordic market might need to communicate with two hubs and more than 200 grid owners operating in Sweden and Finland.

### **3.3.1 European market integration**

In recent years, the European Commission's focus on European market integration has been increasingly directed towards the end-user market. In the winter/spring of 2013/2014, the European Commission has taken a series of initiatives to investigate matters such as the grid owner role, grid tariffs, end-user markets, the need for new regulations on demand flexibility and an in-depth study of consumer dissatisfaction with the energy markets. The Energy Efficiency Directive will also be reviewed. The European discussion attaches great importance to greater opportunities for customers to act on the energy markets (e.g. to control their consumption, to produce electricity themselves as well as being able to export it), and the advantages this has in relation to the EU's overall energy policy objectives. The relationship of the wholesale power markets to end-user prices, the role and tasks of grid owners, the entry of new actors and the tools enabling end-users to act are all important pieces of the market design that is currently being analysed. From the European Commission's perspective, the year 2014 can probably be seen as a year of fact gathering, and a natural consequence is that this data will in the not too distant future form the basis for proposals for new Directives and Regulations.

## **3.4 Nordic Balance Settlement**

The system operators in Sweden, Finland and Norway have produced a model for harmonised balance settlement (the NBS model). A harmonised balance settlement is an important component of the work towards a common Nordic end-user market. On 28 February 2014, Ei submitted its statute proposal to the Government that, if implemented, will make it possible for Svenska kraftnät to coordinate balance settlement with the other Nordic system operators according to the model they have produced. The harmonisation of balance settlement is proposed to proceed step-by-step, where step one is proposed to be implemented in 2015. Ei assesses that step two, which also includes harmonised profile-based settlement, will be able to be implemented once a decision has been made on the future information management model for the Swedish electricity market.

The NBS model entails balance settlement being carried out by a newly formed company, eSett Oy. The company is owned in equal parts by the Nordic national grid operators Fingrid, Statnett and Svenska kraftnät.

One of the main reasons for this step-by-step implementation is that the parts proposed to be implemented in step two, primarily harmonised profile-based settlement, require major investments in the electricity grid operators' IT systems as regards reporting between Swedish grid owners and the newly formed Nordic

company. A change to the Swedish information management model could potentially enable central reporting to eSett, which would reduce or eliminate the needs for investments in the grid operators' IT systems. Pending further clarity on the future Swedish information management model, the system operators have therefore chosen to await a harmonised solution. Ei supports the proposal for step-by-step implementation because this reduces the risk of stranded costs.

### **3.5 Energy services increase the need for accessibility to meter values**

Today, the energy services market is a relatively new market that is likely to grow as a result of the requirements placed on reaching the EU's 20-20-20 targets and 2050 targets. Developments in Europe have not gone sufficiently fast to achieve the more efficient energy use needed to reach the subtarget by 2020. The European Commission communication<sup>20</sup> from November 2013 notes that energy services, linked among other things to demand flexibility and aggregation, are available in Europe, but that the development and expansion of these services are going slowly.

The Energy Efficiency Directive, as implemented in Swedish law in June 2014, supports different types of energy services that can lead to demand flexibility. This development could result in energy service companies becoming new actors to which customers can turn in order to manage their energy consumption more effectively. The essence of energy services is to use the customer's existing consumption to design services that help the customer with energy use in various ways. Meter data is thus not used directly for billing, but as input data for analysis and different services. Nevertheless, energy services require timely access to accurate meter values, which means increasing demands on accessibility to meter values once this market gathers momentum.

The regulation changes made with reference to the implementation of the Energy Efficiency Directive mean that customers will be given more influence and control over their energy consumption. Meter values that grid operators report today will, on request, also be reported to the company appointed by the customer<sup>21</sup>. Moreover, implementation of the Energy Efficiency Directive entails greater demands on electricity suppliers and electricity grid operators to provide customers with information, including customers' electricity use.

#### **3.5.1 Open interface**

In accordance with the Energy Efficiency Directive, the Government decided that the approach should be to fit electricity meters with an open interface for energy and system services. An open interface means that meter values and other information from the electricity meter can be retrieved in a simple manner by the customer or by the company the customer engages, for example, an energy services company. However, the introduction of an open interface will largely necessitate the replacement of electricity meters. A process of this kind must be carried out with good advance planning. For this reason, the Government believed

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<sup>20</sup> Commission Staff Working Document. Incorporating demand side flexibility, in particular demand response, in electricity markets

<sup>21</sup> Chapter 3, Section 10a of the Electricity Act (1997:857)

that the Directive's requirements regarding an open interface should be initially implemented by means of an obligation on electricity grid operators to report meter values to a supplier of energy services designated by the customer.

This approach will mean that grid operators will no longer have the same advantage over actors in the competitive market as regards access to meter data. However, the grid operators will continue to have access to validated data.

### **3.5.2 Use of meter values**

Different types of information about a customer have different areas of use depending on what the information is to be used for. Certain information might be required by energy market actors offering products and services to customers, while other information might be less suitable for the reason that the information is not useful to anyone other than the customers themselves. Details that are suitable in the design of products and services and for debiting electricity consumption are quality-assured historical meter values. For companies offering services to facilitate the control of customer equipment, real-time values are important.

Historical meter values might be useful when a customer is deciding on a suitable type of energy service or electricity supply contract in a particular case or when an energy service company is evaluating what type of service is to be offered to the customer. This is due to the fact that historical meter values might indicate the type of change in behaviour that could lead to more efficient energy use and/or costs.

The use of instantaneous meter values from an electricity meter can be used to control customer equipment. Instantaneous meter values mean that the consumption has already occurred, and to influence electricity consumption, this control should be automated so that it can be done before the consumption has taken place. This may be done through a link to price signals or, e.g. load control or a power monitor, to prevent customers from exceeding a certain power. Instantaneous meter values might be useful for controlling equipment or for supplying information that might influence customer behaviour, such as a screen displaying a customer's electricity consumption in real time. These values can also be used to control equipment that regulates indoor temperature on the basis of outdoor temperature. These types of services require fast communication paths, and in most cases information other than meter values from the electricity meter must also be used to influence consumption, such as regulation of the heating system.

In the foreseeable future, it will not be possible to offer instantaneous meter values via the data warehouse of an electricity grid operator or via a central hub because, for practical reasons, quality-assured values cannot be instantaneously held in a data warehouse at the same moment that the customer is using the electricity. Therefore, the retrieval of instantaneous meter values from an electricity grid owner or hub is probably not an option for controlling equipment or influencing customer behaviour in real time. In cases where meter values are needed from the electricity meter, the values can be retrieved directly from the meter, for example via an open interface as described in Chapter 3.5.1. An open interface facilitates fast access to non-validated meter data.

### 3.6 Managing customer privacy

It is possible to find out whether or not a customer is home depending on how often the customer's electricity meter is read. When customers are at home, it is also possible to suppose what they are doing at a given time due to varying consumption patterns for different household appliances. This places demands on electricity grid operators that have smart meters controlling customer meter values with respect to their management of customer data and privacy. The issue of protecting customer privacy has been long been high on the European agenda. Working Party 29<sup>22</sup>, which is a joint organisation of the European data protection authorities, has made a statement in its report<sup>23</sup> to the Commission that data from smart meters is to be regarded as personal data and should be treated as such.

The European Commission has formed the Smart Grids Task Force<sup>24</sup> whose purpose is to identify harmonised solutions to the various components that together constitute a smart grid and to advise the Commission. Working groups have been formed under this group for different areas. One area is privacy and security; EG2 Expert Group for Regulatory Recommendations for Privacy, Data. This group has been working for two years and has produced materials stressing the importance of giving particular consideration to these issues in the initial roll-out of smart meters and in all other parts of a smart grid.

Expert Group 3 (EU Task Force for Smart Grids) is producing recommendations on smart grids and demand response. Publication is expected in December 2014. This ongoing work, which has a bearing on information models, discusses the role of present balance responsible parties and their need for meter values. Given that in the future an end user (a connection point) may not only have relationships/contracts with grid owners and electricity suppliers, but also with aggregators, there is probably a need for particularised information on the customer's meter data. In short, meter data will be valuable, and it must be accurate and easy to access for the actors concerned.

### 3.7 Summary – Ei's assessment of the future market

Taken together, the developments described in Chapter 3 will result in a future increase in the demands on information management on the electricity market. The following is a summary of the most central future changes on the electricity market.

#### 3.7.1 Nordic and European market integration

*Ei considers it probable that:*

The differences in regulations between the Nordic countries will gradually decrease. This will result in electricity suppliers and energy service companies being able to establish operations across multiple countries in a much simpler and

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<sup>22</sup> The Article 29 Data Protection Working Party. This Working Party was set up under Article 29 of Directive 95/46/EC. It is an independent European advisory body on data protection and privacy. Its tasks are described in Article 30 of Directive 95/46/EC and Article 15 of Directive 2002/58/EC.

<sup>23</sup> [http://ec.europa.eu/justice/policies/privacy/docs/wpdocs/2011/wp183\\_en.pdf](http://ec.europa.eu/justice/policies/privacy/docs/wpdocs/2011/wp183_en.pdf) 140314

<sup>24</sup> [http://ec.europa.eu/energy/gas\\_electricity/smartgrids/taskforce\\_en.htm](http://ec.europa.eu/energy/gas_electricity/smartgrids/taskforce_en.htm) 140507

cheaper way than today, creating conditions for a Nordic end-user market for electricity.

European harmonisation of the grid owner role and of conditions on the end-user market will take place. In the long term, this will create conditions for a harmonised European end-user market for electricity. That the EU's basic rules of free trade should also apply (without complications) to end-user services for electricity and gas is a plausible development, and we are now seeing the first steps towards this.

### **3.7.2 Nordic Balance Settlement**

*Ei considers it probable that:*

Nordic Balance Settlement is performed according to the model proposed by the system operators. Ei assesses that clarity is necessary on the establishment of a central hub in Sweden before step two of the proposed NBS model can be implemented.

### **3.7.3 New actors**

Today's actors on the end-user market for electricity – consumers, electricity suppliers – will probably become more numerous. Above all, we see the following:

Increased demand for energy services leads to new actors for these services and to existing electricity suppliers adding energy services to their offering.

Increased demands from consumers to take advantage of their own electricity production.

### **3.7.4 Energy services increase the need for accessibility to meter values**

*Ei considers it probable that:*

Customer demand for energy services will increase

This increased demand for energy services will place greater demands on access to meter values. Meter values will need to be made available more quickly, with far greater detail and more integrated than at present.

### **3.7.5 The role of grid owner**

*Ei considers it probable that:*

The tasks performed by electricity grid operators today will also mainly be performed by electricity grid operators tomorrow.

There may be increased demands on separation between electricity grid operations and competitive activities, such as electricity supply and the marketing of energy services.

### **3.7.6 Protection of privacy**

*Ei considers it probable that:*

Requirements to protect customer privacy will remain at the present level or increase. This in turn places major demands on IT security and well-designed processes for managing personal data, such as meter values at the hourly level.

### **3.7.7 Smart grids**

*Ei considers it probable that:*

In order to promote the development of smarter grids, electricity grid operators will need to continuously monitor information from the electricity meters of individual customers. This will reduce the need to expand the electricity grids' transmission capacity and contribute to a more efficient grid operation.

The development of smart grids will alter production and consumption patterns, which increases the need of electricity grid operators to monitor, check, automate, balance and control the electricity grid.

The development of smart grids will make it possible to harness the expected expansion of small-scale electricity production, also by household customers, in an efficient manner. This in turn creates the need for new contractual relationships between micro-producers and grid owners and between micro-producers and electricity suppliers. Sweden might also acquire the need for aggregators that pool and sell unused electricity from consumers. This will also require a new contractual relationship between consumers and aggregators. Multiple contract parties at an outtake point (the electricity supplier and the aggregator) also require a new framework in relationships to the balance responsibility party at that point.

As mentioned in the Energy Efficiency Directive, this will create incentives for dynamic electricity grid tariffs.

### **3.7.8 Managing data**

*Ei considers it probable that:*

There will be greater demands on the grid owner to provide customers with consumption information in a quick and easy way to be used for energy efficiency purposes, etc. by the customers themselves or by actors the customers have chosen.

Greater demands regarding the accessibility of information place greater demands on the grid operators' processes and IT systems.

There will be greater demands for the simple communication of meter values by grid operators to the actors chosen by customers. In this way, the grid operators contribute to the development of a market for energy services, but the energy services themselves are performed by actors other than grid operators.

There will be greater demands for vertically integrated companies (grid operations combined with electricity supply/production and energy services) not to enjoy any competitive advantages over companies that are not vertically integrated.

Several actors will demand particularised information on the customer's meter data, and it must be accurate and easy to access.

## 4 Different models for information management

There are many different models for communication and information management that can be used on an electricity market. The designations of these different models often vary, and it is not unusual for there to be some confusion of concepts when discussing the different models. In this chapter, Ei presents the principal models for information management. The descriptions provide an overview.

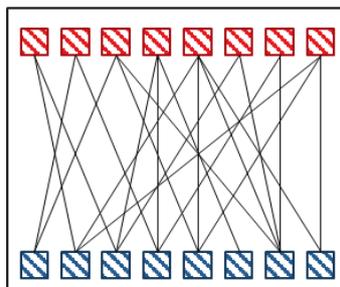
### 4.1 Description of models

The pictures below are a schematic representation of five models for information management. Red and blue striped boxes represent market actors such as electricity suppliers and electricity grid operators. Grey boxes and circles represent different variants of central communication points.

#### 4.1.1 All-to-all

The model used in Sweden today is an all-to-all model that is based on bilateral communication. In this model, electricity market actors send messages directly to each other in order to manage processes such as billing, balance settlement, supplier switches, etc.

Figure 2 All-to-all model

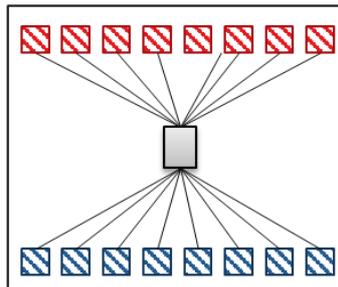


Source: Sweco

#### 4.1.2 Communication hub

A communication hub contains an internal name service (look-up service) that the communication hub itself uses to construct and send messages to the parties that actors communicate with. The communication hub acts as an intermediary, forwarding messages from sender to recipient and also ensuring that any responses from recipients are sent back to the right original sender. All communication takes place via the central hub, ruling out direct communication between electricity market actors. A communication hub does not store any meter values or other information beyond what is needed for forwarding messages.

Figure 3 Communication hub

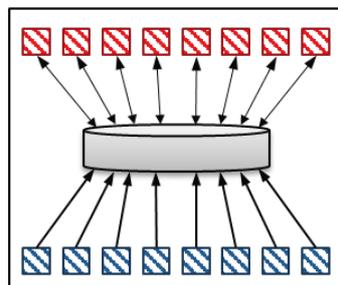


Source: Sweco

#### 4.1.3 Service hub with central storage

A service hub with central storage (also called “data hub” by many) acts as a central point for the exchange of information between the electricity market actors. The grid owners are responsible for supplying the hub with information about connection points and with meter values for consumption and production. The electricity suppliers deliver information about customers, electricity supplies, moves and supplier switches. The information received in the hub is stored in a central database and is available to authorised actors. Market actors implement moves, supplier switches and other central processes directly in the hub and serve as the main source of historical meter values, etc.

Figure 4 Service hub with central storage

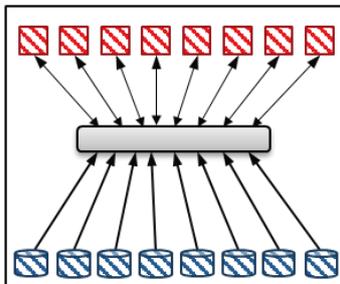


Source: Sweco

#### 4.1.4 Service hub with decentralised storage

A service hub with decentralised storage of information functions in essentially the same way as a service hub with central storage, except that data in this model is stored by the market actors (primarily by electricity grid operators).

Figure 5 Service hub with decentralised storage

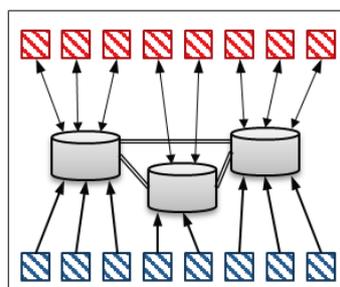


Source: Sweco

#### 4.1.5 Competing hubs

A model with competing hubs is a decentralised hub solution, where every electricity market actor can connect to the hub service provider that they consider to best meet its needs at the lowest cost. Examples of hub services could be settlement and load profile shares, EDI management, meter value management, supplier switching and billing. System development and changes are then managed by the hub service provider, which is also expected to have knowledge of the regulations of different countries.

Figure 6 Competing hubs



Source: Sweco

## 4.2 Evaluation of information management models

In 2012, on behalf of Ei, Sweco performed an evaluation of alternative information management models.<sup>25</sup> The evaluation covered models already used in other countries and models that are still only proposals, in particular those put forward by various actors with strong ties to the Swedish electricity market. Norway, Denmark and Finland were studied because these countries, along with Sweden, are working towards a harmonised Nordic end-user market. At the time of the study, Norway and Denmark were already actively working on alternative information management models.

<sup>25</sup> Framtida modell för informationshantering och behov av centraliserad mätvärdeshantering, En rapport till Energimarknadsinspektionen, Sweco, 2012-10-02

#### 4.2.1 Evaluation of different communication solutions

The models/proposals evaluated by Sweco are:

- The Danish hub taken into operation in 2013
- Statnett's proposal for a future Norwegian data/service hub
- The national hub in the Netherlands
- A proposal from the company Tieto (competing hubs/all-to-all model)
- A proposal from the company Logica (service hub with central storage)
- A proposal from the company Rejlers (competing hubs)
- Communication hub

The models were evaluated on a scale of 1-5, where 5 stands for the model best meeting the criteria set. Table 1 presents an overall assessment of a comparison between the different models.

**Table 1: Comparison of case studies**

Förslag	Nuläget	Danmark / Norge/ Nederländerna / Logica	Tieto	Rejlers	Kommunikations-hubb
Kontroll	1	4	2	4	4
Neutralitet	1	5	3	4	4
Tillgänglighet	2	5	3	3	4
Effektivitet	2	3	3	3	3
Flexibilitet	3	2	5	3	2
Nordisk marknad	1	4	3	3	3
<b>Delsumma</b>	<b>11</b>	<b>22</b>	<b>19</b>	<b>19</b>	<b>20</b>
Reglering	5	4	3	1	4
<i>Summa</i>	<b>16</b>	<b>26</b>	<b>22</b>	<b>20</b>	<b>24</b>

Source: Sweco

The table above shows that the present situation receives low scores in relation to the criteria that an information management model should be able to meet. Furthermore, it shows that a centralised model, in the second and fourth columns, largely meets the criteria produced in connection with the investigation.

Sweco's proposal is the introduction of a central, mandatory, regulated service hub on the Swedish electricity market. A hub of this kind should provide the most basic functions needed for the functioning of the electricity market. Sweco believed

that responsibility for operating such a hub should be given to an actor capable of developing and operating critical societal systems that manage very large data volumes. The actor should be regulated and have the mission of providing the greatest possible societal benefit at the lowest possible cost. Finally, the actor must be neutral and have no business relationships with other actors on the electricity market.

#### **4.2.2 Ei's assessment from 2013**

Ei used the Sweco document together with other data when producing the report "Easier for the customer<sup>26</sup>". In the report, Ei noted that today's all-to-all-model does not fully meet the demands that will be placed on the future electricity market. Furthermore, Ei noted that there is much in favour of a centralised solution, and Ei also proposed that Svenska kraftnät be commissioned to investigate the design of a central information management model.

### **4.3 Information management models in the Nordic countries**

In light of the increased communication between grid owners and electricity suppliers, NordREG has made the assessment that information management and access to information are central to the establishment of a Nordic end-user market. NordREG therefore recommended its members in January 2012 to examine which type of information management model should be implemented nationally to facilitate the establishment of a Nordic end-user market.<sup>27</sup> This section describes how Denmark, Norway and Finland reasoned when choosing to investigate information management models. A comparative overview of the Nordic models for information management can be found in Appendix 1.

#### **4.3.1 Service hub in Denmark**

Denmark conducted an investigation to find answers regarding which information management model was most suited to Danish conditions. The investigation was published on 21 April 2009 and advocated a service hub solution with central storage of information that would manage meter values and processes such as supplier switching. This kind of solution was considered to be future-proof and best able to contribute to an effective Danish end-user market, as well as a prerequisite for the establishment of a Nordic end-user market.

The report made the assessment that it was most appropriate to commission the Danish system operator Energinet.dk to build and operate a service hub because the operation of a hub was viewed as a natural extension of its existing area of responsibility. Furthermore, it was considered important that the responsible actor should have a primary focus on the public interest ahead of commercial interests.

The report preceding the decision to introduce a service hub focused on investigating the best way to organise information management on the Danish electricity market in the future. The report notes that without some kind of central

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<sup>26</sup> Easier for the customer – proposals to improve the conditions for a Nordic end-user market (Ei R2013:09)

<sup>27</sup> High level suggestions for common Nordic processes for information exchange- obstacles and possibilities, NordREG Report 1/2012

point for information exchange there would be problems with the exchange of data between market actors. A service hub would reduce or eliminate the opportunities of grid operators to give preferential treatment to various electricity suppliers, and this would increase confidence in the market. It was assessed as easier and cheaper to make a change in one central service hub compared with the individual actors making adjustments to their own IT systems.

The investigation also notes that a service hub is almost a prerequisite for the establishment of a common Nordic end-user market. Moreover, a service hub would contribute to more efficient processes, especially with increasing quantities of data due to hourly reading, which would additionally promote conditions for greater competition on the market. The greatest risk of introducing a service hub with central storage was assessed to be a total loss of data traffic, which unlike today would affect all actors.

The report notes that it is difficult to make an accurate cost calculation for a central service hub. The overall assessment was that the economic gains would far exceed the calculated costs. The original calculations performed in the report estimated the investment cost to be a maximum of DKK 85 million with a maximum annual operating cost of DKK 13 million. Ahead of the hub launch, the cost calculation was updated to an investment cost of DKK 140 million with an annual operating cost of DKK 20 million.

#### **4.3.2 Service hub in Norway**

The Norwegian Water Resources and Energy Directorate (NVE) announced on 30 January 2012 that the Norwegian national grid operator Statnett was to have overall responsibility for investigating and developing a common information management model for the Norwegian electricity market. Statnett performed an analysis of this area, published on 31 May 2012 in a report detailing an effective end-user market for electricity<sup>28</sup>. The investigation focus was on defining common IT solutions for the future electricity market.

Statnett's conclusion was that a service hub with a central storage of meter values etc. was the preferred information management model on the Norwegian market. This meant that a mandatory service hub should be introduced to centralise all communication on the Norwegian electricity market. It is important to remember that the investigation is closely linked to the roll-out of smart metering systems in Norway. NVE therefore wanted to investigate which information management model would best harness all the opportunities that smart metering systems can provide market actors.

The report compared different information management models though comparing a communication hub and a service hub with central storage. One of the reasons for Statnett choosing a service hub is its advantages over a communication hub. One argument put forward was that a service hub with central storage very much supports a supplier-centric model. Data quality can be raised by having the hub check reported data. This is not found in a communication hub. The grid operators do not need to have as advanced/expensive systems as compared with if they had needed to manage

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<sup>28</sup> Effektivt sluttbrukermarked for kraft, Statnett, 31 May 2012

requests to withdraw data from customers, electricity suppliers and energy service companies.

A service hub would entail a higher degree of separation between monopoly activities and competitive activities. Moreover, market actors would gain faster access to customer information and meter values in that a service hub is assessed to manage details on customers, installations, addresses and various types of fees more efficiently than a communication hub. Processes such as customer moves, supplier switches and balance settlement would also become more efficient. A service hub was also assessed to be more flexible and easier to develop than a communication hub because changes to the latter would require the development of all the actors' IT systems.

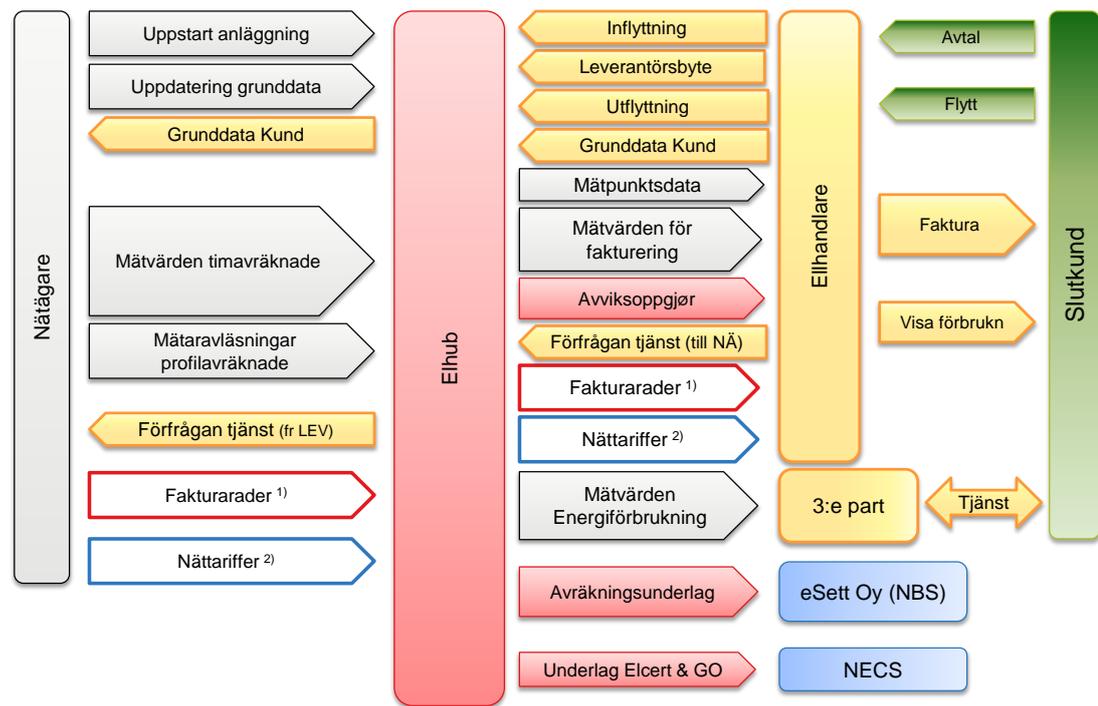
Statnett's investigation estimates a cost saving for the industry of between NOK 200 and 400 million per year if a service hub is introduced. The investment and operating costs for a service hub are included in this calculation. The corresponding annual figure for a communication hub spans the interval from NOK 80 million in added costs to NOK 100 million in reduced costs.

#### **4.3.3 The design of service hubs in Norway and Denmark**

Both Denmark and Norway have made decisions to introduce service hubs with central storage of information for their respective end-user markets for electricity. In Denmark, a service hub has been in operation since 1 March 2013, and Norway commenced development of a hub in autumn 2013 with the goal of taking it into service in October 2016.

Both the Danish hub and the forthcoming Norwegian hub have been designed with a central system for case management and storage of meter values. The main principle is that grid owners report basic data for customers' electrical installations to the hub. Continuous reports are made of all meter values necessary for billing end users and for settlement. These are stored in the hub and made available to electricity suppliers, balance responsible parties and producers and to energy service providers delivering new types of service to end users, see Figur 7.

Figure 7. Overview of the process flow for Elhub.no



Alternativa løsninger i v 2.0  
<sup>1)</sup> Genomfakturering  
<sup>2)</sup> Engrosmodellen

Source: Sweco

The hub assumes the grid owners' responsibility for providing data for balance settlement to eSett (Nordic Balance Settlement). Data is also made available to end users, but in both Denmark and Norway a solution has been chosen where access to data in the hub takes place via the website of the electricity supplier. The reasoning behind this design is the electricity supplier-centric model, which would be undermined if customers could go directly to the hub. Electricity suppliers will also have the responsibility for identifying customers and thereby the responsibility for providing customers with access to their own data.

In the electricity supplier-centric model, electricity suppliers will be responsible for virtually all customer matters, such as supplier switches and moves. The service hub makes it possible to implement these directly in the hub. This means that a supplier switch can be implemented immediately. The limiting factor here is the hub's response time. The same applies to customer moves, which at present are primarily managed by grid owners, but which in the hub can be performed directly by electricity suppliers. In some situations, it might only be a question of moving in or moving out, but often both at the same time. Grid owners do not need to be involved in some of these customer matters. Denmark and Norway have somewhat different views on how much information the grid owners should have access to. The Danish model involves (when fully developed in version 2.0) grid owners not having access to information about who supplies the customer. In Norway, the approach is more liberal at the moment.

The second main task of the service hub is to distribute meter values to the customer's electricity supplier. This can be done using two alternative solutions. One entails each actor being allowed to retrieve meter values that they need for things such as billing. The second entails meter values being sent to the actor who is to have them, i.e. in principle the same as in today's model. Both Denmark and Norway have chosen to distribute the meter values that have to be supplied under the regulations by placing them in a queue for retrieval by the respective actors. This can be supplemented by making retrieval possible, where necessary, from the hub through a request via a web portal or via a web service from computer to computer.

The service hub also has a third main task. When all meter values are available, it will be easy to centralise grid settlement and calculate it for all grid areas. This means that grid owners are relieved of a great workload, and the task can be performed centrally with very limited personnel resources. For Nordic Balance Settlement, this means that communication only takes place with the hub's organisation instead of with hundreds of grid owners.

The same hub can also receive reports on the allocation of electricity certificates and guarantees of origin. The reporting of volumes produced is managed in a natural way by a central hub with access to all meter values. In the Norwegian model, the hub will also report outtake volumes for each actor having an electricity certificate obligation.

#### **4.3.4 Finland**

Finland today has a decentralised model for information management that is in many respects similar to the model used in Sweden. Grid operators are responsible for meters and ensure that meter values are read and reported to other actors. All communication takes place by means of point-to-point communication, but most actors have outsourced the management of data communication to external data communication agents. There is also a central database for metering points operated by Finsk Energiindustri via its subsidiary Adato Energia. The database currently covers about 95 per cent of the metering points and is used by electricity suppliers for supplier switches. The service is thus to be regarded as a name service. Use of the service is optional.

In Finland, parliament decided in 2013 to amend its electricity legislation to make the Finnish national grid operator, Fingrid, responsible for information management on the electricity market. Fingrid is currently conducting an investigation into the future of information management expected to be completed in autumn/winter 2014.

## 5 Cost-benefit analysis

Ei chose to commission Sweco to perform a cost-benefit analysis of the introduction of a central service hub (by Sweco termed *data hub*) with central storage in Sweden. The analysis constitutes an important basis for Ei's recommendation regarding a future information management model. This chapter presents the main elements of Sweco's analysis and their assumptions. For more information, the reader is referred to Sweco's report *Kostnadsnyttoanalys av Datahubb – En rapport till Energimarknadsinspektionen*.<sup>29</sup>

Sweco's report was the subject of a hearing on 9 May 2014. This was attended by around fifty representatives from electricity suppliers, electricity grid operators, IT suppliers and Svenska kraftnät (SvK).

Ei's commission to Sweco mainly consisted in producing an overview model of a service hub with central storage for the Swedish electricity market, in describing a developed version of today's information management model, and in using a cost-benefit analysis to compare these two alternatives.

The starting point for Sweco's analysis is based on the criteria defined by Ei for assessing which additional elements in the models are appropriate. These criteria are described in Section 1.3.

### 5.1 Method and assumptions

The cost-benefit analysis was performed in a number of stages, and the overall implementation process is illustrated in figur 8.

The data used is based on previous investigations and facts. We have also looked at the cost-benefit analyses performed for the Norwegian hub. Ei has also used a questionnaire to consult the industry and stakeholders. Finally, Sweco conducted a number of interviews with energy companies (electricity suppliers and electricity grid operators of varying size) and system suppliers.

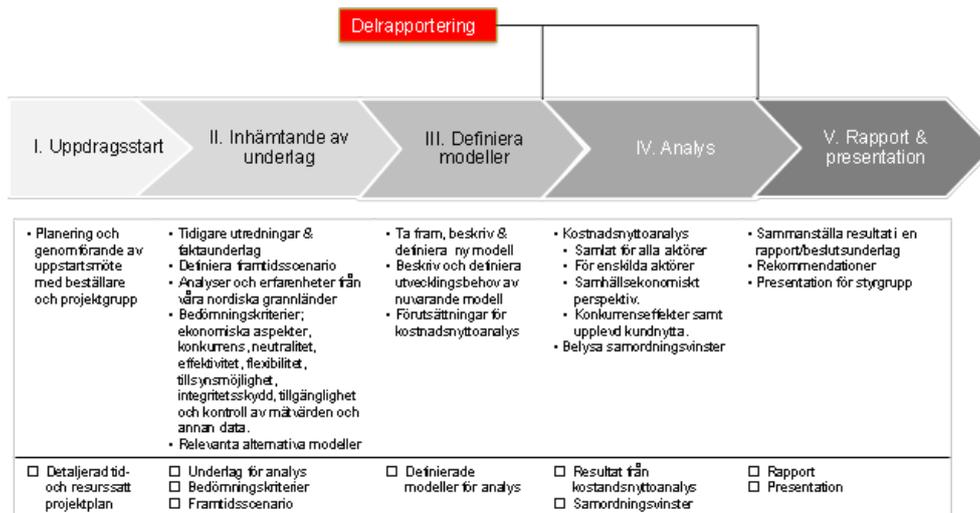
As part of the commission, Sweco also gave an overview definition and description of a new central service hub model and of the development work needed by the present model to reasonably meet future demands.

The cost-benefit analysis was performed using quantitative methods with respect to the elements for which it was possible to estimate costs and benefits. In addition to this, a number of further costs and benefits are also discussed in qualitative terms.

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<sup>29</sup>[http://www.ei.se/Documents/Projekt/Framtida%20centraliserad%20informationshanteringsmodell/Kostnadsnyttoanalys\\_av\\_datahubb\\_%20SWECOs\\_rapport\\_till\\_Ei\\_140430.pdf](http://www.ei.se/Documents/Projekt/Framtida%20centraliserad%20informationshanteringsmodell/Kostnadsnyttoanalys_av_datahubb_%20SWECOs_rapport_till_Ei_140430.pdf)

Figure 8. Analysis implementation



Source: Sweco

The cost comparisons were made between two different future information management models. That is, the analysis is not a direct comparison with the present situation.

These models are a service hub with central storage (by Sweco termed *data hub*) and a developed version of today's all-to-all model.

The developed version of today's all-to-all model can either be achieved through minimum development or through development that, as far as is deemed reasonable, corresponds to the functionality of a central service hub. Depending on the alternative chosen, the initial investment and the annual costs differ. The starting point for this analysis was that both models should essentially meet the same requirements, which meant that the functionality of the two models should be similar.

### 5.1.1 Costs and savings

Costs are divided into initial investment costs and annual costs. The cost-bearing activities are grouped into a number of "activity groups". For these "activity groups", quantitative cost estimates were made as far as possible. These are based on experience from Norway and Denmark, adapted to suit Swedish conditions and the Swedish market, and on Sweco's internal knowledge, experience from EMIX and interviews with selected market actors. These form the basis of the estimated cost increases and cost reductions (per activity category and in total) for the various stakeholders.

### 5.1.2 Quantitative and qualitative calculations

The stakeholders whose costs (and benefits) are estimated quantitatively are electricity grid owners, electricity suppliers and "central" ("central" meaning the costs and benefits that do not arise for individual existing actors, but centrally for the coordination of the electricity market's information management).

Competitive effects and perceived customer benefit, and the impact on electricity customers, energy service providers and the relevant authorities, are treated qualitatively. In addition to the quantitative analysis, there is also a broader qualitative assessment in terms of the economy.

### **5.1.3 Calculation assumptions**

The analysis was performed for a period of 10 years. It was assumed that the central actor, grid owners and electricity suppliers make initial investments. These investments are made before the new model has been taken into operation. There then arise running costs for the different models. In the first few years, the actors are expected to have higher costs for their organisations, systems and conversion, which subsequently decrease. This also captures any adjustments and adaptations that may initially be expected for a new IT system.

The cost flows arising for the two alternative information management models have been discounted to present value. Sweco chose to discount for two different assumed interest levels. One alternative was a real interest rate of 5.2 per cent, which corresponds to the WACC<sup>30</sup> that Ei believes should be used in the revenue regulation for electricity grid operators during the current regulatory period. The other alternative was 10 per cent, in the event that a hub investment were to be considered a far more risky project.

### **5.1.4 Delimitation**

The analysed model is to be described on a general level, which means that it should not contain detailed technical descriptions or solutions. Analysis of the need for amendments to legislation and regulations was not part of the commission.

## **5.2 Central service hub in Sweden**

The definition of service hub used in this cost-benefit analysis is as follows:

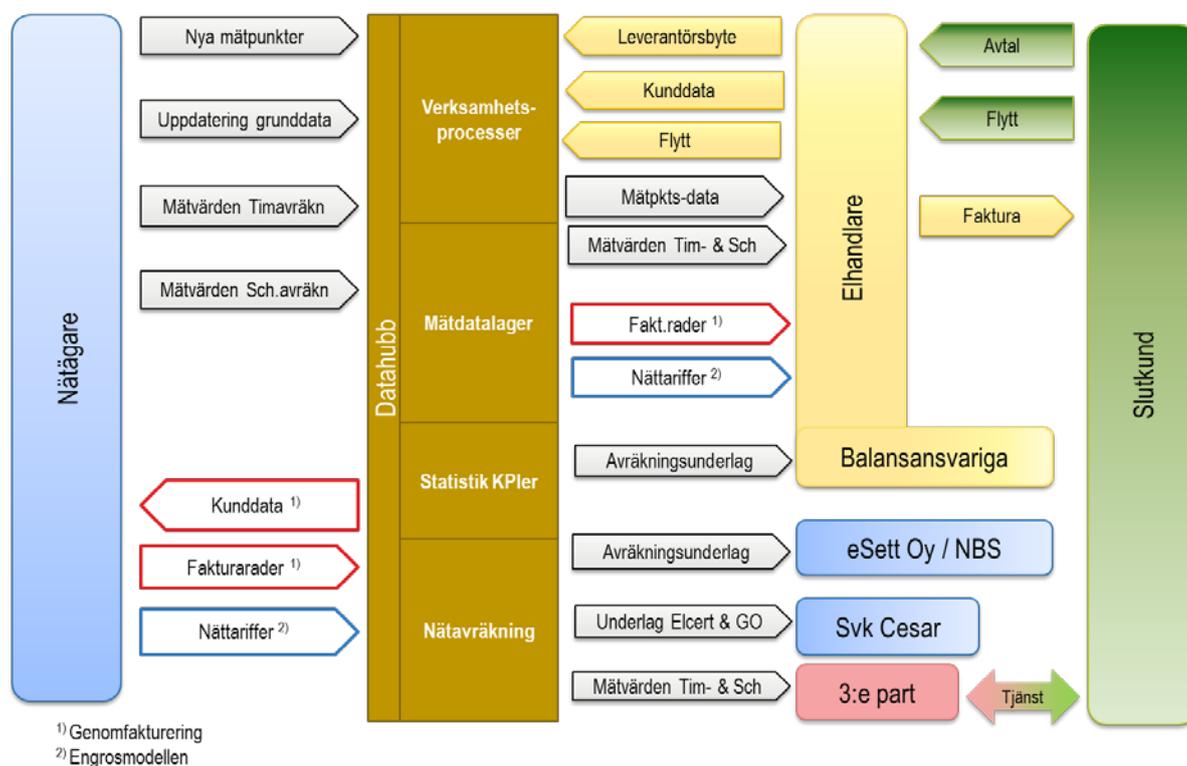
A service hub with central storage is an information management model based on the central database collection of the data to be exchanged between market actors. Responsibility for data in the central database is shared between the actors in an unambiguous manner. The grid owners are responsible for defining all metering points using installation ID and other basic data. Electricity suppliers are responsible for registering and updating data on customers at the respective metering points and the suppliers and balance responsible parties for the customer's consumption or production. The grid owners deliver all meter values needed for billing, balance settlement, etc. to the central database. The hub delivers/facilitates retrieval of meter values for billing to the relevant supplier. Meter values can also be delivered to/retrieved by end users or their representative (e.g. energy service providers). Furthermore, the hub can perform grid settlement for all grid areas and deliver the results to the party responsible for balance settlement.

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<sup>30</sup> The minimum return that can be tolerated in order to meet the lender's interest requirements (and also, in the case of for-profit activities, owners' dividend requirements)

A service hub with central storage allows a temporal separation between the reporting and receiving of data. This means, for example, that electricity grid operators can report meter values to the hub, which electricity suppliers may retrieve later in time. A service hub with central storage can thus make possible a temporal separation between the points that different actors/actor types implement decided changes by offering transitional solutions for message management. Separated communication interfaces can be applied to grid owners and electricity suppliers. Therefore, changed communication needs for electricity supply do not necessarily require a change for grid owners. Figure 9 illustrates the process flow in the proposed hub.

Figure 9. Process flow for service hub with central storage



Source: Sweco

The service hub encompasses processes and logic that realise certain basic functions needed for a well-functioning electricity market. Examples of these functions are the identification and authentication of systems and individuals requesting information from the hub, the aggregating of meter values as input data for balance settlement and the implementation of supplier switches and moves. These basic services are those considered to facilitate the processes required for the basic functioning of the end-user market.

Besides these, further services that add value could be established in the hub. However, this requires a clear distinction between the types of services that a service hub is to provide and the services that are to be left to the market actors. Table 2 lists the basic services needed for the functioning of the end-user market for electricity and additional services that might be considered for establishment in

the hub. An important principle in the design of a hub solution should be that the service hub only offers competition-neutral services.

**Table 2. Processes in the hub**

Basic processes

1. Installation start-up, i.e. the grid owner registers a new metering point in the hub
2. Moving in
3. Moving out
4. Supplier switch (including search installation ID)
5. Updating of installation data (including meter)
6. Updating of customer data
7. Service request from electricity supplier to grid owner (e.g. cancellation)
8. Meter value management
9. Settlement data for Nordic Balance Settlement (production, consumption (hourly & profile-based), exchange between grid areas, grid losses, etc.)
10. Correction settlement (hour & reconciled energy)
11. Combined bill – wholesale model or through-billing
12. Evaluated additional processes/services
13. Meter values and historical data accessible by customers
14. Meter values to energy service providers (3rd party)
15. Reporting and statistics
16. Additional services for customer interface to hub
17. List of customers' active power of attorneys accessible by customers, or that customers can see an overview of the actors that have access to their details
18. Information on the expiry date of customers' active contracts accessible by customers, including contracts signed but where supply has not yet commenced
19. Any costs for breaking present contracts accessible by customers
20. Additional services incorporated
21. Basis for the allocation of electricity certificates & guarantees of origin
22. Reporting of consumption subject to quota obligation

Source: Sweco

### 5.2.1 Definition of functions in a central service hub

The following is a list of the various processes and functions that a service hub will be able to manage if it is built according to the principles implemented and planned in Denmark and Norway.

The list covers the most essential processes and functions and does not describe the details of special cases such as assigned supply. The majority of the functions are performed in the actor's own system, which updates or retrieves data in the service hub via a web service interface. For this reason, the hub updates in principle at the same time as registration takes place in the actor's system. The described hub also has a web portal where actors can perform all functions directly in the hub as an

alternative to a direct connection to their own systems. All actors that will be using hub services must have a contract for this.

#### **Basic functions**

- |                                  |  |
|----------------------------------|--|
| 1. Installation start-up         | 7. Service request from electricity supplier to grid owner |
| 2. Moving in                     | 8. Meter value management                                  |
| 3. Moving out                    | 9. Settlement data for Nordic Balance Settlement           |
| 4. Supplier switch               | 10. Correction settlement                                  |
| 5. Updating of installation data | 11. Combined bill  |
| 6. Updating of customer data     |  |

#### **Evaluated additional processes/services**

- |  |                              |
|--|------------------------------|
| 12. Meter values to customer                             | 14. Reporting and statistics |
| 13. Meter values to energy service providers (3rd party) |                              |

#### **Evaluated additional services for customer interface to hub**

- |  |  |
|--|--|
| 15. List of customers' active power of attorneys           | 17. Information on any penalty fees for breaking present contracts |
| 16. Information on the expiry date of customers' contracts |  |

#### **Evaluated additional services incorporated in hub**

- |   |  |
|---|--|
| 18. Basis for the allocation of electricity certificates and guarantees of origin | 19. Reporting of consumption subject to quota obligation |
|---|--|

#### **Further functions**

The above lists of basic functions and evaluated additional services do not include all the functions that could form an appropriate part of a central service hub. Here are some examples of functions that would create further added value.

- Queries from grid owners or electricity suppliers to the hub regarding data
- Search metering point is a special case of the preceding function (which is also part of a supplier switch)
- Questions/matters to the hub's support organisation and responses back
- Reminders from the hub to the grid owner regarding missing meter values
- Special pages on the actor portal customised for different roles, such as a status summary for grid owners on meter value reporting for their grid areas

- Cancellation of electricity contracts
- Reverse or correct a move
- Stop a supplier switch (that has not been fully completed)
- Automated correction of erroneous supplier switch already in force
- Phasing out of electrical installation
- Switch of balance responsible party
- Restructuring of grid areas

### **5.3 Development needs of today's information management model retained**

Meeting the requirements outlined in the future scenario will demand development if today's systems and communication solutions are to be retained. Here, this development can be envisaged as only being carried out with regard to those elements that will be an "absolute must" for achieving the minimum requirements. On the other hand, the development can be outlined at a level that makes the technical solution more comparable with the functionality of a central hub solution. Below are the minimum requirements for a combined bill and Nordic Balance Settlement.

#### **Minimum level for a combined bill**

EDIEL must be supplemented by new message types to be able to exchange data for a combined bill. This will give rise to two variants depending on the choice made between "through-billing" (A) or "the wholesale model" (B).

- A. A message formats for bill lines must be developed

The grid owners' systems must develop interfaces for sending bill lines in this format and modify the billing system to produce these standardised bill lines.

The grid owners' systems must be developed with functions for the integrated billing of grid fees to electricity suppliers, or the electricity suppliers' systems must be developed to make payments to grid owners based on the amount billed to customers.

The grid owners' systems must be developed with functions for the integrated receipt of payments from electricity suppliers, or the electricity suppliers' systems must be developed to make payments to grid owners per grid customer.

The electricity suppliers must develop interfaces for receiving bill lines and supplement the billing system to be able to receive, bill and book these.

- B. A message format for transferring information on grid tariffs from grid owners to electricity suppliers.

All grid owners' systems must be adapted to be able to transfer grid tariffs. This should perhaps be done as a stand-alone standard application ("mini-hub") that can be used by all grid owners that do not want to put this in the ordinary billing system when billing will not be done there anyway.

All electricity suppliers' billing systems must be developed to be able to create billing data for their respective grid owners so that these can bill the total grid fee to the electricity supplier. For the minimum level, the billing data is limited to one report, which the grid owners can use for manual input into their billing systems.

### **Minimum level for Nordic Balance Settlement**

The grid owners' systems must be adapted for a somewhat different reporting content for balance settlement and get a new interface for sending and receiving messages in XML format.

#### **5.3.1 Level comparable with a central hub**

It is difficult to specify what should be developed to make today's all-to-all model comparable with a central hub solution. The following might constitute one approach, but does not fully cover the possibilities of the central solution.

An application corresponding to today's Norwegian NUBIX to facilitate supplier switches and moves. NUBIX is used today by Norwegian electricity suppliers to find a customer's installation ID regardless of where in the country the customer lives.

A function in electricity suppliers' systems for compiling electronic billing data for transfer to grid owners so that these can bill the total grid fees.

Interface for sending billing data between electricity suppliers and grid owners.

A function in grid owners' systems for receiving billing data from electricity suppliers and for issuing bills to electricity suppliers.

In addition, further functionality could be developed to enable today's model to implement the processes of moving and supplier switching in a way similar to that in a central service hub. Moreover, measures could be implemented to improve quality, but these are at present a little more difficult to specify in detail.

#### **5.3.2 Functions unable to be resolved with system development**

There are a number of functions offered by a central service hub that in Sweco's assessment will be difficult to accommodate in today's model even if it is developed.

The very rapid management of supplier switches in the hub facilitates operations markedly for electricity suppliers, and customers will perceive these to act more quickly. The technology also makes it possible for electricity suppliers to develop web solutions through which customers can implement supplier switches with direct online confirmation. Moves can to some extent be automated in a corresponding manner. Notification of moving out can be made fully automatically. Moving in can presumably only be automated for "easy cases" in which it is easy to identify the installation where the customer is moving in. Corresponding automations can be performed in today's model, but are unable to give a direct response to the customer.

Combined billing according to the wholesale model will be difficult to get to function in a fully automated manner. Through-billing should theoretically work in today's model developed with new message formats. However, the large number of actors and varying system solutions will pose challenges, such as reconciling the billing between grid owners and electricity suppliers.

A central service hub provides good opportunities for market surveillance, which cannot be achieved in today's decentralised model.

The migration from the present situation to a supplier-centric model and the introduction of an integrated Nordic Balance Settlement are greatly facilitated by a central service hub. The central apparatus allows a gradual transition to the new way of communicating. With all communication taking place in relation to a central point, old and new formats can be allowed to exist in parallel for a transitional period, and the service hub manages the translation between these old and new formats. Actors can thus choose when they go over to the new formats without having to wait for all their counterparts to be ready. In a decentralised model, all actors must be ready to migrate by a certain time at which information management under the new principles starts for all the parties involved.

## 5.4 Quantitative analysis

The stakeholders whose costs and benefits are estimated quantitatively are electricity grid owners, electricity suppliers and "central", "central" meaning the costs and benefits that do not arise for individual existing actors, but centrally for the coordination of the electricity market's information management. In addition to the quantitative analysis, there is also a broader qualitative assessment in terms of the economy. Actors such as end users, energy service providers, the relevant authorities, balance responsible parties, impact on competitiveness and society as a whole are treated qualitatively. The benefits and costs arising for end users via electricity suppliers/electricity grid operators are taken into account by estimating benefits and costs for electricity suppliers and electricity grid operators. These are treated qualitatively for end users because of the difficulty of estimating them and to avoid double counting. The cost comparison is made between two different future scenarios: "hub" or "developed version of today's (all-to-all) model". The developed version of today's all-to-all model is achieved through development that as far as possible corresponds to the functionality of a central service hub.

The cost-benefit analysis contains cost-bearing activities, their size and how they would change upon introduction of a service hub and upon development of today's all-to-all information system. These are based on Sweco's internal knowledge, experience from EMIX, interviews with selected market actors and on the calculations forming the basis for the Norwegian decision regarding the introduction of a Norwegian service hub<sup>31</sup>. The interviews with system suppliers, electricity suppliers and electricity grid operators were partly used to confirm cost estimates and to adjust cost estimates from Norway and Denmark to the Swedish market.

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<sup>31</sup> Effektivt sluttbrukermarked for kraft, Statnett, 31 May 2012

### **Quantitative analysis assumptions**

For practical reasons, Sweco has in part chosen to make use of Norwegian statistics on costs etc. As there are great similarities between the Norwegian and Swedish electricity markets, it is considered possible to use part of the Norwegian material as a basis for assessing benefit values if information management in Sweden changes. However, there are some significant differences today that must be taken into account. The most important difference is that the vast majority of electricity metering in Norway is still manual reading, although the decision has now been made to introduce an advanced metering system (AMS) no later than from 01-01-2019.

This analysis will count the costs based on the total cost mass for all actors (electricity suppliers and electricity grid owners) in the whole of Sweden. The costs are divided into one-off costs and annual costs. Due to the uncertainty, these are indicated in intervals.

For operations where Norwegian values were available, and these were assessed to be reasonable, these values have been scaled up in proportion to the number of supply points in Sweden compared with Norway. In Norway, there are 3.2 million supply points, in Sweden 5 million. The values have therefore been scaled up by a factor of 1.5. This factor has also included the difference in currency. Special assessments have been made for areas in which there are significant differences between the countries at present.

### **One-off costs**

The actors can be initially expected to have costs for adapting systems, organisation and operations to the new model. This applies to both alternatives. These will be distributed over a couple of years during the introduction project. The calculation spreads the total cost equally across years 1 and 2.

### **System costs for electricity suppliers and electricity grid operators**

The costs for adapting the actors' own systems to a changed information management model were discussed with some of the dominant suppliers of standard systems on the Swedish market. These made their own calculations and assessments based on the assumptions regarding system requirements described earlier in the report. To some extent, it has been possible to incorporate experience from the changes implemented in Denmark and from the step 2 introduction of the wholesale model for combined billing.

The overall assessment from interviews with system suppliers is that the two alternatives will not have any crucial differences regarding development needs in the actors' systems.

In order to apply the system development costs to all actors regardless of size, the cost was expressed in SEK/supply point, and separately for grids and electricity supply.

The overall assessment arrives at the following costs of the system changes, for

- Electricity grid                      SEK 12 - 15/supply point
- Electricity supply                    SEK 15 - 35/supply point

These average values might be too high to apply to the very biggest actors and too low for the very smallest companies, but can still provide a true picture at the total level.

Converted to the country level (5 million supply points), this means

- Electricity grid MSEK 60 - 75
- Electricity supply MSEK 75 - 175

The costs for individual companies will, of course, be greatly influenced by how these act with regard to procurement, partnerships, purchase of services, etc. It is natural that in individual cases there will be companies that have to completely replace their system solution if this change were to result in the inability of the existing system platform to meet the new requirements. This type of event has not been taken into account, but neither has it been assessed as probable.

#### **Project costs for electricity suppliers and electricity grid operators**

The introduction of such major changes in the actors' systems will naturally also require relatively major change projects in their operations. Here too, the assessment is that about the same amount of work will be required in both models, with the exception of one item. As this does not give rise to any distinction between the alternatives, Sweco dispensed with a calculation of the total project cost for all actors.

However, the introduction of a service hub occasions a very extensive migration in order to move data from the actors' systems to the central hub. In Denmark, this took about one calendar year to implement with repeated tests. Of course, this is not full-time work for every actor, but might, depending on the size of the respective database, involve costs for their own time of between SEK 100 000 to SEK 1 million. Denmark had extensive work to correct erroneous data (called data cleaning). The assessment here is that much of this work has been carried out in Sweden, partly as a result of EMIX, and that electricity suppliers are gradually trying to improve their customer databases.

Migration costs from the actor's perspective have been estimated at SEK 80–160 million for grid owners in total at the country level and SEK 40–60 million for electricity suppliers.

#### **Costs for a central service hub**

To calculate a probable cost of establishing a Swedish service hub, the calculated costs for the projects in Denmark and Norway were examined. Denmark implemented step 1 and took it into service in March 2013. Step 2 with the introduction of combined billing according to the wholesale model is in progress and is aimed to be completed in autumn 2015. Norway made the decision in 2013 to initiate a development project with the goal of taking a central hub into operation in October 2016. This decision was based on an estimated project cost of NOK 180–240 million (2012 price level). A new calculation was prepared in conjunction with Statnett's decision to initiate procurement of the hub solution, but this is currently confidential until the procurement is concluded. The cost interval mentioned refers to a version 1.0, which does not include the combined billing solution that is planned for version 2.0.

Sweco has assumed that a Swedish service hub will include a combined billing solution. At the same time, a Swedish project should be able to learn important lessons from both the Danish and the Norwegian projects, which should reduce costs. There may be an opportunity here for Sweden to join forces with Norway on a common or almost identical solution, which could reduce costs significantly. However, Sweco's calculation has not considered this alternative, but has assumed that Sweden will procure its own solution, albeit with many similarities to the Norwegian solution. The fact that Sweco makes extensive reference to the Norwegian hub is because this will result in a more modern solution due to it already having had the opportunity to learn from the first Danish version.

The total cost of a hub project will include costs for

- Requirements specification
- Procurement
- Development and supply of the hub system from system supplier
- Development and supply of systems for testing and certification by actors
- Introduction costs
- Costs of migrating data from the actors' systems
- System and actor tests
- Training and information activities

The overall assessment is that the central project could cost between SEK 270 and 340 million.

#### **Central costs for developing today's all-to-all model**

This alternative includes the establishment of a central name service similar to today's NUBIX in Norway. NUBIX is used by all electricity suppliers to search for the customer's installation ID regardless of where in the country the customer's installation is. The system uses postcodes to identify who the grid owner is and queries the grid owner's database directly. Grid owners have therefore been obligated to equip their systems with a standardised web service interface that can manage the query from NUBIX. NUBIX also offers a web service interface to which electricity suppliers can connect to NUBIX directly from their own business systems and retrieve details from the grid owner directly into their own systems. Although this greatly facilitates supplier switches and moves, these processes cannot be carried out by this means.

The central project and development costs for a similar solution in Sweden can be estimated to about SEK 20 million.

No further development costs at the central level have been assumed in this alternative.

#### **Annual costs for system solutions**

The annual costs for the actors will change with respect to maintenance costs (licence costs) for their systems. Operating costs for the systems are not expected to be affected as long the same system environment is retained.

#### **Electricity suppliers and electricity grid operators**

Maintenance and a minor further development of standard systems typically

involves an annual cost of 15-20 per cent of the one-off cost. Since we are here dealing with a major change that could very well need a few years to fine tune, we have assumed that the maintenance costs will be higher for the first few years and then decrease to a normal level. The approach is that for year 1 these costs constitute 30 per cent of the development cost to decrease linearly to 20 per cent as of year 5, and then remain at that level. However, the combined calculation has only treated this as minimum and maximum alternatives.

In theory, electricity grid owners should drive down their system costs somewhat because a large part of today's functionality will become superfluous. However, Sweco's calculation has not weighed this in.

### **Central**

“Central” means the costs and benefits that do not arise for individual existing actors, but centrally for the coordination of the electricity market's information management.

#### *The Central Service Hub alternative*

The costs for the operation and administration of a central hub consist of

- Operating costs
- System maintenance
- Administration costs

The requirements for the accessibility and performance of a central hub will be very high. The system will need very great processing power and extensive storage capacity. It will in all likelihood need to be duplicated and spread over multiple and separate premises.

System maintenance is performed by the system supplier. The assessment is, however, that there is no need to have on-site personnel for emergency maintenance, but that this can be performed remotely. In the same way as it was assumed that electricity suppliers and grid owners will have a higher maintenance cost for the first five years, this is also assumed to apply centrally.

The administration of the service hub will at least require a couple of full-time posts. These are part of the organisation that must be built up around the hub and are therefore counted in the organisation cost.

With this delimitation, the operation and maintenance of a central service hub is assessed to cost SEK 35-40 million per year.

#### *Today's all-to-all model alternative*

The operating and administration costs of a central name service (of the type NUBIX) are assessed to be around SEK 5 million per year.

“Today's model” otherwise contains no central costs if we disregard the organisation for the administration of the EDIEL system and the EDIEL portal.

#### 5.4.1 Organisation costs

The establishment of a central service hub requires an organisation that is responsible for the operation and administration of the hub. A support organisation is needed to be responsible for the processes run by the hub, e.g. grid settlement, and to manage the questions and problems coming from the actors that use the hub.

Looking to Denmark, it is assumed here that this might involve 12-15 persons in the central organisation once development and migration is complete. This organisation is assumed to purchase services for administration from a parent organisation (e.g. Svenska kraftnät). The annual cost of the hub's organisation has therefore been calculated to about SEK 20 million.

#### 5.4.2 Operational costs at present

The calculation of the benefit value for the different information management models is based on how the operational costs will change in the respective alternatives. The total operational costs for electricity suppliers and grid owners in the areas affected by the choice of information management model have been calculated on the basis of the statistics available for the Norwegian energy companies.

In Norway in 2012, the costs for the entire industry were calculated to amount to NOK 426 million for electricity supply and NOK 690 million for the electricity grid (see Table 3). With 3.2 million supply points in Norway, this means an operational cost of NOK 349 per supply point for electricity supply and grid together.

Table 3. Calculated industry costs in Norway (NOK million)

	Electricity supply	Electricity grid
Meter value management	62	167
Billing	186	143
Other customer service	21	248
Moving in and out	46	79
Supplier switches	111	23
Grid settlement	0	30
<b>TOTAL</b>	<b>426</b>	<b>690</b>

Source: Effektivt sluttbrukermarked for kraft; Statnett

An overview assessment of the differences between Norway and Sweden indicates a lower cost per supply point in Sweden. The main reasons for this are that Sweden has had automated meter reading since 2009 and that we therefore have billing based on read consumption.

As mentioned in the introduction, the Norwegian costs have been scaled to Swedish conditions by a general factor of 1.5. This factor is derived from the number of electrical installations being 5 million in Sweden and 3.2 million in Norway, which would give a factor of 1.56. Taking the current exchange rate into

account, and in order to use the 2014 price level, the scale factor has been set at 1.5. Before converting the Norwegian industry's costs into corresponding Swedish costs, a number of special assessments were also made.

The item "other customer service" includes all management of customer matters not carried out in direct contact with the customer. This might largely involve the management of errors in billing, metering, etc. The statistics show a disproportionately high cost for grid operators and, conversely, a low cost for electricity suppliers. It has been assumed here that the total level for this item in Sweden is half the size. It is also assumed that it is distributed equally between electricity supply and grid. Furthermore, statistics reporting has been removed to a separate item in the calculation because it is a task that changes greatly with a central service hub.

The annual total costs for the Swedish companies is therefore currently estimated to approximately SEK 718 million for electricity supply and SEK 774 million for the electricity grid (see tabell 4). The operational costs for the Swedish companies would thus amount to an annual total of about SEK 300 per supply point (144 SEK for electricity supply and SEK 155 for the electricity grid).

Table 4. Calculated annual industry costs in Sweden (SEK million)

	Electricity supply	Electricity grid
Meter value management	93	251
Billing	279	215
Other customer service	101	101
Moving in and out	69	119
Supplier switches	167	35
Grid settlement	0	45
Statistics reporting	10	10
<b>TOTAL</b>	<b>718</b>	<b>774</b>

Source: Sweco

#### 5.4.3 Change in operational costs

The two information management models compared will affect energy companies' operations in slightly different ways. It is not completely easy to calculate how the models affect operational processes without drilling deeper into what these will actually look like. Here, the model with a central hub is more defined with respect to what the processes will look like because there are both Danish process descriptions and proposed Norwegian descriptions to look at. However, what a development of "today's model" would entail in practice is unclear because this technical solution is only outlined in overview form. There are certainly several conceivable variations of this. Here, the following starting points have been used to estimate the impact of each alternative on operational processes.

### **The Central Service Hub alternative**

Here, all the information of common interest is in a central database. This enables the electricity supplier to assume all management of customer matters apart from purely technical issues. The model allows the electricity supplier to seek out the customer's installation in the hub and implement a supplier switch. The hub notifies the previous electricity supplier that its supply is to cease. The grid owner will not be involved in the process, with the possible exception (depending on application) of getting information on who the new supplier is. The electricity supplier also implements moves completely independently for both moving in and out. The grid owner is informed that there has been a customer switch, but this requires no intervention on its part unless written grid contracts become mandatory.

The hub's basic data on customers and electrical installations will be updated from both electricity suppliers and grid owners with a strict division of responsibility for each set of data.

Grid owners will continue to report meter values in much the same way as today, but with only a single recipient. However, they are completely freed from the task of performing grid settlement both for hourly settled and profile-based settled installations. The grid owners also do not need to report meter values to third parties representing customers, nor to the electricity certificate register.

The electricity supplier will be responsible for producing a combined bill to the customer. For those who have both grid and supply today, the difference will not be that great in terms of management. However, the process to retrieve grid fees or grid prices from the hub will be a new element that is expected to require more resources on the part of the electricity supplier than today.

For the grid owner, it is of great importance which billing model will be chosen. In the case of through-billing, the grid owner continues to bill each installation and send this to the hub for forwarding to the right electricity supplier. Therefore, there is a lower reduction in resource requirements for the grid owner. It is freed from the actual distribution of bills to end users, and there is less work with sub-ledgers and payment demands.

If the wholesale model for billing is chosen, the grid owner's work with billing disappears almost completely. There will be only one bill per electricity supplier to produce, and the basis for this is served by the central service hub. The only thing that remains is the updating of products and price lists for grid services in the hub. This is assumed to take place directly via a user interface to the hub. This is therefore the technical solution that would yield the highest efficiency, but the calculation has nevertheless taken the precaution of assuming that the through-billing model will be chosen so as not to overestimate the benefit of the central model.

### **The "Today's all-to-all model developed" alternative**

This model continues to build on the placing of original data on electrical installations, and who are customer, supplier and balance responsible party, in the grid owner's database. This means that data queries must be made to the grid owner's system, where updates must also take place. There will thus continue to

be a message flow between all actors, which admittedly can be speeded up, but will still require a certain amount of time and involve both parties in some way.

This alternative has assumed the adaptation of the message flow to better correspond to the supplier-centric model. It will therefore be possible for the electricity supplier to initiate and implement a move, both in and out. As the grid owner continues to have responsibility for original data, the assessment is that the grid owner is not relieved in the same way as in the case of a central hub. For supplier switching, there will not be any difference from today as regards process design. However, a development of today's model to give it a name service and more rapid management by the grid owner can reduce the amount the electricity supplier has to do.

In terms of processes, the updating of basic data is not different from today.

The grid owner's efforts to collect and report meter values will be unchanged. Meter values for billing are distributed to the respective electricity suppliers. Customers wishing to make use of their opportunity to access meter values, directly or via a representative, will continue to have such access. However, it has been assumed that this will be take place using a more modern message format than today's EDIFACT standard. The grid owners will continue to be responsible for performing grid settlement and will report to Nordic Balance Settlement (eSett Oy). The reporting of volumes produced for electricity certificates will be reported separately to Svenska kraftnät.

#### **Assessment of the impact on operational processes**

Based on the above description of the process changes for each model, the following assessment has been made of the impact on total operational costs. Besides the operations presented above, an addition is made here for Statistics reporting since this is an area that will be greatly affected in the case of a central hub. The extent of this in today's situation is estimated to SEK 10 million each for electricity supply and grid. This only includes the reporting that might be affected by the information management model. Changes and costs are stated in terms of an interval. This is shown in Table 5 and Table 6.

**Table 5. Relative change in per cent and total operational cost for the further development of today's all-to-all model.**

"Today's model"	Relative change (%)				Operational cost (SEK million)			
	Electricity supply		Electricity grid		Electricity supply		Electricity grid	
	min	max	min	max	min	max	min	max
Meter value management	0	0	0	0	93	93	251	251
Billing	+30	+40	-60	-40	363	391	86	129
Other customer service	0	0	0	0	101	101	101	101
Moving in and out	+40	+60	-60	-40	97	110	47	71
Supplier switches	-20	0	-50	-40	133	167	14	17
Grid settlement	N/A	N/A	0	0	N/A	N/A	45	45
Statistics reporting	0	0	-20	0	10	10	8	10
<b>TOTAL</b>					<b>794</b>	<b>871</b>	<b>551</b>	<b>623</b>
SEK per supply point					248	272	172	195

Source: Sweco

**Table 6. Relative change in per cent and total operational cost for the introduction of a central service hub.**

Central service hub	Relative change (%)				Operational cost (SEK million)			
	Electricity supply		Electricity grid		Electricity supply		Electricity grid	
	min	max	min	max	min	max	min	max
Meter value management	0	0	-10	0	93	93	225	251
Billing	+20	+30	-80	-60	335	363	43	86
Other customer service	0	0	-70	-60	101	101	30	40
Moving in and out	+20	+40	-100	-100	83	97	0	0
Supplier switches	-40	-30	-100	-100	100	117	0	0
Grid settlement	N/A	N/A	-100	-100	N/A	N/A	0	0
Statistics reporting	-100	-80	-100	-80	0	2	0	2
<b>TOTAL</b>					<b>711</b>	<b>770</b>	<b>299</b>	<b>379</b>
SEK per supply point					222	241	93	118

Source: Sweco

#### 5.4.4 Overall evaluation

The overall evaluation of the two alternatives has used a calculation according to the present value method. This is based on a real interest rate of 5.2 per cent.<sup>32</sup>

As there is considerable uncertainty regarding both costs and the benefit evaluation, it was decided that both extreme cases should be analysed, where one case assumes the costs to be at the maximum level, with its benefit value set at the minimum level, while the second case assumes the opposite. In total, this gives four different cases for the hub and four different cases for all-to-all, i.e. a total of 16 combinations (see Table 7 and Table 8).

The uncertainties in the cost estimates result in relatively great differences in outcomes for the extreme cases, i.e. for the comparison of the most and least favourable cases for a hub in relation to the all-for-all solution. Even in the least favourable case for a hub, the analysis result indicates that a hub solution is economically advantageous. The mean value of the 16 cases results in a surplus over a ten-year period of about SEK 1.9 billion for the hub solution. The least favourable alternative for the hub yields a surplus of about SEK 330 million, while the most favourable alternative yields a surplus of about SEK 3.5 billion. Sensitivity to the interest rate assumed in the calculation is low. Even if the calculation assumes a real interest rate of 10 per cent, all the cost cases yield a surplus for the hub solution. The fact is that the calculation must assume a real interest rate of 21 per cent in order for the hub solution and the all-to-all solution to be cost-neutral over the 10-year period in the hub's least favourable cost comparison.

Table 7. Cases analysed in a present value calculation

	Cost combinations, Hub
Case A	High investment costs and high operating costs
Case B	Low investment costs and low operating costs
Case C	Low investment costs and high operating costs
Case D	High investment costs and low operating costs

	Cost combinations, All-to-all
Case E	High investment costs and high operating costs
Case F	Low investment costs and low operating costs
Case G	Low investment costs and high operating costs
Case H	High investment costs and low operating costs

Source: Sweco

<sup>32</sup> A detailed calculation can be found in Appendix C to the report *Kostnadsnyttoanalys av Datahubb – En rapport till Energimarknadsinspektionen, Sweco, 2014*

**Table 8. Present value of cost saving for Hub compared with All-to-all (SEK million)**

	Case E	Case F	Case G	Case H
Case A	1 843	332	1 736	439
Case B	3 467	1 957	3 361	2 064
Case C	2 107	597	2 000	703
Case D	3 203	1 693	3 096	1 799
Max saving	3 467			
Min saving	332			
Mean saving	1 900			

Source: Sweco

## 5.5 Qualitative analysis

Because some of the costs and benefits arising from a service hub and from a development of today's all-to-all model are difficult to estimate quantitatively, Sweco has also performed a qualitative analysis of the two models. This partly concerns the impact that each information management model would have on end users, energy service providers, the relevant authorities, competition and society as a whole.

### 5.5.1 End users

A service hub will have impact on end users. In Sweco's assessment, a number of benefits would arise for customers as the service hub would be gathering electricity-related information about customers.

Customers can gain access to the information relating to their own historical energy consumption via the electricity supplier's website, or directly in the service hub if the choice is made to build a customer interface. Access to meter values in a standardised format and regularly updated increases the opportunity (e.g. for electricity suppliers) to pictorialise customers' electricity consumption in a simple and individualised manner. Customers' direct or indirect hub access to stored information about their own electricity consumption underscores customer ownership of meter values. In a hub solution, the customer is not dependent on the individual assessment of a particular grid owner or electricity supplier regarding the storage of historical data. Our assessment is that the accessibility and speed of information can be improved in a service hub solution compared with a developed all-to-all solution.

The benefit of an end-user interface directly in the hub is fairly limited if the information can be reached by customers via their electricity supplier's website. Here, a more principled stance can be taken.

IT security can be improved across the entire collective. Regardless of whether a hub is introduced or not, IT security requirements will be higher for all actors. Sweco's assessment is that a service hub has a better opportunity to have high IT

security than any individual electricity grid owner. The same can be said about accessibility in the systems since the hub will have higher accessibility demands than the systems of individual grid owners and electricity suppliers. One problem raised in interviews is that of how to manage persons who have a protected identity or address. This will have to be managed separately. Here, it will be important for all customer information that is collected, stored and distributed to be under the customer's control. It must only be possible to disclose this information to actors if the customer expressly consents to this.

With the hub, customers no longer themselves need to know their installation ID in order to switch electricity supplier. This simplifies supplier switching and could contribute to greater competition. Furthermore, there is the possibility for the hub to provide information on issued power of attorneys (or for customers to see an overview of the actors that have access to their details), present contracts and any costs for breaking these contracts. Customer access to integrated and overview information simplifies matters and affords customers greater control of their information.

As described in the quantitative analysis, the service hub simplifies the information management of electricity suppliers and electricity grid owners in processes such as supplier switching, moving in and out, updating of basic data. This also creates value for customers by shortening the time for these processes, getting things right from the start and by their perceiving these matters as being smoother than before. Because the hub enables more continuous scrutiny of whether values are reported on time and in the right form, the hub also makes it possible for meter values to be of higher quality.

Access to an individual customer's historical data is improved through the hub. In addition to customers themselves being able to reach the data (via an electricity supplier or directly in a hub interface), customers can also disclose data to energy service providers in a simplified manner. Instead of them having to contact electricity grid operators as is the case today, communication can easily take place through the hub, but only with the end user's permission. The hub also provides opportunities to develop the management of power of attorneys and make this easier for customers to navigate. The hope is that this will simplify the energy services market and give customers greater opportunities to purchase energy services in a simple manner.

At an initial stage, the service hub could mean increased costs for end users due to the cost of establishing the hub. In the long term, however, the hub could reduce costs for end users because it makes matters easier for electricity market actors, which should lead to lower costs in the industry.

As a development of today's all-to-all model is very similar to today's solution, not as many additional qualitative values have been identified for this information management model. One value that would arise for end users in a further development of today's all-to-all model (which is difficult to quantify) is that the costs – initially, at least – would be lower than with a service hub solution. A further development of today's model would not achieve the same extent of qualitative benefits described above. However, it is possible for a development of today's model to achieve many of these, but at a higher cost. It is, for example,

possible to set higher IT security requirements in the future even in the case of an information management model that is a development of today's model. However, this is something which increases the costs for each individual actor, at the same time as it being difficult to ensure full compliance with the IT requirements.

### **5.5.2 Energy service providers**

Because a service hub simplifies access to full customer meter values, customers' energy service providers can, upon customer approval, gain simpler and faster access to these values. The hub can contribute to improved competition and neutrality on the market as no actor is given preferential treatment (the hub makes no distinction so that some companies receive values while others are denied/have to wait longer).

At the same time, there is less dependence on the local systems of different electricity grid operators, where an obstacle can sometimes be posed by accessibility, interpretation and application of regulations and limited opportunities for change. The hope is that this will make matters easier for both energy service providers and customers, thereby increasing choice and competition.

Several companies interviewed by Sweco emphasise that it would be negative if an end-user interface were developed directly in the hub as this risks curbing the development of visualisation solutions on the open market. This risk exists, but the improved accessibility of historical meter values also makes it possible for energy service providers to develop and offer new products to customers.

One qualitative value of instead using a development of today's all-to-all information management model would be that energy service providers can freely develop visualisation solutions, etc. This would, however, mean missing out on the values of energy service providers gaining improved access to customer meter values (upon customer approval). Competition is therefore "freer" with respect to what an actor can do, but today's problems persist, with cases of unequal competition and inefficient processes for third-party access to meter values, and these can be said to impair competition.

### **5.5.3 The relevant authorities**

The relevant authorities are primarily the Swedish Energy Markets Inspectorate and Svenska kraftnät. It is conceivable that a central service hub solution would be managed by Svenska kraftnät. Benefits to Svenska kraftnät that may be mentioned are that a central service hub would entail fewer contacts when collecting statistical data and a potentially improved quality of meter data for Swedish balance settlement reporting to eSett. If Svenska kraftnät is commissioned to establish and manage the hub, this means a new operation in an organisation that is already today strained by expansion.

For the Swedish Energy Markets Inspectorate and for the actor given responsibility for a central service hub (Svenska kraftnät is proposed), the benefit of this would be the opportunity to streamline and simplify supervision of compliance with the regulations. For example, there is greater opportunity to require and follow up the timely delivery of information to the hub and make this subject to a penalty. This is

because transparency is improved and there are better opportunities to follow up that all actors are working in accordance with the regulations. It is also easier to place demands on the actors when everything goes via the hub. It would also be easier to exclude actors that do not comply with the regulations. No insight by the relevant authorities into individual electricity supply contracts and similar business-related information is being considered. Neither will this type of information be stored in the hub. However, there may be a certain risk of individual actors perceiving the mission of the relevant authorities (such as Ei and Svenska kraftnät) as being more of a “big brother nature”.

No specific qualitative benefits were identified for the relevant authorities in their instead having an information management model based on a development of today's model. It could perhaps be pointed out that an initial cost is avoided as regards conversion from today's approach to a service hub. However, there will still be conversion costs for adapting to changing demands on the electricity market, for which reason the initial saving will be limited.

#### **5.5.4 Competition**

It was not part of Sweco's commission to analyse in detail the competitive situation on the end-user market for electricity. The assessment is that competition on the end-user market is relatively good. There are a large number of competing suppliers, and the search and switching costs for customers are relatively low. In 2013, just over 560 000 switches of electricity supplier were performed, which means that over 10 per cent of customers switched supplier during the year. Internationally speaking, this is a relatively high rate of switching and comparable to the switching rates of other similar services for which customers retain their supplier if they do not make an active choice (telephony, insurance, banking). With the exception of car insurance, the switching rate of these services appears to be on a par or below that of the electricity market.

Previous investigations of electricity supply margins indicate that the margins are relatively low, at least for active customers. On the whole, this means that the competitive situation on the end-user market is assessed to be relatively good. From this perspective, it is likely that potential gains in the form of greater competition resulting from improved information management are relatively limited. This does not mean, however, that the market functions without any problems. It is well known that margins for non-active customers can be significantly higher, but the extent to which this is affected by the introduction of a hub is uncertain. Furthermore, there are regular reports concerning various problems related to switches. Improved information management might be expected to reduce some of these problems, which could increase customer confidence and willingness to be active on the market.

A centralised service hub makes data accessible, with the relevant customers' approval, to the electricity market actors. Actors gain access to data on the same terms, and this can help to enhance competition through simplified supplier switching processes. Greater demands on separation between grid owners and competitive activities can be accommodated more easily. Furthermore, the service hub is able to manage languages, accessibility and quality, facilitating greater competition in a Nordic end-user market. With today's system, every actor must

itself build up systems to request and deliver information (or pay to have this done). This can be said to create thresholds on the electricity market, which could be lowered through the hub's system for this.

If today's all-for-all solution were to be developed, it could be appropriate to introduce a name service. A name service of this kind would enable easier and more neutral access for actors than today. It can be thus be said that a developed version of today's all-to-all model would also have some positive impact on competition.

However, a service hub is assessed to have the same or a possibly somewhat better impact on the competitive situation, even though the total impact on the competitive situation is likely to be limited regardless of the choice of system solution.

#### **5.5.5 Overall societal impact**

The establishment of a service hub can yield gains when forthcoming changes are introduced on the Swedish and Nordic electricity markets. This specifically relates to the implementation of Nordic Balance Settlement, an electricity supplier-centric market model and a Nordic end-user market.

Probably the greatest coordination gain if Svenska kraftnät is commissioned to establish a Swedish service hub is the greater opportunities of Svenska kraftnät to coordinate the operationalisation/introduction of parallel changes that have been decided for the Swedish and Nordic electricity markets. This specifically relates to the implementation of Nordic Balance Settlement, an electricity supplier-centric market model and a Nordic end-user market and a Swedish service hub.

Several of the actors responding to Ei's questionnaire point out that a central service hub supports an electricity supplier-centric market and is in principle a prerequisite for a Nordic end-user market to function as intended. The achievement a Nordic end-user market requires some form of aggregated hub solution. An electricity supplier-centric market entails a greater need for information transfer between electricity suppliers and electricity grid owners. A service hub can facilitate this information transfer, which might, for example, make it easier to manage disconnections when customers have not paid their electricity bill. This means, for example, that customers do not get disconnected unnecessarily and that they can be reconnected efficiently when payment is received. Furthermore, it is assessed that centralised information management creates a better functioning electricity market with improved transparency, clearer division of responsibilities between actors, and enables economies of scale and automation.

However, there are also actors that consider a distributed solution to be preferable. They cite the negative impact on society that a service hub could have if a computer crash were to occur. This would have significant implications for settlement and debiting, thus causing financial losses for many actors. These electricity market actors also cited the risk of delays and cost increases associated with a service hub project as being risks that have a negative societal impact. Here it is important to design a procurement that does not create dependency on a particular supplier.

The risks are also cited of a re-regulation of today's competitive part of the electricity market and a "locking in" to a particular technical solution and system supplier. These factors are important to keep in mind when designing a service hub and implementation projects.

At the same time, it can be said that a service hub makes it possible to create a vision and to "do things right from the start" when designing information systems that are suited to the future electricity market.

To some extent, a development of today's all-to-all model avoids the risks of locking in to a particular system supplier and technical solution. A further qualitative value is that the risk of a computer crash is spread over multiple actors, with each computer crash having a more limited impact on the electricity market as a whole. However, these computer problems would arise more frequently. Economies of scale and automation are also not created by a development of today's all-to-all information management model. At the same time, Nordic balance settlement, an electricity supplier-centric end-user market and a Nordic end-user market place high (and potentially very costly) demands on a further development of today's all-to-all system.

#### **5.5.6 Electricity grid operators, electricity suppliers and balance responsible parties**

Costs and benefits for electricity grid operators and electricity suppliers are treated primarily in the quantitative analysis. A major value for electricity grid operators, electricity suppliers and balance responsible parties in the introduction of a central service hub is the sharp decrease in the number of contact points required for various processes; in many cases it is sufficient to communicate with the hub alone. This would make it simpler for electricity suppliers to manage supplier switches, moves and power of attorneys. A further qualitative value is the creation of higher accessibility compared with distributed data warehouses.

If, instead, a further development of today's all-to-all model for information management were to be implemented, a qualitative value would be that the transition to this system could take place more slowly. The disadvantage, however, is that values relating to a reduced number of contact points do not arise. A further disadvantage of a developed version of today's all-to-all model is that it is not possible to apply wholesale billing since there will be too many contact points for the system to function in practice.

## **5.6 Coordination gains**

Sweco's commission also included shedding light on any coordination gains that may arise if Svenska kraftnät is commissioned to establish a Swedish service hub that as far as possible is coordinated with system operators in other Nordic countries.

The coordination gains that could be achieved in this case are of the nature of synergies rather than economies of scale. Economies of scale could be achieved by merging, for example, the Swedish and the Norwegian hubs. Synergies could also arise in different phases of a change. Some have a greater effect/role at an initial stage and some more at a settled stage.

### 5.6.1 Multiple changes affect each other

Probably the greatest coordination gain if Svenska kraftnät is commissioned to establish a Swedish hub is the greater opportunities of Svenska kraftnät to coordinate the operationalisation/introduction of parallel changes that have been decided for the Swedish and Nordic electricity markets. This specifically relates to the implementation of Nordic Balance Settlement, an electricity supplier-centric market model and a Nordic end-user market and the Swedish service hub.

If carried out in the “wrong order” and in the “wrong way”, coordination and synchronised implementation of these changes might occasion relatively high and unnecessary costs for electricity suppliers, balance responsible parties and above all grid owners on the Swedish electricity market, mainly in the form of repeated changes to the IT support systems and work processes of these actors.<sup>33,34</sup> If Nordic Balance Settlement were to be introduced today, changes would be required in the systems of all grid owners. This is because the proposal for Nordic Balance Settlement is that grid owners are to create a changed/expanded basis. If a hub were to be introduced, it would be possible to perform these calculations in the hub. It is reasonable to say that introducing the change to grid owners first and then having a hub perform the calculations is not cost-effective. An actor with a good overview, planning ability and a clear coordination task should be well placed to minimise actor costs and maximise customer benefit.

Regardless of which actor is given responsibility for the operation and management of a Swedish data/service hub, the establishment of a hub, compared with an all-to-all model, results in gains when introducing additional/subsequent changes on the Swedish electricity market. The bigger and more far-reaching these changes are, the greater the differences between the models.

In an all-to-all model, most major changes have an impact on the support systems of all actors. This may, for example, relate to changed formats for information management, the introduction of new exchanges/services or changed roles for the actors. These changes to the actors' systems, in turn, place major demands on coordination and synchronisation.

In a hub solution, the transition can instead (technically, at least) take place gradually during a transitional period without requiring all actors to implement the change at exactly the same time. This should reasonably lead to a lower burden on the implementing organisations of actors and system suppliers, resulting in lower costs for the change.

### 5.6.2 Possible gains from Swedish-Norwegian cooperation

Economies of scale could be achieved by Sweden joining the Norwegian hub. The similarities between the markets are great. The differences are mainly between profile settlement for manually read meters in Norway and profile-based settlement for monthly read meters in Sweden. In practice, only one or the other can be accommodated in a common hub. Otherwise two, in principle, identical hubs must be established. This would also mean that there is no need to build an interface for translation between Norwegian and Swedish formats and rules.

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<sup>33</sup> Regelförändringar som möjliggör nordisk balansavräkning (Ei R2014:06)

<sup>34</sup> Conversation with Lars Munter, Svenska kraftnät

Elhub.no would then deliver services to actors on both the Norwegian and Swedish electricity markets. This can also bring advantages with respect to the establishment of a common Nordic service hub in the longer term. A step-by-step Nordic harmonisation would “skip” the step of each country developing different forms of national solution that might then in the long term be transformed into a common Nordic solution. If a common Nordic information management is to be achieved in the long term, a step-by-step Nordic harmonisation would in that case be more effective and less of a cost-driving factor.

This commission has not included any closer examination of possible restrictions with regard to the legal or information security aspects of sensitive information (e.g. classified installations). Sweco assesses there to be potential benefits in Sweden joining the Norwegian hub, and that it would therefore be of interest for the next stage to analyse any differences in Business Requirement Specifications (BRSs) between Sweden and Norway. Agreement by the countries on common BRSs makes it easier to agree on common solutions.

### **5.6.3 Operational synergies for Svenska kraftnät**

The operational synergies we have identified as part of this work are summarised below. These synergies should provide opportunity to benefit from Svenska kraftnät's knowledge, experience and established contacts.

There are already established channels and forms of cooperation between the Nordic system operators in adjoining issues/areas, where the formation of the jointly owned eSett in Finland is a case in point.<sup>35</sup>

As system operator, Svenska kraftnät is responsible for neighbouring/connected national areas, which can give Svenska kraftnät a better understanding and broader view of the issues and problems to be solved.

Svenska kraftnät already has an authority role as regards responsibility for the electricity system and questions of emergency preparedness, and is responsible for Sweden's role in the Nordic cooperation on these issues.

In its present commission, Svenska kraftnät has procedures for managing data security and has experience of managing sensitive data/information.

Svenska kraftnät has good knowledge of the electricity industry in the Nordic countries in general and of the Swedish actors in particular. Today, Svenska kraftnät's organisation has five councils attached.<sup>36</sup> They consist of representatives from Svenska kraftnät, the electricity industry and other stakeholders. The five councils are:

- The Operations Council
- The Contingency Planning Council
- The Electricity Market Council
- The Dam Safety Council

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<sup>35</sup> <http://www.nbs.coop/>

<sup>36</sup> <http://www.svk.se/Start/English/About-us/Organisation/Councils/>

- The Planning Council

Svenska kraftnät currently has responsibility for Ediel<sup>37</sup>, the electricity industry's EDI (Electronic Data Interchange) system that is used for electronic information management between the actors on the Nordic energy market. This manages all the information that is not in real time, such as the reporting of meter values and supply values. The Ediel portal is a tool for the electricity and natural gas markets in Sweden. It contains, among other things, a register of all Ediel actors in Sweden and a test system for Ediel messages. Statnett manages the operation of the Ediel portal for both Sweden and Norway (ediel.se and ediel.no).<sup>38</sup>.

Historically, and especially in connection with deregulation in 1996 and the years following, Svenska kraftnät has had a prominent role in electricity market developments in Sweden and the Nordic countries. Svenska kraftnät was, among other things, responsible for the production of the Swedish Electricity Market Manual and is now one of several actors involved in developing it further.

If commissioned to establish a Swedish service hub, one probable need that Svenska kraftnät has for the smooth completion of this commission is complementary skills that offer its activities broad electricity market expertise and experience from the end-user market.

## 5.7 Sweco's conclusions from the cost-benefit analysis

Sweco's overall assessment is that the introduction of a central service hub is economically justified. There are considerable uncertainties regarding cost estimates for the two information management models analysed. Sweco has therefore analysed cases with different assessments of the introduction and operating costs for a model with a central service hub and for a model with a further development of today's all-to-all model. For eight analysed cost combinations, a central service hub yields an average economic gain of approximately SEK 1.9 billion over a ten-year period (present value). A central service hub also yields a surplus in the case assuming the highest costs for a service hub and the lowest costs for a further development of today's all-to-all model. For this reason, even though there are considerable uncertainties in the cost estimates, Sweco assesses these results to be relatively robust. Furthermore, the qualitative analysis points to a number of non-quantified benefits that can be achieved with a central service hub.

Sweco's analysis indicates that the greatest economic benefits arise for electricity grid operators. However, the commission did not include a proposal or analysis regarding how the costs are to be paid for. It is expected that a central service hub, or central elements of a further developed all-to-all model, will be financed by fees. The fee design might influence the distribution of the surplus between various actors if a hub is introduced, but not the total surplus.

Sweco assesses that a central service hub yields potentially great advantages for a future Nordic (or European) end-user market due to the hub being able to offer

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<sup>37</sup> <http://www.svk.se/Drift-och-marknad/Verktyg-for-branschaktorer/Ediel/>

<sup>38</sup> <http://www.statnett.no/>

“format filtering”. Compared with a developed all-to-all solution, this means that fewer adjustments are required to link national markets with a hub solution. Sweco also assesses that a service hub more simply and efficiently meets the future requirements that may be expected on the electricity market (an assumed “future scenario”).

A service hub supports the development of energy services due to an information management model that makes it possible for new market actors, even outside the energy industry, to enter the electricity market. A central interface simplifies access to full customer meter values, to which energy service providers can, upon customer approval, gain simpler and faster access.

From a cost-benefit perspective, Sweco assesses that it could be potentially favourable for Sweden to join the Norwegian hub. This would lead to economies of scale, and there is also no need to build an interface for translation between Norwegian and Swedish formats and rules. It would therefore also be of interest for the next stage to review the alternative of Sweden joining the Norwegian hub instead of developing its own service hub solution and to analyse any differences in Business Requirement Specifications (BRSs) between Sweden and Norway. Agreement by the countries on common BRSs makes it easier to agree on common solutions.

Assuming that a decision is made to introduce a central service hub, Sweco assesses there to be major advantages in Svenska kraftnät being commissioned by the Government to own and manage a central service hub solution. The most important arguments for this are that Svenska kraftnät has unique opportunities to coordinate the operationalisation/introduction of parallel changes that have been decided for the Swedish and Nordic electricity markets. For this reason, irrespective of whether Sweden develops its own central service hub solution or joins the Norwegian hub, Sweco's recommendation is for Svenska kraftnät to have a central role in the work with the service hub. There are many operational synergies arising from good opportunities to benefit from Svenska kraftnät's knowledge, experience and established contacts. A positive outcome for the introduction of a central service hub in Sweden requires the electricity market actors to cooperate with each other.

There are differing perceptions in the industry regarding solutions, both in terms of more general models and technical solutions. It is therefore important to maintain and deepen dialogue with the industry. A number of actors express the view that a service hub solution with central storage of information is antiquated and that developments are moving towards more decentralised solutions (for example, a service hub with decentralised storage). Of course, it cannot be ruled out that developments in the longer term will move in this direction but, in Sweco's assessment, such decentralised solutions with the same functionality as a service hub with central storage are relatively untested.

There are also important differences between the situations in Sweden and in other Nordic countries. For example, AMR has already been rolled out in Sweden, which means that all billing is based on read consumption. This has greatly reduced the burden on customer service departments with considerably fewer questions from customers. A significant rationalisation has thus already been implemented, and

which Norway and Denmark are now implementing at the same time as introducing central hub solutions.

A number of service providers in Sweden have also invested in various solutions based on today's all-to-all information management model. These investments would largely be lost in a transition to a central service hub solution. By analysing a number of different cases with different cost assumptions, we have taken this into account to some extent.

# 6 Analysis and proposals

Today's information management model with bilateral contacts functions relatively well under the conditions prevailing on the electricity market today. However, this model does not satisfactorily meet the demands that will be placed on the electricity market in the future. This was already noted by the Swedish Energy Markets Inspectorate (Ei) in its report "*Easier for the customer*" from 2013. This conclusion was based on the extensive market changes currently in progress and that are expected over the next ten years. These changes primarily consist of ongoing work in the Nordic countries to implement an electricity supplier-centric market model, to harmonise the Nordic end-user markets for electricity and to achieve a Nordic Balance Settlement.

There is also a development at the European level and a general market development which might place increased demands on separation between monopoly activities and competitive activities. Here, customers want faster access to information, the energy services market develops at an increasingly faster pace, new types of actors enter the electricity market, micro-production and personal production increase and the importance of privacy issues grows parallel to increasing quantities of information on individual customers.

Today's information management model lacks the conditions to manage these coming changes on the electricity market. This conclusion is shared by a clear majority of the actors responding to Ei's questionnaire survey conducted in March 2014.

## 6.1 Which model should we choose for the future?

Future challenges related to information management can be met by means of various solutions. Possible future models are competing hubs, communication hubs, service hubs with central storage and hubs with few or many functions. The following is a discussion of the characteristics that a new model should have.

### 6.1.1 Low entry barriers and cost-effective processes are desirable

When introducing a new information management model, it is important not to create new entry barriers for the competitive actors. Vertically integrated actors must also not be given opportunities to favour their own companies at the expense of other market actors. Similarly, a model may not favour actors choosing only to act in Sweden at the expense of foreign actors.

The information management model should also lead to cost-effective processes and systems for the distribution, control and storage of meter values and high-quality structure information. The costs of all actors must be taken into account. At the same time, the information management model should also be flexible. As the electricity market develops, the model should be easily adaptable to new conditions. The model should also be scalable, standardised and may not prevent actors from developing new services on the electricity market.

The choice of future information management model is crucial to how and at what pace the regulations for an electricity supplier-centric model will be able to be implemented. Effective information management is important in an electricity supplier-centric model since electricity suppliers and grid owners are dependent on being able to communicate quickly with each other as a means of offering good customer service. It is also important that customers feel secure to act on the market. Effective and robust information management could increase confidence in the electricity market.

There are major advantages to a system having few interfaces in a future information management model. In order to act effectively, it is important for the competitive actors to have simple access to basic data. Few interfaces are also good for the grid owner, which is obliged provide data. It also becomes easier for new actors wishing to establish themselves on the market when they only need to adapt to and communicate with one party for most market processes.

## **6.2 A service hub will yield significant economic gains**

The cost-benefit analysis that compared the introduction of a service hub with central storage of information with the further development of today's all-to-all model indicates significant economic gains if a hub is introduced. 16 different outcomes were developed, all showing a significant economic surplus over a ten-year period if a service hub is implemented. The mean value shows a surplus of SEK 1.9 billion. The span between the lowest and highest gain ranges from a surplus of SEK 330 million up to a surplus of SEK 3.5 billion. Ei assesses the results to be sufficiently robust to conclude that the implementation and operation of a service hub over a ten-year period is far more economically advantageous compared with developing today's information management model.

Large parts of the cost savings in a hub solution compared with the further development of the all-to-all model derive from the fact that the management of grid settlement, service, moving, supplier switching and, to some extent, billing can be largely managed centrally, rather than being performed by each individual grid owner.

## **6.3 A service hub is a future-proof choice**

A central service hub is the information management model that is most suited to future Swedish conditions and should therefore be introduced.

A service hub facilitates a Nordic and, eventually, a European end-user market by making it possible for electricity suppliers to obtain quick access to all relevant electricity market information via one contact point. A service hub lowers the entry barrier for electricity suppliers and energy services companies wishing to establish themselves in Sweden.

A service hub also reinforces an electricity supplier-centric market model by providing the electricity supplier with quick and efficient access to data on the customer, the customer's consumption and the customer's installation, etc. It enables the electricity supplier to give better service to the customer, for example,

by implementing moves and supplier switches while speaking to the customer over the phone.

### **6.3.1 Mandatory service hub ensures non-discrimination**

Bilateral disclosure of information from an electricity grid operator to an actor on the competitive market has a built-in risk of the electricity grid operator giving preferential treatment when disclosing that information. This might involve an actor being given priority, thereby obtaining faster processing of a request to access information or receiving more information than is customary. It might also mean that information disclosure is delayed (“put at the bottom of the pile”), called into question or that complete information is not disclosed. A correctly designed service hub takes care of this problem and ensures competition-neutral access to meter values and other customer information.

The service hub serves as a firewall between monopoly activities and competitive activities to ensure non-discriminatory behaviour on the part of the grid owners vis-à-vis electricity suppliers and energy service companies. Communication should therefore be organised so that the grid owner does not gain knowledge of which actor(s) on the competitive market the customer has chosen to engage.

To ensure competition on equal terms and to ensure society's streamlining of the electricity market, there should be regulations requiring electricity grid operators, electricity suppliers and balance responsible parties to use the service hub to implement the basic processes described later in this chapter.

### **6.3.2 More effective supervision**

A centralised management of central electricity market processes (such as meter value reporting and supplier switching) allows continuous monitoring of compliance with the regulations. Compared with other information management models, it is thereby easier to set requirements regarding information provided to the service hub (including frequency and quality) and to verify compliance with these requirements. Centralisation allows Ei to pursue a more effective supervision of compliance with the regulations governing the market's central processes.

### **6.3.3 Customers should have access to information about their consumption and their contract**

A service hub according to the proposed model ensures customer access to unbroken time series of meter values. This information can be important for a customer determining, for example, the benefits of a particular energy efficiency measure or electricity supply contract. Furthermore, central access to information on the expiry date and release fee for a customer's existing contract can improve the customer's experience of switching supplier. By giving the new electricity supplier access to this information, the customer and the new electricity supplier can agree on a suitable time for the new electricity supply contract to start and ensure that the customer does not involuntarily suffer penalty fees by unintentionally breaking a fixed-term contract.

For this reason, the hub should make it possible for customers to view their own meter values within a reasonable time, access information about the existing

electricity supply contract's expiry date and whether customers will suffer a penalty fee if they break their contract prematurely<sup>39</sup>.

#### **6.3.4 Improved management of power of attorneys**

The principle should be that all meter values generated by the customer are to be under the customer's control. This means that the customer should be informed about data management and, when consent is required, the customer should be informed of the implications of this consent. It must only be possible to disclose this information to actors if the customer expressly consents to this.<sup>40</sup> Today, this is primarily managed through power of attorneys.

Ei may note that there are differences in the functioning and management of the power of attorney process. This is unsatisfactory both for market processes and customer privacy. An organised management and registration of power of attorneys on the electricity market would benefit electricity customers.

The hub should therefore also make it possible for customers to access and manage (register, update and delete) active power of attorneys that the customer has given to actors on the electricity market. There should be regulations requiring all electricity market-related power of attorneys from customers to electricity suppliers, energy service companies, etc. to be registered in the hub. Such requirements ensure that customers are kept informed about which actors can gain access to their information.

#### **6.3.5 No customer interface in the hub**

Access to power of attorneys and other information should in the first instance take place through customers logging in on "my pages" on their electricity supplier's website, which in turn has a direct connection to the service hub. A solution of this kind reinforces the electricity supplier-centric market model compared with creating a customer interface directly in the hub.

#### **6.3.6 Nordic Balance Settlement**

The introduction of the proposed service hub means that Nordic Balance Settlement can be implemented without the grid owners needing to make costly investments in their IT systems. The reconciliation settlement can be done in the service hub instead of by each grid owner. Centralised settlement also reduces the risk of errors compared with if all grid owners performed settlement themselves.

### **6.4 Svenska kraftnät should develop and operate a hub**

Svenska kraftnät (SvK) should be commissioned by the Government to develop and operate a central information management model, a service hub, for information management on the Swedish electricity market. SvK's commission should take place in consultation with Ei. At the same time, the Government should commission Ei to investigate what regulatory amendments are needed to enable the introduction of a service hub in an electricity supplier-centric market

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<sup>39</sup> However, information on the actual cost of breaking the contract need not be visible to the customer

<sup>40</sup> A certain limited dissemination of basic data needed by electricity suppliers and other actors for billing purposes or statutory obligations for grid operations should be exempt from this

model with the functionality described in Chapter 6.5. Ei's commission should take place in consultation with SvK.

Ei assesses SvK to be an appropriate principal for a Swedish service hub because SvK is an impartial market actor that also has an authority role.

SvK is also well placed to take stock of current and future market changes, giving it opportunity to coordinate parallel changes on the Swedish electricity market, such as an electricity supplier-centric market model, Nordic Balance Settlement and also, if so decided, the introduction of a service hub.

Ei currently has the right to issue regulations for a certain part of information management on the electricity market, including roles and areas of responsibility. It is therefore natural for Ei to retain responsibility for these questions even if a hub is established in Sweden. Ei assumes that actors making use of the service hub will enter a contract with SvK. Just as is the case for balance contracts, Ei should inspect and approve the methods for drawing up this contract.

#### **6.4.1 Svenska kraftnät should investigate how meter values are to be stored**

In Ei's opinion, the service hub with central storage of meter values etc., described by Sweco and largely corresponding to the hubs in Denmark and Norway, would probably serve the Swedish electricity market in an excellent way in the future. In contrast, many actors during the investigation argued that it would be more efficient and future-proof to choose a service hub with decentralised storage of meter values compared with centralised storage. The service hub would then essentially function in the same way as the hubs in Norway and Denmark. The difference would be that there is no central data warehouse to which actors report meter values and other information. Instead, the information is stored by the grid owners, as is mainly the case today. It might be possible to achieve the same functionality and separation between monopoly activities and competitive activities in a hub with decentralised storage as in a hub with central storage.

The cost analysis calculations<sup>41</sup> indicate a significant economic gain if a service hub with central storage is chosen as the future information management model for the Swedish electricity market. An economic analysis of this kind has not been performed for a service hub with decentralised storage.

Against this background, SvK should be commissioned by the Government to investigate the design of the service hub's technical specifications, including whether it is most appropriate to organise the storage of meter values and other information centrally at SvK, or if the information should continue to be stored in a decentralised manner with guaranteed access via a central service hub. The societal benefit of both a service hub with central storage and a service hub with decentralised storage is positive. Further investigation should, however, shed light on whether there are any crucial differences in terms of costs and benefits between a service hub with central storage and a service hub with decentralised storage.

Furthermore, SvK should investigate whether it is possible and appropriate to cooperate with other system operators to build up and operate the hub, thus

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<sup>41</sup> Kostnadsnyttoanalys av datahubb, En rapport till Energimarknadsinspektionen, Sweco, 30 April 2014

enabling cost savings and/or promoting the integration of national end-user markets for electricity.

SvK should be commissioned to carry out the above investigations in consultation with the Swedish Energy Markets Inspectorate. SvK should also obtain experience and knowledge from the Swedish Data Inspection Board, the Swedish Competition Authority, the Swedish Energy Agency, Statistics Sweden and the Swedish Consumer Agency.

## **6.5 Functions in the hub**

It is Ei's assessment that the service hub should manage and perform the following central processes and functions on the electricity market:

### *1. Installation start-up*

The grid owner registers basic data for new electrical installations in the service hub, i.e. installation ID, metering period (hour/month), reporting frequency, settlement method, main fuse, any meter data, calculated annual consumption etc.

### *2. Moving in*

A customer contacts the electricity supplier and reports moving in at a new address. The electricity supplier finds the right installation via a search function based on the customer's address and can identify that it is, for example, the right apartment. The electricity supplier registers the customer's moving in to the electrical installation in the service hub and the fact that the electricity supplier is commencing supply from the date of moving in. This can mean that existing customers are automatically moved out and existing contracts terminated if they get another electricity supplier. The grid owner is informed that there has been a customer switch at the address in question.

### *3. Moving out*

A customer reports moving out to the electricity supplier, which registers the move in the service hub. This sometimes means that the electricity contract is terminated. Most often, it will mean the customer also moving in at another address. With the service hub's access to every electrical installation in the whole of Sweden, the electricity supplier can move the customer in at the new address and move the electricity contract there. Relevant grid owners are informed of the customer switch.

### *4. Supplier switch*

The customer has contact with the electricity supplier and agrees on an electricity contract. The electricity supplier seeks out the customer and the relevant installation in the service hub and registers a supplier switch for the agreed date. The hub notifies the old electricity supplier that its contract is terminated. The grid owner need not necessarily be informed. A power of attorney is not necessary since the electricity supplier only has contact with the hub. This applies, for

example, when a customer is switching electricity supplier and an electricity supplier has a power of attorney to terminate the customer's existing contract. In contrast, the search in the hub should be part of an agreement between electricity supplier and customer. A contract should have been entered before the electricity supplier implements the supplier switch in the hub. (In Denmark, this is controlled by Energinet.dk using random samples).

If a contract period for fixed-term contracts is registered in the hub, electricity suppliers can inform customers that they already have a valid contract before a new agreement is finalised. The customer can thus elect to break the old contract immediately, and incur a cost for doing so, or to start the new contract only when the old one expires.

#### *5. Updating of installation data*

The updating of basic data relating to the installation and the meter, e.g. meter change or change of settlement method, main fuse, etc. The grid owner is responsible.

#### *6. Updating of customer data*

The updating of basic data relating to the customer, e.g. change of name, address, deceased, etc. The electricity supplier is responsible.

#### *7. Service request from electricity supplier to grid owner*

The electricity supplier needs the grid owner's help to perform a task, such as the closure of an installation. This is managed as a matter in the hub with confirmation and response upon completion of the measure. It might also simply relate to a question.

#### *8. Meter value management*

Grid owners report all meter values to the service hub. This also applies to regional and national grids. It covers all meter values of interest for billing and settlement - hourly values and monthly readings, consumption, production, exchanges with adjoining grid areas, etc. The hub performs a formal validation (the grid owner remains responsible for the quality of the meter value). Meter values for billing are immediately forwarded to the electricity supplier. Meter values are stored in the hub. Electricity suppliers and grid owners can retrieve meter values when needed. Electricity suppliers can only retrieve meter values for their own customers during the contract period. A customer may authorise an electricity supplier to have to access historical meter values.

#### *9. Settlement data for Nordic Balance Settlement*

The service hub performs grid settlement for all grid areas. First to be calculated are totals per grid area. These are reported back to grid owners so that they can control that reporting has been done in full. Then consumption per electricity supplier is aggregated per grid area. The hub calculates the other time series that

Nordic Balance Settlement requires, such as production per installation, exchanges between grid areas, grid losses, assigned supplies, etc. This is distributed to eSett Oy (Nordic Balance Settlement) and to the relevant balance responsible parties and electricity suppliers.

#### *10. Correction settlement*

This is partly a new function resulting from a full introduction of Nordic Balance Settlement. It will manage the corrections in meter values made after settlement has been closed after 13 days. The hub calculates corrections for hourly settled installations (production and consumption) which are priced according to balance power price (or another price). Data for settlement with the relevant parties is delivered to the party responsible for such settlements. The equivalent for profile-based settlement is in principle the same as for reconciled energy today. This is also calculated by the hub, which sends data for financial settlement to the responsible party.

The process of combined billing should be managed through the service hub. However, the question needs to be investigated separately and is dependent on the model of combined billing chosen (through-billing or the wholesale model).

Furthermore, the hub should manage the disclosure of individual customers' meter values to third parties (such as energy service companies) with whom the customer has contracted to this effect.

The service hub should also make it possible for customers to view their own meter values within a reasonable time, access information about the electricity supply contract's expiry date and whether customers will suffer a penalty fee if they break their contract prematurely<sup>42</sup>. The information to customers should be provided by requiring electricity suppliers to present this information to customers (in the first instance via the electricity supplier's website). A solution of this kind reinforces the electricity supplier-centric model whereby the electricity supplier is the customer's primary contact point compared with an interface directly in the hub.

Ei notes that there are differences in the functioning and management of the power of attorney process. This is unsatisfactory both for market processes and customer privacy. The hub should therefore also make it possible for customers to access and manage (register, update and delete) active power of attorneys that the customer has given to actors on the electricity market. A good way to provide access to the power of attorneys is by customers logging in on "my pages" on their electricity supplier's website. There should be regulations requiring all electricity market-related power of attorneys from customers to electricity suppliers, energy service companies, etc. to be registered in the hub.

The compilation of information into reports and statistics on the aggregate level should be managed through the service hub. This can meet the needs of the Swedish Energy Markets Inspectorate, the Swedish Energy Agency, Svenska kraftnät, Statistics Sweden, etc. and might, if the compilations are based on existing

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<sup>42</sup> However, information on the actual cost of breaking the contract need not be visible to the customer.

data, greatly reduce the reporting burden on the companies concerned, at the same time as probably reducing the resources required by responsible authorities for collection.

In addition to the functions mentioned above, continued investigation could consider whether further functions can be incorporated in the service hub.

## **6.6 Questions for continued investigation to consider**

Of course, it is not entirely unproblematic to introduce a service hub, and there are many important questions to consider as the process continues.

In a certain sense, bringing together the electricity market's central processes in a service hub makes the system more vulnerable compared with a more decentralised information management model. Ei's assessment, however, is that an awareness of this early in the development phase makes it possible to plan to have sufficient IT protection and redundancy in the system etc.

It is also important for a service hub to guarantee that the privacy of individual electricity customers is protected. No unauthorised person is to have access to information about customers. Ei assesses there to be a need for a general increase in awareness and greater measures to guarantee a high level of privacy protection, completely regardless of the information management model chosen for the future.

The establishment of a central service hub also creates a monopoly on important parts of the electricity market's information management. It is therefore important to build the service hub in such a way that it becomes possible over time to make smooth and easy use of different IT suppliers for development and maintenance. It is also important that the service hub can be easily modified to manage additional or fewer processes, data elements, etc. There should be great flexibility to ensure that the hub does not inhibit future innovations.

During the development phase, the body in charge of the hub needs to communicate with the relevant market actors in a clear and transparent manner in order to ensure as much predictability as possible. Both the timetable and the division of responsibilities between actors (for the development and operational phases) must be established as early as possible.

It will be of the utmost importance in the continued investigation for the analysis to include the relevant legislation and regulations. Questions regarding matters such as classified installations and customers who have a protected identity need to be managed separately.

The question of the hub's financing needs to be investigated. Ei identifies two main alternative models; financing through fees from those using the hub or financing via Svenska kraftnät's national grid tariff (no special fees for users of the hub). Since the construction and operation of a service hub cannot be regarded as grid operations, Ei does not believe it is reasonable for electricity grid customers as a collective to finance the costs for the hub via the grid tariff. Therefore, the hub should be financed through fees from the actors making use of the hub. In its further work, SvK should investigate how the hub can be financed through fees.

## 6.7 Implementation

As with the future development of a hub, Svenska kraftnät's investigation should be performed in close dialogue with the relevant authorities<sup>43</sup> and with industry and customer representatives.

Ei estimates that, after a decision, it will take three to four years to establish a service hub in Sweden. This assessment is based on experience from Norway and Denmark. If further investigation reveals that it is possible for Svenska kraftnät to connect to an existing hub, it is Ei's assessment that Swedish implementation will probably be able to be speeded up considerably.

For a number of years, work has been under way towards harmonising the Nordic end-user markets for electricity at the same time as implementing an electricity supplier-centric market model with combined billing for electricity grid and electricity supply. In addition, the system operators in Finland, Norway and Sweden are working to coordinate balance settlement, both to streamline settlement and to enable a Nordic end-user market. Making these changes in the “wrong” order could result in high and unnecessary costs for market actors, costs that are ultimately likely to affect Swedish electricity customers.

As Ei pointed out in the report *Regelförändringar som möjliggör nordisk balansavräkning*<sup>44</sup>, the Government needs to make a decision on the direction of a future information management model before a Nordic Balance Settlement can be fully implemented. This is to avoid Swedish electricity grid operators making costly investments in IT systems to adapt to a Nordic Balance Settlement. These investments could become obsolete if a service hub is introduced a year or so later. If a decision to introduce a service hub is made in the relatively near future, it is possible for the Nordic system operators to coordinate balance settlement according to the plan they have produced.

Many of the changes needed to implement an electricity supplier-centric market model with combined billing require changes both to the market actors' IT systems and work processes. It would therefore be wise to develop a Swedish service hub parallel to an investigation of the legal changes needed in order to introduce an electricity supplier-centric market model. The point of departure should be operationalisation of a Swedish service hub at the same time or slightly before most of the legal changes necessary to implement an electricity supplier-centric market model enter into force.

A transition to the combined billing of electricity supply and electricity grid should be coordinated with the implementation of a service hub. It is probably most economically advantageous to introduce combined billing at the same time or slightly after a service hub is taken into operation. In this way, costly change processes can be synchronised and implemented as efficiently as possible. The question of whether other regulation changes aiming to facilitate an electricity

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<sup>43</sup> The Swedish Energy Markets Inspectorate, the Swedish Data Inspection Board, the Swedish Energy Agency, the Swedish Consumer Agency, Statistics Sweden and the Swedish Competition Authority

<sup>44</sup> *Regelförändringar som möjliggör nordisk balansavräkning* (Ei R2014:06)

supplier-centric market model should be synchronised with the operationalisation of a service hub needs further investigation separately.

## 7 Impact analysis

The Swedish Energy Markets Inspectorate's proposals in this report do not cover any statutory amendments. There is therefore no requirement to undertake an impact analysis in accordance with Ordinance (2007:1244) on Impact Analysis of Regulation. However, if implemented, the proposed measures will have a relatively great impact on many actors on the Swedish electricity market. Ei therefore believes it is important to shed light on the effects of the proposals presented.

The commissioning of Svenska kraftnät (SvK) to establish a central service hub on the Swedish electricity market can meet future demands on information management in a cost-effective and customer-friendly manner. The proposal facilitates the efficient and coordinated further harmonisation of the Nordic electricity markets and the implementation of both Nordic Balance Settlement and an electricity supplier-centric market model.

The cost-benefit analysis that Ei commissioned Sweco to perform shows that significant economic gains can be achieved through the introduction of a service hub in Sweden. The analysis result indicates 16 different outcomes which all yield a significant economic surplus over a ten-year period if SvK establishes a service hub instead of the market actors developing today's all-to-all information management model. The average economic surplus is calculated to SEK 1.9 billion. The span between the lowest and highest gain ranges from a surplus of SEK 330 million to a surplus of SEK 3.5 billion. Ei assesses the results to be sufficiently robust to conclude that the implementation and operation of a service hub over a ten-year period is far more economically advantageous compared with developing today's bilateral information management model.

The cost-benefit analysis is based on a service hub with central storage of information. Ei proposes the establishment of a service hub, but that Svenska kraftnät should investigate whether information should be stored centrally or decentralised. Ei assesses that the economic gain remains even if the Swedish service hub is designed so that the storage of meter values and other information is decentralised.

It is likely that the estimated cost saving resulting from the establishment of a service hub will benefit customers to some extent. The calculations show that it is mainly electricity grid operators that will have reduced costs. The electricity grid operators' revenue frame, which states how large revenues these companies are allowed to take from their grid customers via grid tariffs, is regulated by Ei. In the long term, reduced costs for electricity grid operators result in a lower revenue frame, which benefits customers.

Many effects of the introduction of a hub are difficult to estimate quantitatively. However, it is Ei's assessment that the benefits exceed the costs. This primarily relates to a hub enabling faster and better customer service, access to information

in a competition-neutral manner, streamlining of supervision and the opportunity to efficiently implement parallel projects such as a Nordic end-user market, an electricity supplier-centric model, Nordic Balance Settlement and, if decided, the introduction of a hub.

## **7.1 Relevant actors**

The changes proposed by the Swedish Energy Markets Inspectorate concern Svenska kraftnät, electricity grid operators, electricity suppliers, electricity producers, balance responsible parties, electricity customers, energy service companies and the Swedish Energy Markets Inspectorate. There are today about 5.3 million electricity customers, about 150 electricity suppliers, just over 160 electricity grid operators and 32 balance responsible parties on the Swedish electricity market.<sup>45</sup> Ei has no data on how many electricity producers there are on the Swedish market that might be affected by Ei's proposals. Ei assesses, however, that the effect on electricity producers is very small so that they will not have any increased costs as a result of the proposals. Any impact on electricity producers is only assessed to be positive.

### **7.1.1 Common consequences for the relevant actors**

Ei assesses that future demands (as further described in Chapter 3) will result in the need for relatively major changes to operational processes and IT systems, particularly those of electricity suppliers and electricity grid operators, but also other actors will be affected. There is not assessed to be any appreciable difference in this cost depending on which information management model is chosen.<sup>46</sup>

In Ei's assessment, an effective way to take future demands into account is to adopt a holistic approach to information management on the electricity market. The establishment of a service hub according to the proposal presented by Ei in Chapter 6 entails a temporary increase in both workload and cost. It is assessed that this increase will affect all market actors to a greater or lesser extent. Ei assesses, however, that the temporary increase in costs and work will, after a few years, turn into a long-term saving for both individual market actors and for society as a whole.

Ei assesses that the introduction of a service hub will probably require statutory amendments. The potential amendments to Acts, Ordinances and regulations and their exact design need to be treated separately.

### **7.1.2 Electricity grid operators**

The introduction of a central service hub entails a sharp reduction in the number of contact points that are required for various processes. Electricity grid operators continue to report meter values just as today, but the sole recipient in the proposed model is the hub. The proposal means that electricity grid operators no longer need to communicate customers' meter values to electricity suppliers or energy service providers. These actors instead gain access to meter values via the hub. This

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<sup>45</sup> Data from February 2014

<sup>46</sup> Kostnadsnyttoanalys av datahubb, En rapport till Energimarknadsinspektionen, Sweco, 30 April 2014. p.41.

contributes to more efficient processes and reduced costs for electricity grid operators.

The costs of electricity grid operators in a developed version of today's all-to-all model is calculated as being between SEK 551 and 623 million in total, or between SEK 551 and 623 per supply point. The corresponding cost for a service hub is calculated to be between SEK 299 and 379 million in total, or SEK 93 to 118 per supply point.

### **7.1.3 Electricity suppliers**

The introduction of a central service hub entails a sharp reduction in the number of contact points that are required for various processes. In most cases, communication with the hub will suffice. This simplifies a series of processes that the electricity supplier is involved in today and will be responsible for in a future electricity supplier-centric model. The service hub also helps electricity suppliers to provide faster and better service and information to their customers.

The costs of electricity suppliers in a developed version of today's all-to-all model is calculated as being between SEK 794 and 871 million in total, or between SEK 248 and 272 per supply point. The corresponding cost for a hub is calculated to be between SEK 711 and 770 million in total, or between SEK 222 and 241 per supply point.

### **7.1.4 Small companies in particular**

Ei assesses that the proposal contributes to reduced entry barriers on the electricity market for electricity suppliers and energy service companies. The establishment of a central service hub to which actors can turn to retrieve meter values or perform processes lowers the functionality requirements in the actors' own IT systems. This is assessed to be of particular benefit to small electricity suppliers and energy service companies. The temporary increase in costs and work entailed by a transition to a service hub might, in a transitional period of necessary adjustments to the hub, result in an adverse impact on small companies with limited financial and/or human resources relative to larger companies with greater resources.

### **7.1.5 Energy service providers**

A service hub helps customers' energy service providers, upon customer approval, to gain simpler and faster access to full meter values. The service hub can contribute to improved competition and neutrality as no actor is given preferential treatment. At the same time, there is less dependence on the local systems of different electricity grid operators, where an obstacle can sometimes be posed by accessibility, interpretation and application of regulations and limited opportunities for change. Ei assesses that this may make matters easier for both energy service providers and customers, and that simpler and competition-neutral access to meter values is likely to increase both choice and competition on the energy services market.

### **7.1.6 Electricity producers**

The proposals are not assessed to occasion any additional costs or major benefits for electricity producers. More efficient information management might give

micro-producers simpler access to historical production values, contract information, information about power of attorneys etc. in the same way as electricity customers.

#### **7.1.7 Svenska kraftnät**

Benefits to Svenska kraftnät that may be mentioned are that a central service hub would entail fewer contacts when collecting statistical data and a potentially improved quality of meter data for Swedish balance settlement reporting to eSett.

If Svenska kraftnät is commissioned to establish and manage the service hub, this means a new operation in an organisation that has already expanded greatly in recent years. In the long term, this may to some extent be compensated by Nordic Balance Settlement relieving SvK's organisation. However, there is also the major workload over the next few years of implementing both a service hub and Nordic Balance Settlement.

If Svenska kraftnät is commissioned to establish a service hub, it must bring in additional resources in terms of knowledge and experience from the end-user market, as the organisation probably lacks sufficient resources of this kind.

#### **7.1.8 The Swedish Energy Markets Inspectorate**

For the Swedish Energy Markets Inspectorate, the benefit of a service hub would be streamlined and simplified supervision of compliance with the regulations. This is because a large part of the processes under Ei's supervision will be managed centrally instead of decentralised.

#### **7.1.9 End users on the electricity market**

Ei also assesses that a service hub contributes to better and faster customer service due to the electricity supplier's more rapid ability to carry out many customer-oriented processes, such as moves and supplier switches.

Customers will also benefit from increased access to historical meter values, details on whether they can incur costs for breaking electricity contracts prematurely, details on the expiry date of existing electricity contracts and the opportunity to manage active power of attorneys.

## **Appendix 1**

# **Overview of the Nordic models for information management**

Table 9 provides an integrated overview of the Nordic models. For Norway, the forthcoming model is presented.

**Table 9. Integrated overview of the Nordic models**

Denmark	Norway	Finland	Sweden
Mandatory service hub with central storage with built-in functionality for certain basic calculations	Planned mandatory service hub with central storage with built-in functionality for certain basic calculations	Optional central Name service covering about 95 per cent of the market today. Decentralised all-to-all model	Decentralised all-to-all model
<i>Processes *)</i>	<i>Processes *)</i>	<i>Overall functioning</i>	<i>Overall functioning</i>
<ol style="list-style-type: none"> <li>1. Installation start-up</li> <li>2. Moving in &amp; out</li> <li>3. Supplier switch</li> <li>4. Updating of installation data (incl. meter)</li> <li>5. Updating of customer data</li> <li>6. Service request from electricity supplier to grid owner (e.g. closure)</li> <li>7. Distribution of meter data for a metering point (hourly metered incl. hourly metered profile-based settlement)</li> <li>8. Meter reading for profile-based settled metering point</li> <li>9. Meter values to energy service providers (3rd party)</li> <li>10. Consumption for profile-based settled metering point</li> <li>11. Distribution of calculated energy time series (for balance settlement)</li> <li>12. Reporting &amp; statistics</li> <li>13. Combined bill – the wholesale model (in version 2.0 - Oct 2015)</li> </ol>	<ol style="list-style-type: none"> <li>1. Installation start-up</li> <li>2. Moving in &amp; out</li> <li>3. Supplier switch (incl. search metering point ID)</li> <li>4. Updating of installation data (incl. meter)</li> <li>5. Updating of customer data</li> <li>6. Service request from electricity supplier to grid owner (e.g. closure)</li> <li>7. Meter values for hourly settled installations</li> <li>8. Meter readings for profile-settled installations</li> <li>9. Meter values to energy service providers (3rd party)</li> <li>10. Calculation of preliminary profile consumption (per metering point)</li> <li>11. Settlement data for Nordic Balance Settlement (prod, consumpt, (h + profile), exchange, grid losses, etc.)</li> <li>12. Deviation settlement (h &amp; profile)</li> <li>13. Basis for the allocation of electricity certificates &amp; guarantees of origin</li> <li>14. Reporting &amp; statistics</li> </ol> <p>In version 2.0, planned Solution for combined billing (through-billing or the wholesale model)</p>	<ol style="list-style-type: none"> <li>1. Grid operators are responsible for meters and ensure that meter values are read and reported to other actors.</li> <li>2. All communication takes place through point-to-point communication</li> <li>3. Most actors have outsourced the management of data communication to external data communication agents.</li> <li>4. There is also a central metering point database currently covering about 95 per cent of the metering points</li> <li>5. Used by electricity suppliers for supplier switches.</li> <li>6. Use of the service is optional.</li> </ol> <p>All requisite processes are managed bilaterally.</p>	<ol style="list-style-type: none"> <li>1. All parties communicate with all parties.</li> <li>2. Some actors use service providers that collect the traffic or perform certain services, such as grid settlement.</li> <li>3. Information flows between the actors and is stored locally by the party needing that information in its operations.</li> <li>4. The vast majority of original data is stored by the grid owners, which are thus the authoritative source of all information that needs to be exchanged between the parties in order to perform the processes of the electricity market.</li> <li>5. All data is spread across all grid owners' different systems, i.e. at about 150 installations. Only data relating to customers, installations and meter values within the grid owner's grid area is held locally.</li> <li>6. Electricity suppliers operating across the entire country have around 150 different parties to communicate with in order to manage their customers.</li> <li>7. Similarly, most grid owners have a large number of electricity suppliers and balance responsible parties to which they must supply meter values.</li> <li>8. Previously, there was the optional communication hub EMIX that is now operated by a data communication agent.</li> <li>9. All requisite processes are managed bilaterally.</li> </ol>
The grid operators retain responsibility for collecting meter values, but report these only to the hub.	The grid operators retain responsibility for collecting meter values, but report these only to the hub.	Grid operators are responsible for meters and ensure that meter values are read and reported to other actors.	Grid operators are responsible for meters and ensure that meter values are read and reported to other actors.

Source: Sweco \*) Selected processes. This level of detail covers around 40 processes

