



ELECTRICITY RETAIL MARKET MODELS

Final report

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EXECUTIVE SUMMARY

- Retail market models in the Nordic countries and Estonia are similar in general terms. The major differences relate to the billing model and concept of default supplier and obligation to supply:
 - Denmark, Norway and Sweden have decided or are about to change into a supplier-centric market model with mandatory combined billing. Estonia has taken a step towards a single bill too. In Finland, mandatory combined billing is not under consideration. Billing model has an affect on the conducts of customer service, i.e. primary point of contact.
 - In Finland, suppliers with delivery obligation are nominated by the Finnish Energy Authority. In Denmark all suppliers have an obligation to supply. In Sweden, Norway and Estonia DSOs have an essential role. There also are some differences in additional obligations of default supplier or supplier with obligation to supply (e.g. tariff regulation). The general aim, however, is to encourage customers actively to choose a supplier.
 - Datahubs, which have already been implemented in Denmark and Estonia and will be introduced later in Norway, Finland and Sweden, will change the retail market processes in many ways.
- Retail market models for demand response, electricity storages, energy communities and other new energy market concepts are not well-defined in any of the countries:
 - There is need for definitions, guidelines and even regulation to facilitate and control, if needed, the development of markets and new business concepts.
 - Since none of the countries have yet well-established concepts and regulation, there are lot of opportunities for co-operation and harmonization.

INTRODUCTION



BACKGROUND AND SCOPE OF THE STUDY

The study addresses Nordic retail market models by analyzing and comparing national retail markets. The results of the study can be utilized in market design and harmonization work.

- NordREG started the harmonization work to create pan-Nordic electricity retail markets last decade.
- The goal of the harmonized retail market model was set to supplier centric retail market model.
- The national execution of recommended retail market model has proceeded at different pace in Nordic countries. For the time being, the supplier centric model has been implemented only in Denmark.
- The integration of Nordic wholesale market, implementation of pan-Nordic imbalance settlement, implementation of data hubs and the recognition of Nordic electricity market as a role model in the European Union have given a new impetus to harmonize the Nordic retail markets.
- To analyze the current status and upcoming development of the Nordic retail market models and to support the Finnish harmonization work, this study addresses the following questions:
 - What is the current status of retail market models in Nordic countries (Sweden, Norway and Denmark) and Estonia compared to the Finland and NordREG's recommendation?
 - What changes are expected to be implemented in the near future and what is the target state of the retail market models?
 - What are the similarities and differences between the national retail market models?
 - What differences have to be especially taken into account from the Finnish perspective?

The purpose of the study is to produce objective and up to date information about the Nordic and Estonian electricity retail market models. The results can be utilized in harmonization work and to create a road map in issues important to Finland as well as in stakeholder communication.

RESEARCH PLAN

The main objective is to identify and understand main differences of electricity retail market models in Finland, Sweden, Norway, Denmark and Estonia

1

Definition of retail market model

- Identification of different aspects included or closely relating to retail market model
- Definition of the scope of the analysis

2

Current status of the Nordic national retail markets

- Basic information on the national retail markets to understand the current retail market models and to identify aspects influencing to the future development

3

Analysis of the retail market models

- Description of the current status, development and most significant differences of the national market models based on the aspects defined on phase 1.

4

Summary, conclusions and reporting

- Documentation of the results including summary and conclusions and Finnish point of view to the development of the retail market models

ANALYSIS FRAMEWORK

Retail market model defines the roles of electricity supplier, distribution system operator (DSO) and third parties relative to end-user in the processes and functionalities of customer interface. Model defines tasks, responsibilities, rights and obligations of the different market parties.

Retail market processes and functions

- Contract structure
- Billing model
- Primary point of contact
- Move-in/out process
- Metering of supplied electricity
- Imbalance settlement
- Information exchange
- Access to information
- Privacy and data security
- Disconnection and reconnection
- Default supplier and obligation to supply



New concepts and business models

- Demand response
- Aggregator business
- Electricity storages
- Small-scale production
- Energy communities
- DSO tariffs
- Operating models for E-mobility

OVERVIEW OF THE RETAIL MARKETS



OVERVIEW OF THE RETAIL MARKETS (1/2)

Characteristic					
Total electricity consumption (GWh)	85 100	120 000	120 000	31 000	7 440
Metering points (million)	3,5	5,2	2,9	3,3	0,9
Number of active suppliers	72	122	140	51	16
Market concentration index (HHI)*	1250	1250	n/a	1350	5500
Number of DSOs	77	151	146	61	34
Number of legally unbundled DSOs	48/77	151/151	7/146	61/61	1/34
Switching rate	11,4 %	10,3 %	13,7 %	7,1 %	5 %
Most common supply contract type**	Variable price, 55 %	Variable price, 48 %	Spot price, 33 %	Fixed price	Fixed price, 65 %
Status of automated meter reading	~100 %	> 90 % monthly reading	~50 % by August 2017; due 1.1.2019	~60 % hourly reading; due 31.12.2020	~100 %
Status of datahub	2019	2021	2018	Online	Online
Retailing Subject to License	✗	✗	✓	✗	✓
Standard Compensation for Outages	✓	✓	✓	✗	✓

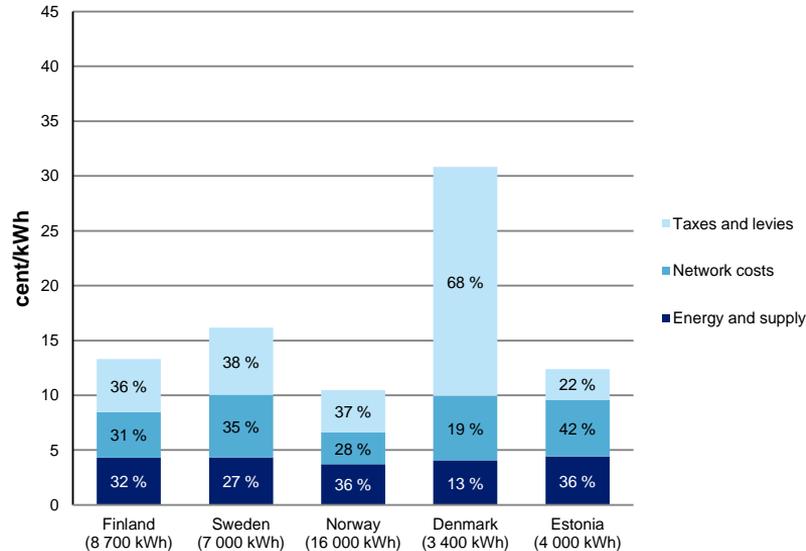
*Sum of squares of each participants market share (10 000 = monopoly)

**Variable price refers to indefinite duration of contract, fixed price to fixed duration of contract.

OVERVIEW OF THE RETAIL MARKETS (2/2)

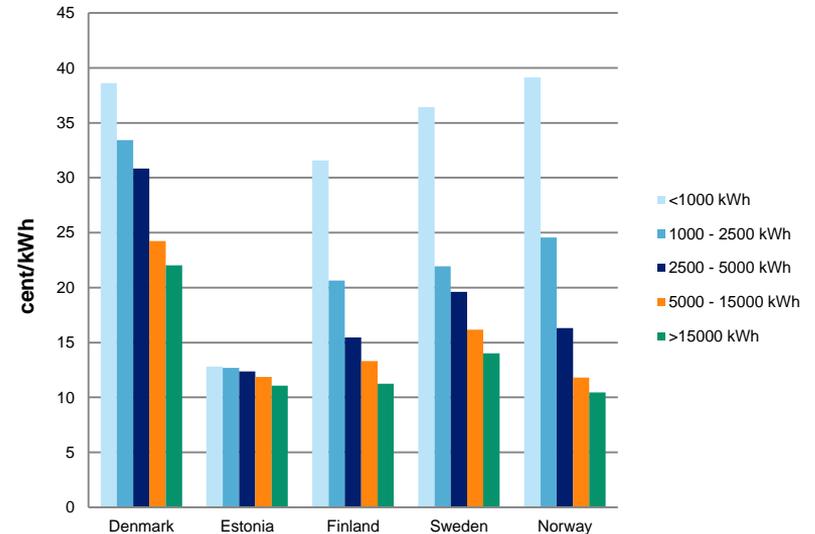
Cost breakdown for average households shows that Denmark has the highest electricity price. This is mainly due taxes and levies for RES support.

Electricity cost breakdown for average household 2016



The average household consumption in each country varies as shown in the graph.

Total cost for different consumption categories 2016



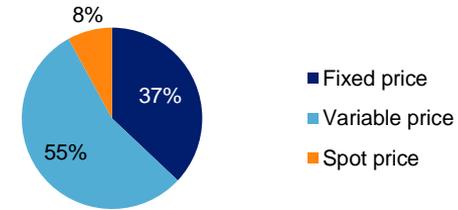
The range between consumption categories is smallest in Estonia (11,7–12,8 cent/kWh) and highest in Norway (10,46–39,15 cent/kWh).

FINLAND – RETAIL MARKETS



- The total electricity consumption in Finland was 85 100 GWh in 2016. Residential, agricultural, service and construction sectors formed 50 % of the final consumption, totaling 42 600 GWh.
- There are 72 retailers on the market of which 8 are independent without obligation to supply. In addition, there are few retailers with obligation to supply unbundled from network activities (e.g. Fortum, Vattenfall)
- In addition to the 77 DSOs with low voltage network, there are 11 operators of high voltage distribution network and 2 operators of private distribution networks.
- DSO unbundling
 - **Legal unbundling:** Electricity network operations must be legally unbundled from trade and generation if the distributed electricity on the operator's 0.4 kV distribution network has been at least 200 GWh/year during three consecutive years.
 - **Functional unbundling:** Separate management is required for legally unbundled DSOs with at least 50 000 customers.
 - **Brand unbundling:** DSOs shall not create confusion about the DSO's identity in communication with customers.
 - No requirements for **ownership unbundling**

Most common contract types



Regulation framework for retail markets

- **Ministry of Economic Affairs and Employment:** Overall co-ordination and planning role in the energy policy field.
- **Energy Authority:** National energy regulator and supervising authority.
- **Competition and Consumer Authority:** In addition to Energy Authority, Competition and Consumer Authority has regulatory responsibility in the energy sector, such as protecting effective economic competition and increasing economic efficiency by prompting competition.

SWEDEN – RETAIL MARKETS



- The total electricity consumption in Sweden was 120 000 GWh in 2014. Residential and service sector formed 57 % of the final consumption, totaling 68 000 GWh.
- There are 122 suppliers in Sweden, but only 68 operate in all bidding areas.
 - Many small and municipal companies, which operate locally in one or two bidding areas.
- Almost 100 % of metering points have smart meters.
 - 90 % of meters are capable of hourly metering.
 - Only 50 % of the meter data management systems are capable and used to provide hourly meter data.
 - Legislation requires monthly reading capability.
- DSO unbundling
 - **Legal unbundling:** An individual with legal responsibilities who conducts network operations may not be involved in generation or supply activities within the same company group.
 - **Functional unbundling:** Functional unbundling is mandatory for DSOs that is a part of a company group with more than 100 000 network customers.
 - **Brand unbundling:** DSOs that are integrated with undertakings conducting generation or trade, shall provide identification in such a way that it is clear which operation the DSO conducts when contacting an individual consumer.
 - No requirements for **ownership unbundling**.

Most common contract types



*E.g. partly fixed partly variable and Spot

Regulation framework for retail markets

- **Ministry of Enterprise, Energy and Communications:** Overall co-ordination and planning role in the energy policy field.
- **Swedish Energy Agency:** Responsible of implementing the energy policy.
- **Swedish Energy Market Inspectorate (Ei):** National energy regulator and supervising authority.

NORWAY – RETAIL MARKETS

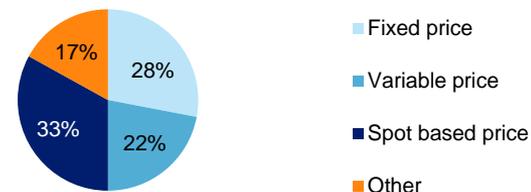


- The total electricity consumption in Norway was 120 000 GWh in 2015. Residential, agricultural, construction and service sectors formed 54 % of the final consumption, totaling 64 800 GWh.
- Norway has an installation plan for AMS roll-out:

	Q4/16	Q1/17	Q2/17	Q3/17	Q4/17	Q1/18	Q2/18	Q3/18	Q4/18
Acc. percentage completed	18	29	43	57	70	82	92	99	100

- The Norwegian Energy Act states that any entity engaged in the physical trading, generation and/or distribution of electricity is required to hold a trading license.
 - Licenses are provided by NVE.
- DSO unbundling:
 - **Legal unbundling:** DSOs with more than 100 000 customers must be legally unbundled.
 - **Functional unbundling:** DSOs with more than 100 000 customers must be functionally unbundled.
 - From 1.1.2021, the Energy act **imposes legal and functional unbundling** for all DSOs, irrespective of size.
 - No requirements concerning **brand or ownership unbundling**.

Most common contract types



Regulation framework for retail markets

- **Ministry of Petroleum and Energy:** Management of water and hydropower and other domestic energy sources.
- **Norwegian Water Resources and Energy Directorate (NVE):** National regulatory authority for the electricity sector. Responsible for managing water resources.

DENMARK – RETAIL MARKETS



- The total electricity consumption in Denmark was 31 000 GWh in 2015. Residential, agricultural, construction and service sectors formed 70 % of the final consumption, totaling 22 300 GWh.
- In 2015 approximately 60 % of consumers had smart meters capable for hourly metering. The largest DSO, DONG Energy Eldistribution A/S has not yet enrolled smart meters and their customers account for $\frac{3}{4}$ of the consumers who do not have smart meters yet.
 - DONG Energy started meter roll outs in 2016 and it should be completed by the end of 2019. Company has approximately 1 000 000 customers in Denmark.
- DSO unbundling:
 - **Legal unbundling:** Licensed network activities must be legally unbundled from other activities such as production and trading.
 - **Functional unbundling:** DSOs with more than 100 000 customers must be functionally unbundled. There are only few DSOs with more than 100 000 customers.
 - **Brand unbundling:** DERA monitors the communication interface towards the customers according to Danish Electricity Supply Act. The goal of the monitoring is to ensure that the branding of DSO supports their own independent identity separated from the consolidated company.
 - No requirements for **ownership unbundling**

Most common contract types

There is no data available about the share of different contract types. NordREG estimates that fixed price is the most common type.

Contract type	Description
Fixed price	Fixed price during contract period.
Variable price	Includes all variable pricing models.
Green products	Products that limit the emission of CO ₂
Combination products	The electricity supply is coupled with the delivery of another product, e.g. natural gas.

Regulation framework for retail markets

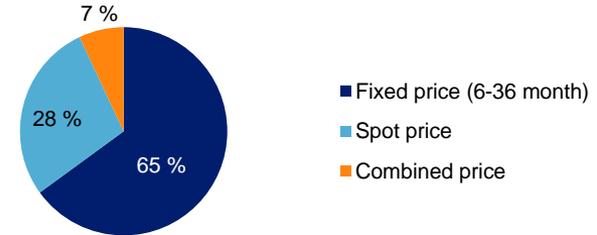
- **Ministry of Climate, Energy and Buildings:** Responsible for national political agreements in major policy frameworks.
- **Danish Energy Agency (Energi Styrelsen):** Supports the political process through undertaking or commissioning analysis and coordinating consultative processes.
- **Energy Regulatory Authority (DERA):** Implementing law on regulation, setting regulatory parameters.

ESTONIA – RETAIL MARKETS



- Estonian electricity market was liberated to competition in 2013.
- Total electricity consumption in Estonia was 7 440 GWh in 2015. Estonian Energy Authority's market states the same volume for retail market.
- All customers should have had AMR by January 1st 2017.
- According to Electricity Market Act selling of electricity requires authorization.
- DSO unbundling:
 - DSO shall form a separate business entity if the number of customers exceed 100 000 and shall not operate in other area of activity than the provision of network service.
 - Applies only to Elektrilevi OÜ that belongs to Eesti Energia AS group, as other DSOs have less than 100 000 customers.
 - A DSO with less than 100 000 customers shall separate its accounts by areas of activity as follows:
 - Provision of network service
 - Sale of electrical energy
 - Ancillary activity.
 - No requirements for ownership unbundling

Most common contract types



Regulation framework for retail markets

- **Ministry of Economic Affairs and Communications:** Overall responsibility for energy policies and co-ordination and implementation of the National Development Plan for Energy Sector.
- **Competition Authority:** Energy market regulator, which exercises state supervision over energy market participants' compliance with the market rules and regulation.

ANALYSIS AND COMPARISON OF THE RETAIL MARKET MODELS



ANALYSIS AND COMPARISON OF THE RETAIL MARKET MODELS

Part A: Processes and functions of the retail market

- Contract structure
- Billing model
- Primary point of contact
- Move-in/out process
- Metering of supplied electricity
- Imbalance settlement
- Information exchange
- Access to information
- Privacy and data security
- Disconnection and reconnection
- Default supplier and obligation to supply



- Demand response
- Aggregator business
- Electricity storages
- Small-scale production
- Energy communities
- DSO tariffs
- Operating models for E-mobility

CONTRACT STRUCTURE

Denmark is the only country where customer has a single contract for both supply and network services. Finland and Denmark have more simple process for forming supply and network contracts, as the customer contacts only supplier to form both supply and network service contracts.

Current situation					
Customer's contracts with supplier and DSO	Separate*	Separate	Separate	Single	Separate
Process for forming supply and network service contracts	One process with supplier	First DSO, then supplier	First DSO, then supplier	One process with supplier	First DSO, then supplier

Future changes

- Norway is planning to adopt the supplier-centric market model in 2018–2019. The final schedule for the market model change is open. NVE awaits for Elhub to be operational, to be able to solve issues related to information exchanges and invoice bases.
- Sweden is planning to adopt the supplier-centric market model in 2021. The proposal for new market model is on a commentary round until late October 2017.

*Single in case where the supplier has a delivery obligation ("contract for electricity supply")

CONTRACT STRUCTURE



- Customer has separate contracts for electricity distribution services and electric energy, except in case where the supplier has a delivery obligation (i.e. “local supplier”).
- Both contracts are initiated in the same process by the supplier. In case of local supplier there is a single contract for electricity distribution services and electric energy (“contract for electricity supply”) managed by the supplier.
- As part of single supply contract, DSO and supplier agree on division of responsibilities mutually.



- Customer has separate contracts with the supplier and DSO.
- The customer contacts the DSO responsible for the area to sign a contract and thereafter chooses a supplier to sign contract with.
- DSO will assign a supplier to the customer if the customer does not choose one directly. However, the customer can still switch supplier.



- Customer has separate contracts with the supplier and DSO.
- First, the customer needs to make a contract with DSO for a point of reference. After making a contract with the DSO, the customer makes a contract with a supplier.
- In the upcoming supplier centric market model all commercial questions go through supplier, which contacts DSO.



- Customer only has one actual contract with supplier (“wholesale model”). Between the supplier and the DSO there is a standard contract.
- The contract between the DSO and consumer is more like a standing agreement regarding the connection – there is no official signing of the contract, but the customer needs to follow a set of rules.
- With DSO contracts there is a standard set of obligations when consumer/customer rents or buys a house, but customers are not informed of this agreement. The supplier is obliged to orient the customer of the existence of these terms.



- The customer has separate contracts for supply and network services.
- The network contract has to be signed first as signing a supply contract requires a valid network contract

BILLING MODEL

Denmark is the only country with mandatory combined billing. Sweden, Norway and Estonia have plans to implement mandatory combined billing. Finland is the only country without any plans to change current billing model. There are no major differences in credit risk management between the countries.

Current situation					
Combined billing	Voluntary	Voluntary	Voluntary	Mandatory	Voluntary
Transparency of network tariffs in combined billing	Full	Full	Full	Partly*	Full
Electricity taxes	DSO	Supplier	DSO	Supplier to DSO, DSO to state	DSO
Credit risks in case of customer bankruptcy	Supplier and DSO**	Supplier	Supplier	Supplier	Supplier
Credit risks in case of supplier bankruptcy	DSO	DSO	DSO	DSO	DSO

Future changes

- Combined billing will be mandatory in Norway and Sweden after the planned market model changes.
- Both Norway and Sweden want to ensure the full transparency of network tariffs in mandatory combined billing.
- In Sweden, DSO shall take over the tax liability from the beginning of 2018. The tax liability will be transferred back to the supplier as the market model change is implemented.
- In Norway, the supplier will be responsible for collecting taxes and pays them upstream to DSO. In the supplier-centric model, collecting taxes would be suppliers responsibility.

*The supplier has much discretion on the transparency as it can decide the price of network service. To improve transparency, all DSO tariffs are stated on the DSOs' website
 **Mutual agreement on sharing the risk.

BILLING MODEL



- Combined billing is used by the supplier with a delivery obligation. Otherwise the customer receives separate bills, unless the supplier and the DSO have agreed on voluntary combined billing.
- In case of combined billing, all the taxes and levies are collected from the customer by the supplier. Supplier transfers network charges and electricity taxes to DSO, who is responsible for electricity taxes to state. In case of separate billing, DSO collects energy taxes.



- Customer receives one bill from the supplier and one from the DSO. In some cases when the supplier and the DSO are included in the same corporate group the two bills are administrated into one.
- Combined billing is voluntary today, but there are plans to introduce mandatory combined billing from the beginning of 2021.
- Customer has full visibility on the network costs also in combined billing.
- Taxes are collected by the supplier until the end of 2017. Thereafter the DSO will take over the tax liability.



- Combined billing model is voluntary and separate billing is more common.
- If the DSO offers combined billing to a supplier, all suppliers are entitled to combined billing with the DSO.
- Supplier-centric billing model is decided to be implemented, but there is uncertainty when the model is going to change (Estimate 2018-2019).
- Currently, DSO collects energy taxes and levies, but in the supplier-centric model it will be the supplier.



- Combined billing is mandatory (“wholesale model”).
- The supplier has much discretion on the transparency as it can decide the price of network service. To improve transparency, all DSO tariffs are stated on the DSO’s website.
- The supplier collects electricity taxes and levies from the customers and pays taxes to the DSO and public service obligations to the TSO. The DSO is responsible for paying the electricity tax to the state.



- The Competition Authority has obliged Elektrilevi, by far the largest DSO, to develop standard conditions by which all suppliers in their network area have a possibility to submit a single invoice. The supplier can voluntarily choose to send combined bills.
- In other networks, customers receive separate bills if the supplier does not belong to the same group with the DSO. Supplier should send an invoice to the customer once a month, unless agreed otherwise with the customer.
- DSO collects taxes and levies.

CREDIT RISKS RELATING TO THE BILLING MODEL



In case of combined billing: Debt collection is done by the supplier towards the customer. Supplier and DSO bear their own credit risks.
In case of separate bills: Debt collection is done by both parties (applies also to voluntary combined billing arrangements as both parties have separate contracts with the customer). Supplier may pay to the DSO before it gets the money from the customer.



Customer bankruptcy: Supplier has the credit risk for the electricity cost and until the end of 2017 also for the taxes. DSO is supposed to take over the tax liability in 2018.
Supplier bankruptcy: DSO has the credit risk. In the future supplier-centric market model the supplier will collect network fees, electricity costs and taxes. If the supplier then goes to bankruptcy, will neither network fee nor taxes be paid to DSO.



Customer bankruptcy: Supplier can end the customer relationship at any point making the DSO the supplier. DSO is obligated to deliver electricity, until the customer stops paying grid fees, at which point the DSO can initiate a process to disconnect. In case of combined billing, the supplier must pay grid fees to the DSO no matter what.
Supplier bankruptcy: In both billing models, DSO as supplier of last resort can charge one price for six first weeks, and after that the price can be set to incentivize choosing a new supplier. The customer chooses the new supplier.



Customer bankruptcy: The supplier can demand bank security or deposit from the consumer, if either the consumer is expected to have lacking willingness or ability to pay. If the consumer does not oblige, the supplier can repeal the contract and disconnect.
Supplier bankruptcy: DSO can cover losses from tariffs and electricity taxes from future customers, which also means that the DSO is obliged to pay public taxes in the case of supplier bankruptcy.



Customer bankruptcy: Customer credit risk belongs to the supplier, including network fees, if the retailer has opted for combined billing. In case of separate bills, debt collection is done by both parties.
Supplier bankruptcy: Elektrilevi has the right to seek a guarantee from the supplier, whose credit rating is lower than Baa3 / BBB- (at least the amount of network service fees for two months)

PRIMARY POINT OF CONTACT

Finland, Sweden and Norway have currently similar models for customer contacting. Sweden and Norway are moving closer to Danish model as the planned supplier-centric market models are implemented. DSO will retain specific network contact related issues in the customer interface even in the supplier-centric model.

Current situation					
Supply and network tariffs and contracts	Respective entity	Respective entity	Respective entity	Supplier	Respective entity
Invoicing and extending the payment period	Respective entity	Respective entity	Respective entity	Supplier	Respective entity
Outages	DSO	DSO	DSO	Supplier	DSO
Connection point or new network connection	DSO	DSO	DSO	DSO*	DSO

Future changes

- In Norway and Sweden the supplier will be the primary point of contact for all issues related to contracts and invoicing, while the DSO remains being the point of contact for outages and connection point or new network connection after the planned market model changes.

*Customers are allowed to contact directly the DSO in the case of manual meter reading, new connection or increasing capacity

PRIMARY POINT OF CONTACT



- Contact model depends on the type of energy company.
- In principle, DSO and supplier are responsible for the customer interface concerning own operations and contractual obligations.
- In vertically integrated energy companies customer service is typically organized in a common customer service function.



- Supplier and DSO are both individual contact points regarding their tariffs, contracts and invoicing. In case the supplier and DSO are part of same corporate group, they might have common customer service function.
- DSO is the primary contact point in issues relating to network services, outages and network connection or connection point.
- In the future the supplier will be the point of contact regarding all tariffs, contracts, invoicing and payment periods for both supplier and DSO.



- The current primary point of contact for contractual and invoicing related issues is the respective company, while for network and delivery related issues it is the DSO.
- In the future, the supplier will be the point of contact for all issues related to contracts and invoicing, while the DSO remains being the point of contact for network service, outages and connection point/network connection.



- Supplier is the primary point of contact in issues relating to: supply and network tariffs, invoicing and extending the payment period.
- Supplier is responsible also for customer-related master data.
- In the case of network service or outages the customer contacts also the supplier, which refers the customer to the DSO if needed.
- Customers are allowed to contact directly the DSO in the case of manual meter reading, new connection or increasing capacity.



- Supplier is the primary point of contact for the customer in cases relating to supply tariffs and contracts as well as invoicing and extending the payment period in case of one bill.
- DSO is the primary point of contact in cases relating to network tariffs and contracts as well as invoicing and extending payment period with separate billing. DSO is also primary contact point for network service, outages and network connections.

MOVE-IN/OUT PROCESS

Finland and Denmark have supplier-centric model for move-in/out process. In Sweden, and Estonia DSO has currently a major role in both move-in and move-out.

Current situation					
Contact point to initiate the move-in process	New supplier*	DSO, then new supplier	DSO or new supplier	New supplier*	DSO, then new supplier
Contact point to initiate the move-out process	Current supplier (or DSO)	DSO	DSO or current supplier	Current supplier	DSO

Future changes

- In Sweden, different alternatives have been discussed for when the data hub is in operation, and a final decision is not yet taken. Two alternatives is foremost discussed, in both cases the customer contacts the supplier for move-in and the supplier sets up contract for both supply and network.
- In Norway, once Elhub is operational, everything goes through the supplier, who delivers information to the DSOs.
- In Finland, move-in/out processes as well as supplier switching will be managed by the supplier in datahub.

*Supplier of the customer's new metering point, which can be also the supplier of the current metering point.

MOVE-IN/OUT PROCESS



- In case of move-in/out, it is recommended that the process is initiated by the supplier of the customer's new metering point.
- In moving-out, it is possible for the customer to contact also the current DSO or the supplier of the current metering point.
- DSO's role is to act as an information hub between the current and new supplier until datahub is operational.



- For move-in the customer has to make a contract with the DSO and with the new supplier separately.
- Usually customer contacts the DSO for move-out and the DSO contacts the supplier.
- When switching supplier, customer contacts new supplier for a contract. The new supplier contacts DSO, which in turn contacts the current supplier to cancel the current contract.



- The consumer can either contact the DSO or the supplier to initiate the move-in/move-out process. If they contact the supplier, the supplier will contact the DSO and vice versa.



- The customer can contact any supplier in move-in process. The current supplier is the point of contact during move-out process.
- If no supplier is contacted after move-in, the supplier of the previous resident will contact the new resident with an offer with deadline of at least 5 days. The new resident then has three options: accept the offer, choose another electricity product or supplier, or get disconnected.
- If the resident does not respond to the offer until the deadline expires, the submitted offer automatically enters into force.



- In move-in process, customer needs to sign a network contract if they buy an apartment or a house, as customer has to have a valid network contract before signing a supply contract.
- In move-out the customer contacts the DSO to end the network service contract. The supply contract is ended automatically after that.

METERING OF SUPPLIED ELECTRICITY

DSO is responsible for metering relating to invoicing and imbalance settlements in all countries. The owners of industrial networks and internal networks inside a property are responsible for internal metering but the detailed practicalities may vary between countries.

Current situation					
Metering responsible for invoicing and imbalance settlement	DSO	DSO	DSO	DSO and customer*	DSO
Metering responsible in industrial electricity networks	Owner of the network	Owner of the network	Owner of the network	Industrial network not defined	Owner of the network
Metering responsible in internal networks inside a property	Owner of the premises	Owner of the premises	Owner of the premises	Owner of the premises	N/A
Responsible party for delivering metering data to relevant parties	DSO	DSO	DSO	Datahub	Datahub

Future changes

- In the future, the DSOs shall deliver the gathered metering data to a datahub in Finland, Sweden and Norway. The datahub will be responsible for delivering this data to relevant market parties.

*In case of manual meter reading

METERING OF SUPPLIED ELECTRICITY



- DSO is responsible for metering and owns the meters. DSO is responsible for collecting, validating and delivering the metering data to other market parties.
- In the future, DSOs will deliver metering data to the datahub, where relevant market participant can receive it.
- Network operator of the closed industrial network has the metering responsibility of the industrial network.
- The holder of a real estate shall arrange the metering of the electricity supplied through the internal electricity system of the real estate.



- DSO (or the one with network concession in case of industrial network) owns and installs the electricity meters and is responsible for metering as well as delivering metering values to the suppliers and other relevant participants.
- In the future DSOs will deliver metering data to the datahub.
- Internal industrial networks do not have to have a network concession and therefore they are not responsible for metering. A network is defined as internal when it includes one or more power line and is built only for own use.



- The DSO is both owner of metering equipment, and responsible for gathering data and making it available to the relevant parties.
- Once Elhub is online, it will acquire the responsibility of supplying information.
- All grids with an area concession deliver the data to Elhub. There is no differences between distribution network, industrial network and real estate network or energy community.



- Currently, in the case of manual metering, the customer is responsible for delivering information to the DSO.
- With smart meters installed, the DSO is responsible of collecting, validating and delivering the data to the DataHub.
- DSOs own the official metering points used e.g. in invoicing.
- Industrial networks are not defined. Outside of the DSO owned metering point, data is only for customer use.



- The DSO is both owner of metering equipment and responsible for gathering data and making it available to the relevant parties.
- Border exchange metering points are included in the datahub so that balance responsible parties can check the meter data in their balance area, including cross-border exchange metering points.

IMBALANCE SETTLEMENT

Finland and Estonia are the only countries where the imbalance settlement is currently based on hourly metering. The next major change will be the switch to 15 minutes imbalance settlement period, however none of the countries have definite plans yet.

Current situation					
DSOs role in imbalance settlement	Responsible for imbalance settlement in their own network area	Reports data regarding generation and consumption	Reports data regarding generation and consumption *	Reports data regarding generation and consumption	Responsible for imbalance settlement in their own network area
Imbalance settlement	Mainly based on hourly metering	Profiling	Profiling and hourly metering	Profiling and hourly metering	Mainly based on hourly metering
Imbalance settlement period	1 hour	1 hour	1 hour	1 hour	1 hour

Future changes

- There is discussion regarding switching to 15 minutes imbalance settlement period but currently none of the countries have definite plans yet.
- In Sweden EI has suggested that all new installed meters from 2017 onwards should be able to change metering frequency to 15 minutes. By 2025 all meters should be able to handle 15 minutes imbalance settlement period.
- When the Finnish datahub is operational, it will take over the responsibility for imbalance settlement from DSOs.
- eSett is responsible for imbalance settlement and invoicing of the balance responsible parties in Finland, Sweden and Norway. When the datahubs are online, the data needed for imbalance settlement is provided by the datahubs.

*When being the default supplier, the DSO is also balance responsible

IMBALANCE SETTLEMENT



- Practically all metering points are included in hourly settlement.
- DSOs are responsible for imbalance settlement in their own network area.
- Imbalance settlement information is delivered to the eSett and balance responsible parties.
- In the future, the imbalance settlement of distribution network owners is done in the datahub.



- DSO reports measuring values regarding generation and consumption to the TSO and the suppliers. TSO calculates hourly balance for each balance responsible party.
- Imbalance settlement is based on profiling as the DSO calculates monthly consumption forecasts for suppliers and balance responsible parties
- The current imbalance settlement period is one hour, but EI has suggested that all new installed meters from 2017 onwards should be able to change metering frequency to 15 minutes.



- The DSO gathers consumption data and delivers it to the relevant parties.
- When being the default supplier, the DSO also is balancing responsible.
- In instances lacking hourly metering, the imbalance settlement is based on profiling.
- Shortening of imbalance settlement to 15 minutes will at least not be implemented over the next few years, as there are no implementation plans for this kind of change.



- DSOs report data regarding generation and consumption for imbalance settlement. Imbalance settlement is TSO's responsibility.
- Profiling is used in instances where smart meters are not installed yet.
- There are no definite plans to shorten the imbalance settlement period to 15 minutes, but this topic is discussed at some level.



- Imbalance settlement is done based on metered consumption values.
- DSO arranges settlement of the balance of the market participants connected to its network and the related exchange information.
- Imbalance settlement period is 1 hour and there are no plans to decrease the period to 15 minutes. Current efforts focus on harmonizing imbalance settlement principles in the Baltic countries.

INFORMATION EXCHANGE

Decentralized bilateral communication between market parties is going to change to centralized information exchange as the datahubs are established. At the moment datahubs are online only in Denmark and Estonia.

Current situation					
Information exchange between market parties	Decentralized bilateral communication	Decentralized bilateral communication	Decentralized bilateral communication	Datahub	Datahub
Responsible party for developing information exchange	TSO	TSO	TSO	TSO	TSO

Future changes

- Norway will adopt the datahub in 2018.
- In Finland, according to current plans the datahub system will be taken in to the use in 2019.
- Sweden is planning to adopt the datahub in 2021 as part of the retail market model change.

INFORMATION EXCHANGE



- Information exchange is currently decentralized with a decision to move to centralized information exchange by the implementation of the datahub at the turn of the decade.



- Today information exchange is based on decentralized bilateral communication through EDIEL system. DSO collects meter data and shares it with the suppliers and other relevant parties.
- In the future the datahub will be the central of all information. The hub will store information relevant for the economic relations between the parties such as facility data, customer data and metering data.



- Current system is bilateral information exchanges, with standards (EDIEL) deciding the format of the information exchanged. Currently consumption data is collected by and sent from DSO to the supplier.
- In 2018, Elhub is assumed to be online, and it is planned that Elhub will send meter information to the supplier instead of DSO.



- Information exchange is implemented through datahub, which was established 2013. Datahub acts as intermediary between other parties.
- The DSO sends metering, tariff and other pricing, while EnergiNet.dk sends TSO tariffs to datahub.
- Datahub sends continuous metering data with tariffs and fees for each measuring point to the supplier. The supplier creates the combined bill and sends it to the customers.



- Estonia has moved to centralized information exchange system, datahub, which is operated by the TSO.
- Information exchange related to metering data and supplier changes happens between market participants and the datahub.
- Elering and the other Baltic TSOs have currently an on-going project to create a common Baltic datahub by using the Estonian datahub as the platform.

ACCESS TO INFORMATION

In Denmark and Estonia implementation of the datahubs have simplified customer access and third party authorization. Current bilateral models in Finland, Sweden and Norway are seen as complicated and they will be replaced with datahubs. Electronic IDs and Bank IDs can be used for authentication in datahub systems.

Current situation					
Customer's access to own consumption data	DSO (and supplier) website	DSO website	DSO website	Supplier website (and Eloverblik.dk)	Datahub web- portal
Third party access to data, if granted by customer	DSO	DSO	DSO	Datahub	Datahub
Management of third party authorizations	Bilateral agreements	Bilateral agreements	Bilateral agreements	Datahub	Datahub

Future changes

- In Finland the current bilateral model to grant access is complicated and will be simplified by the adoption of datahub.
- In Norway Elhub will have plugins on DSO websites where customers can access data. The plugin also gives the customer the possibility to give third-party actors the right to access data. Electronic ID or Bank ID will be used to verify the authorizations.
- In Sweden the management of the third party authorization will be probably done in the datahub.

ACCESS TO INFORMATION



- Customer owns the metering data, and both DSO and supplier must provide the customer access to their own metering data.
- DSO can use metering data for network operation and development.
- Supplier can access the customer's metering data based on the supply contract which it needs for invoicing.
- The customer can grant access to the metering data to third parties, but the current bilateral model to grant access is complicated and will be simplified by the adoption of datahub.



- Customers have access to their data through DSO's web site. In the future the access to information will be through suppliers web page, which accesses the information from datahub.
- Customer can authorize third parties to access their data regarding consumption, in which case third parties contact DSO for the data.
- Before the DSO can give any information they have to check that the third party is authorized. Authorization can be written or oral, and this has been seen problematic in Sweden.



- The customer owns the data, while the supplier and DSO have the right to access necessary information.
- The customer can access data through DSO digitally by logging in with "national electric ID" or Bank-ID.
- With Elhub online, it will have plugins on DSO websites where customers can access data. The plugin also gives the customer the possibility to give third-party actors the right to access data.



- Customer can access the data through Eloverblik.dk with NemID (BankID), or through supplier's website. The customer owns personally identifiable data.
- Aggregated and anonym data is open access and can be downloaded from Energinet.dk.
- Customer can authorize third parties through DataHub with NemID, which is also used to verify accesses. Customers can withdraw the access of a third party at any point.



- Customers can access and authorize third parties to their consumption data in the Datahub web portal. Web portal also enables customers to see who has accessed their consumption data and when.
- The authorization in the web portal can be done with online banking account or an electronic ID card.

PRIVACY AND DATA SECURITY

Privacy and data security is regulated by the general law and decrees. None of the countries have industry specific regulation. Countries are in different stages of implementing EU GDPR* including Norway.

Current situation					
Industry specific regulation	x	x	x	x	x
Industrial agreements and guidelines for privacy	✓	x	✓	x	x

Future changes

- Norway is implementing EU GDPR as well.
- In addition to the GDPR, Swedish government implemented investigations to propose adjustments and additional constitutional requirements, which were presented in May 2017.
- Danish Energy has developed a template to use for data processing agreements, which accounts for changes that will come with GDPR for use for Danish energy companies.

*General Data Protection Regulation

PRIVACY AND DATA SECURITY



- Privacy and data security is regulated by the general law and decrees. There is no industry specific regulation.
- The Finnish Energy has compiled rules and practical guidelines for managing privacy in energy companies.



- Privacy and data security is regulated by the general law and decrees. There is no industry specific regulation.
- In addition to the GDPR Swedish government implemented investigations to propose adjustments and additional constitutional requirements, which were presented in May 2017.



- The core principles relating to privacy and data security are developed, but there is room for further precision.
- There are industrial agreements and guidelines for privacy and data security for customer data.
- Elhub will be responsible for and manage privacy and data security issues after adoption.
- GDPR will be implemented in Norway as well.



- Current Danish privacy and data security rules are already to a large degree aligned with GDPR.
- Danish Energy has developed a template to use for data processing agreements, which accounts for changes that will come with GDPR for use for Danish energy companies.



- Privacy and data security is regulated by the general law and decrees. There is no industry specific regulation.
- Transmission of personalized data via Datahub to a third party, who has no contract with the customer, requires consent of the customer. This consent must meet the requirements stipulated in the Personal Data Protection Act.

DISCONNECTION AND RECONNECTION

The major differences regarding disconnections and reconnections relate to datahubs, which are currently utilized in Denmark and Estonia. In Norway there is no need for supplier to request disconnection as DSO is a default supplier.

Current situation					
Right to request disconnection	Supplier and DSO	Supplier and DSO	DSO	Supplier and DSO	Supplier and DSO
Supplier's contact point to request disconnection	DSO	DSO	-	Datahub	Datahub
Responsibility of the physical disconnection / reconnection	DSO	DSO	DSO	DSO	DSO
Responsibility of damages caused by disconnection / reconnection*	Customer	Customer	Customer	Customer	Customer
Possibility for remote disconnection and reconnection**	✓	✓	✓	✓	✓

Future changes

- Remote disconnection and reconnection are likely to be more common in Norway and Denmark as the AMS roll outs proceed.
- Upcoming datahubs will be utilized as supplier's contact point to request disconnection and reconnection in Finland, Sweden and Norway.

*Customer has to be informed of the period in which the disconnection and reconnection will happen
 **Assuming that the meter has remote control switch

DISCONNECTION AND RECONNECTION



- Both DSO and supplier have the right to request the disconnection of the electricity supply in case of certain contractual breaches defined in the Electricity Market Act.
- DSO is responsible for the physical disconnection / reconnection which can be done also remotely.



- In the case of a contractual breach where the customer neglects its obligations, the DSO can disconnect the customer.
- Disconnection and reconnection process can be initiated by both DSO and supplier.
- A disconnection is not allowed if it could severely damage properties or persons.
- After the implementation of datahub and new market model, the supplier will be responsible for all the contact with the customer. The supplier will then also be responsible for notifying the customer in time for upcoming disconnection.



- DSO is allowed to disconnect consumers if certain requirements are filled, including that there is no risk of health or severe item damage.
- As the AMS roll out proceeds, the remote disconnection of an empty consumption point could become common. Today, the DSO needs to go physically to the relevant apartment to disconnect.



- Depending on the situation, both DSO and supplier initiates the disconnection process.
- The customer is informed of the period in which the disconnection and reconnection will happen, and is responsible for damages.



- A network operator may cancel a network contract and disconnect the consumption point from the network due to failure to pay.
- A supplier may cancel a supply contract by submitting a disconnection or connection request to Datahub which is then transmitted to the DSO. DSO confirms disconnection to datahub.
- The customer shall be notified of the cancellation of an electricity contract at least thirty days in advance.

DEFAULT SUPPLIER AND OBLIGATION TO SUPPLY

Definitions are different between the countries. Default supplier and obligation to supply are not separate except in Denmark. In Denmark and Norway, the adopted models try to activate or incentivize consumers to actively choose their electricity supplier.

Current situation					
Default supplier	Incumbent / local supplier*	Supplier appointed by the DSO*	DSO*	Not defined**	DSO or supplier appointed by DSO*
Supplier with obligation to supply	Incumbent / local supplier*	Supplier appointed by the DSO*	DSO*	All suppliers, in grid area they operate	DSO or supplier appointed by DSO*
Additional obligations concerning the role of default supplier or obligation to supply	✓	✗	✗	✗	✓

Future changes

- In Sweden Ei sees that the current default supplier -system should be changed for the new supplier-centric market model. The new system should incentivize customers to actively choose their supplier e.g. in move-in process. Nevertheless some form of default supplier -system is seen as necessary for consumer protection e.g. in case of supplier bankruptcy. Alternative solutions for the future default supplier -system are discussed in Ei's Ny Modell for Elmarknaden report.

* Default supplier (i.e. the supplier of last resort) and the obligation to supply are not separated

**Default supplier is substituted with a supply obligation from 1st April 2016. The previous supplier of the metering point is "default supplier"

DEFAULT SUPPLIER AND OBLIGATION TO SUPPLY



- There is a mechanism to name a supplier with a delivery obligation (“default supplier”). Suppliers with delivery obligation are nominated by the Finnish Energy Authority. Suppliers with a delivery obligation has to supply electricity in its area of responsibility.



- Obligation to supply and the supplier of last resort are not separated.
- DSO appoints the supplier of last resort / default supplier to the customer.
- Ei sees that the current default supplier -system should be changed for the new supplier-centric market model. Alternative solutions for the future default supplier -system are discussed in Ei’s Ny Modell for Elmarknaden report.



- The supplier of last resort and the obligation to supply is not separated
- The DSO is both default supplier and supplier of last resort, with the obligation to deliver power.



- The default supplier is substituted with a supply obligation from 1st April 2016. The previous supplier of metering point is the “default supplier”.
- All suppliers are obligated to deliver electricity to consumers in their area, except in the case of non-payment.



- DSO is the supplier of last resort or it must designate a supplier to be the default supplier in its network.
- Obligation to supply is subject to standard terms and conditions approved by the Competition Authority, which have to be published on the supplier’s website.
- There is support allocated in the national budget for the payment of connection charge is to compensate persons living in a disadvantaged region.

ANALYSIS AND COMPARISON OF THE RETAIL MARKET MODELS

Part B: New concepts and business models

- Contract structure
- Billing model
- Primary point of contact
- Move-in/out process
- Metering of supplied electricity
- Imbalance settlement
- Information exchange
- Access to information
- Privacy and data security
- Disconnection and reconnection
- Default supplier and obligation to supply



- Demand response
- Aggregator business
- Electricity storages
- Small-scale production
- Energy communities
- DSO tariffs
- Operating models for E-mobility

DEMAND RESPONSE

Market models for demand response are still evolving. The intent is to increase the use of demand response , also for operating distribution networks and optimizing investments. The Finnish reserve market for flexibility is currently the most advanced in Europe. Pilots are taking place in most countries.

Current situation					
Established market model for demand response	x	x	x	x	x
DSO is allowed to make agreements on demand response directly with the end customers	x	x	✓	✓	x
DSOs use the network tariffs to control loads (Time-of-use tariffs)	✓	✓	✓	✓	✓
AMR/AMS systems enable the load control for DSO	✓	x	✓	x	✓

Future changes

- Sweden: In the future DSOs can have special agreements with consumers regarding load control saying that the DSO can control parts of the consumers electricity use to optimize utilization of the network. Some pilot projects regarding this have been done already.
- The Finnish Smart Grid Working Group is exploring and proposing concrete measures to facilitate demand response. Control of the customer's electricity consumption is considered to be a competitive business activity. The time-based control and compulsory time-of-use pricing by DSOs is suggested to be replaced with a more advanced control mechanisms in the future.

DEMAND RESPONSE



- Provision of flexibility to market places is competitive business activity and not allowed to DSO.
- DSO can disconnect loads or generation only in emergency situations by default.
- Load control is currently possible through electricity meters by using time-of-use tariffs (day/night).



- DSOs are not allowed to produce or trade electricity in other cases than to cover their losses. This means that DSO can only use load control in purpose to optimize its own operation and investments.
- In the future DSOs can have special agreements with consumers regarding load control saying that the DSO can control parts of the consumers electricity use to optimize utilization of the network. Some pilot projects regarding this have been done already.



- DSO can participate in demand-side management and response on a non-discriminatory and neutral basis. This allows for example interruptible tariffs and capacity or load based tariffs.
- Currently the DSOs cannot explicitly buy capacity reductions, but this is under evaluation. It is probable that the DSOs will not participate on demand response on a large-scale basis due to lacking commercial attractiveness.



- Demand side management is still in a regulatory discussion phase. There are no implemented business models, but a working group is currently working on developing solutions.
- Currently the DSO is only allowed to make agreements with larger business customers on short-period disconnection during congestion.



- Datahub and the Estfeed service platform are seen as key enablers to unlock demand side response potential on a wide scale.
- Elering and Elektrilevi are piloting a flexibility services platform to coordinate flexibility activations between the TSO and DSO.
- The Baltic TSOs are analysing possible models for a harmonised Baltic DSR market model. Roadmap for future actions is planned to be developed during 2018

AGGREGATOR BUSINESS

None of the countries have specific definition or business models for aggregation. Different business models are piloted and discussed in working groups. Aggregation of loads without balance responsibility is seen as problematic.

Current situation					
Defined role for aggregator	x	x	x	x	x
Aggregation of loads is allowed without balance responsibility	Different business models are piloted	x	x	x	Different business models are piloted

Future changes

- In Sweden, a new actor will be introduced, Balance Service Provider (BSP), which will be able to place bids on balancing services without being balance responsible. Svenska Kraftnät finds that the BSP should operate in agreement with the balance responsible party.
- In Denmark the aggregator role is still in a regulatory discussion phase. A working group is currently developing solutions.
- In Estonia there is an ongoing pilot where the aggregator can combine customers from different balance responsible parties to offer manual frequency restoration reserve to the TSO.
- In Finland, Smart Grid Working Group is specifying the rules and regulation concerning the aggregators.

AGGREGATOR BUSINESS



- Currently, there is no explicitly defined role for independent aggregator with no balance responsibility.
- Independent aggregation is possible only in one market place: FCR-D (frequency containment reserve for disturbances).
- In other market places, any aggregator would be balance responsible as well.



- Currently, there is no defined role for independent aggregator with no balance responsibility.
- In the future a new actor will be introduced, Balance Service Provider (BSP), which will be able to place bids on balancing services without being balance responsible. Svenska Kraftnät finds that the BSP should operate in agreement with the balance responsible party.
- Aggregation over several balance responsible parties should however be avoided, since it hampers imbalance adjustments.



- Currently, there is no role for independent aggregator with no balance responsibility. Any aggregator would be balance responsible as well.
- The aggregator may 'outsource' its responsibilities to another actor with balance responsibility.
- The Nordic regulator's position is that aggregators should continue to be balance responsible.



- There are no business models for aggregator business at the moment.
- The aggregator role is still in a regulatory discussion phase.



- There is no explicitly defined role for independent aggregator with no balance responsibility.
- Different aggregators business models are piloted as part of the harmonized Baltic market model analysis.
- In addition there is an ongoing pilot where the aggregator can combine customers from different balance responsible parties to offer manual frequency restoration reserve to the TSO.

ELECTRICITY STORAGE

Regulation concerning the ownership and taxation of electricity storages is still open in all countries. Currently the DSO's are not incentivised to own and operate electricity storages, but they can be bought as a service in commercial terms.

Current situation					
DSO's right to own and operate electricity storages	Storages are not included in the regulated asset base	Right to own but include in regulated asset base	Regulation indirectly forbids	No specific rules. DSOs are owning storages in pilot projects	Not defined. Could be used to compensate network losses.
Taxation of electricity storages	No specific rules*	Consumption	Both consumption and production	Both consumption and production	Both consumption and production

Future changes

- In all target countries, there is an ongoing discussion concerning DSO's right to own and operate storages in network operations and the avoidance of double taxation. E.g. in Finland, owning and operating storages is seen primarily as a competitive business activity.

*As a default, both consumption and production are under taxation, but it is possible to avoid the taxes for production with certain arrangements.

ELECTRICITY STORAGES



- Electricity storage is not defined as a separate asset class in regulation.
- The use of storage by DSOs is interpreted similar to generation: it is allowed for specific purposes defined in the Electricity Market Act.
- Owning and operating storages should be primarily a task of market players, not monopolies.



- DSO is not allowed to operate electricity storages for any purposes than to cover the distribution losses or to ensure network operation in case of short power outage.
- Electricity storage which is owned by a DSO is not obliged to network fees or taxes if the storage use composes an integrated part of the DSO's business.



- The end users and suppliers are allowed to own electricity storages.
- The regulation is not yet fully designed to specifically cover DSO ownership of electricity storage, but the regulation indirectly forbids DSO ownership in most instances.
- The regulator is open for pilot/test projects for DSO ownership in order to properly define the regulation to incorporate storage.



- Electricity storage is not yet defined in the regulation, and is taxed and tariffed as both a consumer and producer.
- There are examples of DSOs owning storage in pilot projects.



- DSO is allowed to generate electricity only to compensate for network losses.
- No specific mention of electricity storage in the tax legislation, assumption is that charging is treated as consumption.

SMALL-SCALE PRODUCTION

There are no major differences in managing small-scale production. In Finland and Denmark prosumer can sell surplus electricity also to other suppliers than the supplier supplying electricity to the metering point.

Current situation					
Responsible party for collecting information regarding distributed energy sources	DSO	DSO	DSO	DSO	DSO
Centralized database regarding distributed energy sources	x	x	x	TSO	x
Primary party for buying surplus energy	Supplier*	Own supplier	Own supplier	Supplier* or TSO**	Own supplier

Future changes

- In Denmark the responsibility for the register of small-scale production assets is expected to be allocated to Danish Energy Agency by beginning of 2018 .
- In Finland, information regarding small-scale production in metering point will be stored in the datahub.

*The supplier who buys the surplus electricity does not have to be the same as the one supplying the consumption point
 **TSO is required to acquire the surplus electricity especially in the case of support schemes

SMALL-SCALE PRODUCTION



- DSO is obliged to connect small-scale production in their network with general and easily applicable procedures.
- Connection terms are based on the Electricity Market Act and a recommendation for terms of network connection by Finnish Energy.
- Customers have the right to feed in their excess production into the network, but the DSO or supplier is not obliged to compensate for surplus.
- DSOs collect the information about the small-scale production.



- DSO is responsible for connecting small-scale production in their network.
- The information regarding energy resources used in Sweden is collected to the website of the Swedish Energy Agency, but this database does not cover all the resources used for small-scale production today.
- The surplus electricity from small-scale production has to be sold to the same supplier who is supplying the consumption point.



- DSO is responsible for connecting small-scale production to the grid and DSO collects the information concerning distributed energy resource.
- DSO can buy electricity from 'plus customers'. The purchase price for DSO is agreed between DSO and the prosumer, and the DSOs have freedom to set the purchase price as it is not regulated.
- If the DSO does not buy, the prosumer must find a supplier willing to buy the surplus.



- DSO is responsible for connecting small-scale production to the network and reports the production plant to the TSO's register. The responsibility for the register is expected to be allocated to Danish Energy Agency by beginning of 2018.
- The supplier who buys the surplus electricity does not have to be the same as the one supplying the consumption point. In certain situations the TSO is required to acquire the surplus electricity – especially in the case of support schemes.



- DSO is responsible for connecting small-scale production to the distribution network. DSOs collect information on distribution energy resources as part of the network connection process.
- Surplus of small-scale production can only be sold to the same supplier who is supplying the consumption point.

ENERGY COMMUNITIES

Energy communities are not well-defined in any of the countries. In Finland and Sweden internal electricity networks in properties could be seen as one application for energy community. Estonia has a definition for a subconsumer. Subconsumers are apartment owners and tenants buying electricity jointly.

Current situation					
Definition for energy communities	No specific definition	No specific definition	No specific definition	No specific definition	No specific definition
Metering responsibilities in energy communities	Energy community	Energy community	Energy community	Energy community	Energy community
Energy community can consist of several premises	x	x	x	x	x
Specific models for peer-to-peer trading	x	x	x	x	x

Future changes

- Energy communities are introduced in the EU Clean Energy Package and for that reason they are discussed actively in all of the countries.
- In Finland, Smart Grid Working Group has a positive view on the opportunities created by the energy communities for their customers but the rules and regulation of the new role need to be specified in further detail.

ENERGY COMMUNITIES



- Energy communities and peer-to-peer trading are not well-defined.
- The Electricity Market Act (588/2013) specifies the electricity supply of properties and groups of properties.
- Internal electricity networks in properties are not subject to a license. In this case, the owner of the property is responsible for metering.
- The end user needs to have the possibility to contract for electricity supply through the distribution network.



- Swedish Energy Agency has not formed any specific definitions regarding Energy Communities.
- Current legislation on non-concessionary networks (IKN) allows internal networks e.g. for apartment buildings. IKN legislation, however, does not comply with EU's "winter packages" obligation that every consumer should have right to choose whether to participate in energy community.
- In addition, IKN rules are not applicable for communities consisting of several residential buildings, for example in a villa area.



- There is no definition for energy communities and no specific operation models for peer-to-peer trading.



- There is no definition for energy communities and no specific operation models for peer-to-peer trading.



- If a consumer has not entered into a network contract and is consuming electric power via someone else's network connection, they are defined as *subconsumer*. Subconsumers are apartment owners and tenants buying electric power jointly in large apartment buildings via apartment association or administration company.
- Electric power is sold to the subconsumers either by the owner, administrator or association of the immovable property who have the right to choose the electricity supplier.

DSO TARIFFS

None of the countries have legislative barriers for capacity/power -based tariffs. Capacity based tariffs for consumers are under development. Only Norway and Denmark have interruptible tariffs for large customers.

Current situation					
Legislative barriers to capacity based tariffs	x	x	x	x	x
Capacity based tariffs available for consumers	Some DSOs have introduced power-based tariffs to consumers	Available for consumers with main fuse 80 A or higher	Available but requires AMS	Not available, but under development	Not available
Possibility to differentiate the quality or reliability of supply	Interruptive tariffs are allowed but not available	x	Interruptive tariffs for large customers	Interruptive tariffs for large customers	x

Future changes

- DSOs are about introducing or planning to introduce power-based tariffs for consumers on a larger scale.
- In Finland, there is a positive view on replacing the flat-rate of the electricity distribution charge with a power component that provides customers with better opportunities for affecting their distribution charges. Before implementing changes, however, there is need to investigate their effects on different customer groups.

DSO TARIFFS



- Current legislation requires that DSO tariffs are neutral, non-discriminatory and reasonable as well as clear and understandable for customers.
- DSOs provide power-based tariffs for business customers. Some DSOs have recently introduced power-based tariffs based on yearly peak load also for consumers. The wider use is under investigation.
- There is no explicit legislative barriers to power-based tariffs.



- The DSO tariffs should be neutral, objective and non-discriminatory.
- Capacity based network tariffs are available for customers with main fuse on 80 A or higher. Capacity based network tariffs are based on monthly peak load.
- It is possible to have separate agreements on quality and reliability of supply, but these agreements are mainly for industrial customers. For consumers the quality and reliability of supply is regulated by law.



- Both energy and capacity tariffs are allowed.
- For DSOs, proceeding of AMS roll-out enables introducing capacity tariffs in addition to the current energy based ones.
- For capacity tariffs, both fuse and meter load based exists – both with mixed popularity.
- It is possible to differentiate the quality and reliability of supply by separate agreement on improved quality. Minimum levels of quality are regulated.



- DSO tariffs must be neutral and non-discriminatory but DSOs can use different tariff structures for different customer groups.
- Capacity based network tariffs are not available for the consumers at the moment, but DSOs are in the process of developing those.
- DSOs cannot differentiate the quality or reliability between consumers. Interruptible tariffs exist, but only for large customers.



- There are no legislative restrictions for capacity based network tariffs. The criteria adopted by a DSO as the basis for establishing network charges shall be transparent and in compliance with the principle of equal treatment.
- Network tariffs for under 63 A customers are energy based (fixed fee + energy fee)

OPERATING MODELS FOR E-MOBILITY

E-mobility is a competitive business in all of the countries and the role of the DSO is to provide network connection for the charging stations.

Current situation					
Supplier in public charging stations	Predetermined by charging operator	Predetermined by charging operator	Predetermined by charging operator	Predetermined by charging operator	Predetermined by charging operator
Possibility to have separate supply contracts for private charging station and consumption point*	✓	✗	✗	✓	✗
DSO's role in developing charging infrastructure	Network connection	Network connection	Network connection	Network connection	Network connection

Future changes

- According to AFI directive it should be possible to have separate supply contracts for private charging station and consumption point. E.g. in Finland this is enabled through establishing a separate meter point.

*According to Directive on the deployment of alternative fuels infrastructure (2014/94/EU)

OPERATING MODELS FOR E-MOBILITY



- In public spaces the supplier is predetermined. The supplier is chosen by the charging operator (could be the same company).
- In private residences there is a possibility to choose a separate supplier for EV charging, which requires separate metering and metering point. I.e. establishment of a new consumption point.



- Public charging stations have their own electricity contract with one supplier.
- In households, the supplier of the EV charging equipment is the same as the supplier of the entire household.
- DSO's role in the development and management of the charging infrastructure is to connect charging stations to the network.



- In public charging stations it is not possible to select own supplier. Public stations offer free charging and for fast-chargers the supplier is determined by the station owner.
- For households, the charging power for EV must come from the same supplier as the households other electricity.
- DSO's have the same obligations in the development and management of charging infrastructure as for any other connections.



- Commercial actors owning non-household EV charging stations decide upon supplier.
- In private residences there is a possibility to choose a separate supplier for EV charging, which requires separate metering and metering point. I.e. establishment of a new consumption point.
- Charging infrastructure are owned by commercial actors, that acquires a metering point from DSO.



- Nationwide quick charging infrastructure constructed under the Estonian Electromobility Programme (ELMO) is owned by the state. Customers cannot choose their own supplier in this public network.
- The supply contract for EV charging is the same as the supply contract of the consumption point.

