
Nordreg workshop on flexibility services

Danish perspectives

11. april 2018

OSLO

Agenda – a Danish perspective

1. The Danish Intelligent Energy Alliance: Who we are
2. Flexibility services: Drivers and where we are in terms of commercialisation
3. Enhancing the framework for flexibility services: What are the barriers where are we on the pathway to remove them

The Danish Intelligent Energy Alliance



Members:

- Utilities and suppliers within power, gas, heat and water/wastewater
- Industries
- Consultants/Advisers
- Universities etc.
- Municipalities
- Finansielle aktører



Lysbilde 3

F1

Forfatter, 22.11.2017

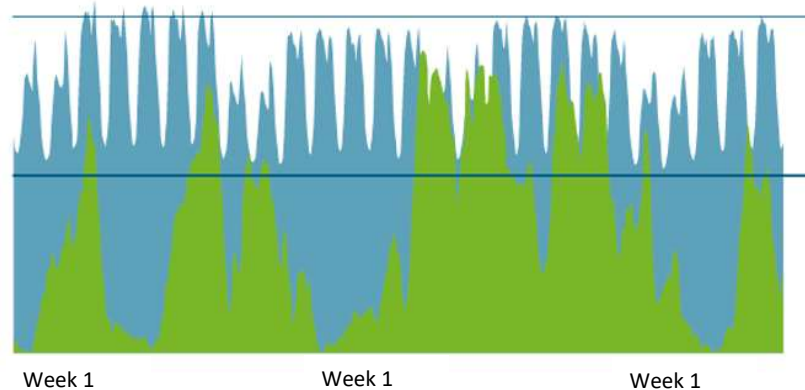
Main drivers for flexibility services

- GHG targets and RE targets - A need to balance the power market through enhanced focus on the demand side
- Cost of energy technologies and rapid take-up of grid edge technologies
- Digitalization of the energy sector and in general enables local initiatives and new business models reducing transaction costs (e.g. blockchain)

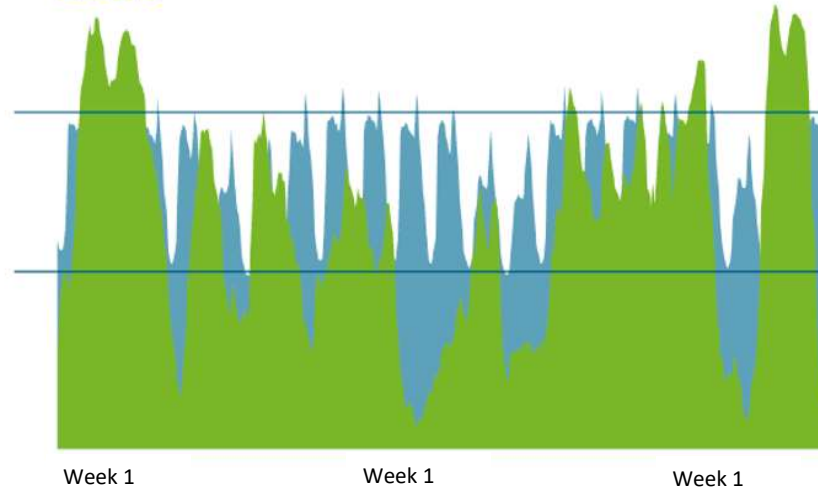
GHG and RE targets – Need to balance through demand side response

- Buildings (heating and cooling), transport units etc. to be engaged through flexibility services – being flexible assets in the future energy system

2015



2035

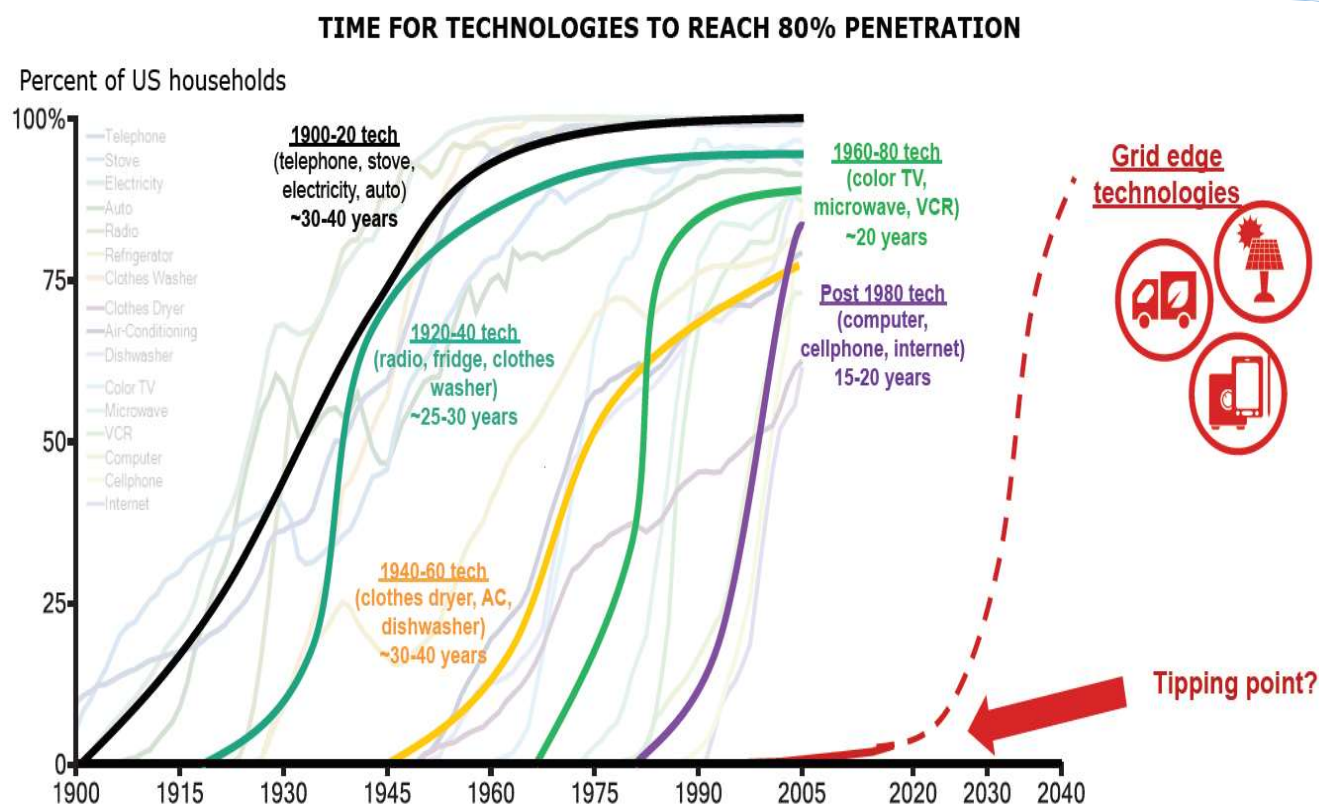


■ Power consumption ■ Power production from wind

**Example:
Three weeks
in the Danish
energy
system in
2015 and
2035**

Source: Energinet 2017

Cost of energy technologies and digitalization ... rapid penetration and new opportunities



Key issues:

- RE costs are falling dramatically
- General movement from central / top-down control to decentralised / local control (grid edge technologies enables this)
- Digitalization of everything – also utilities within power, heat, gas and water
- New technologies enables new players to enter the value chain

We need better co-operation between commercial players and infrastructure owners (monopoly players)

Source: World Economic Forum and New York Times

Blockchain technology enables local energy communities and pave the way for new business models

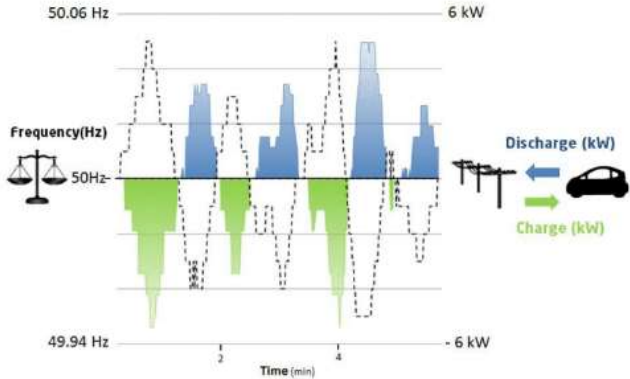
Transacting Local Energy with Neighbors



Policy opportunities in the Danish context

- National Energy Policy Agreement post 2020
- EUs Clean Energy Package
- National work on DSO and TSO tariffs

Many Pilot-projects ... still few commercial activities



Calculated FCR-N availability payment with 10kW V2G units (FCR-N, ~14 h/day)
120 Euro/Month pr Vehicle



Why ... barriers to overcome

- 2018 offers several opportunities to improve framework conditions

1. The business case and -volume

- **Energy Policy framework 2020+**

2. Infrastructure owners wish to reward end-user flexibility

- **Energinet and the DSOs**

3. Better framework conditions for new players – market models for aggregators

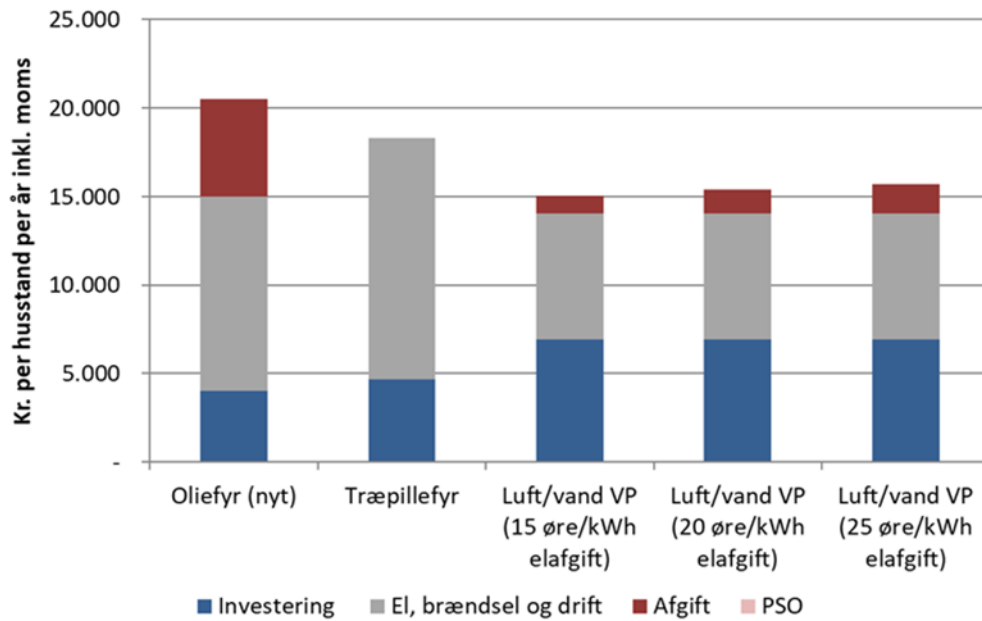
- **National agreement and CEP**

4. Access to energy data - activating end-users and enable business opportunities

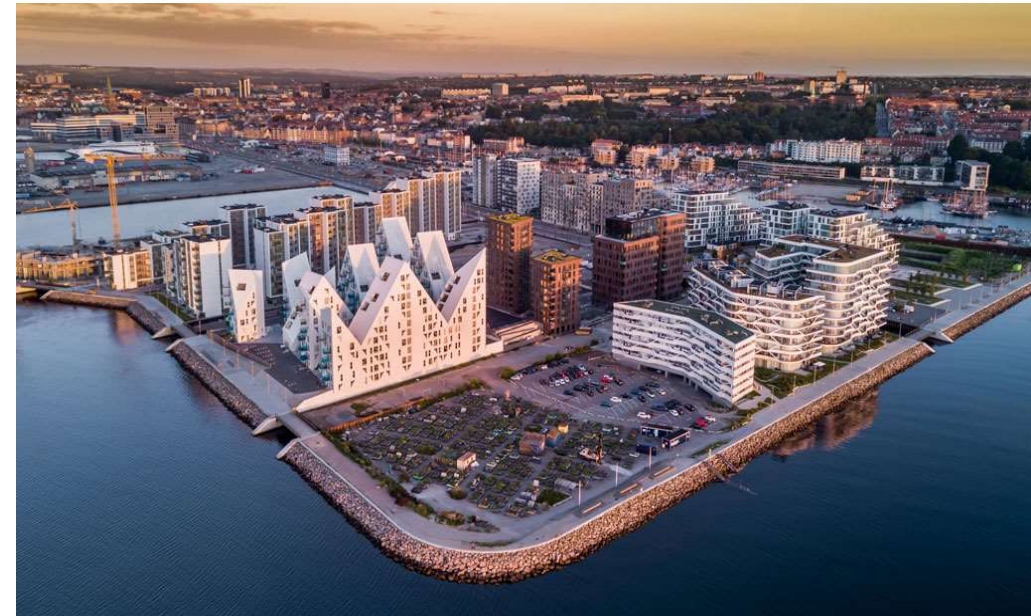
- **The Privacy Act**

1. The business case & - volume

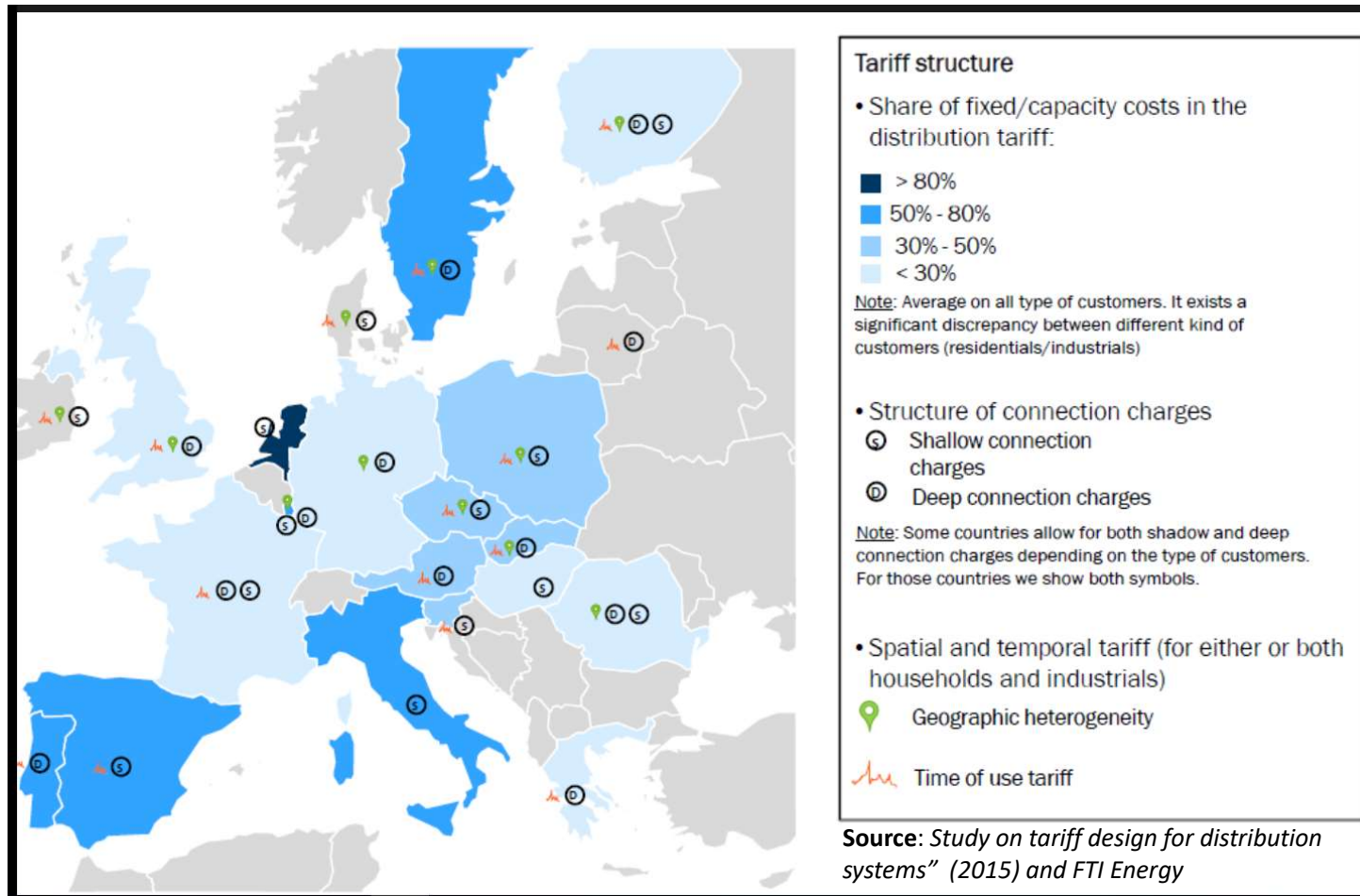
Electrification of individual heating (Electricity tax)



Electrification of district heating (Economic regulation of heat and power)



2.a.EU tariff structures – rewarding flexibility?



2.b. Equality versus better utilisation of the grid

§73 in the Electricity Supply Act



Equality

Cost of Authenticity ???

Fairness towards all customers



Better utilisation of the grid

Activating consumers

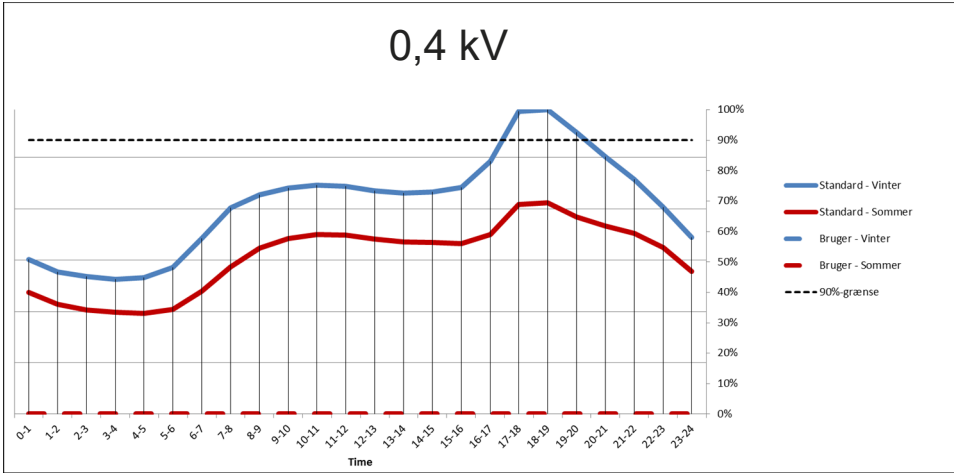
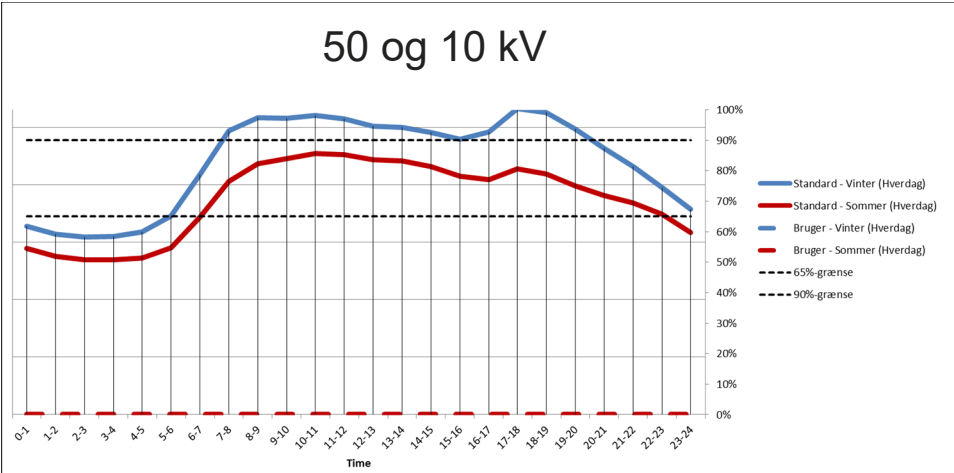
Creating value for consumers

2.c. Danish legislation on tariffs:

§ 73 in the Electricity supply Act:

The pricing of collective electricity utilities for their services pursuant to sections 69-71 shall be based on reasonable, objective and non-discriminatory criteria for the costs of each buyer category. Price differentiation for the efficient use of the electricity grid and security of supply is permitted. **Price differentiation based on geographical demarcation is only permitted in special cases.**

2.d. Current tariff model - rewarding flexibility in Tarifmodel 2.0.

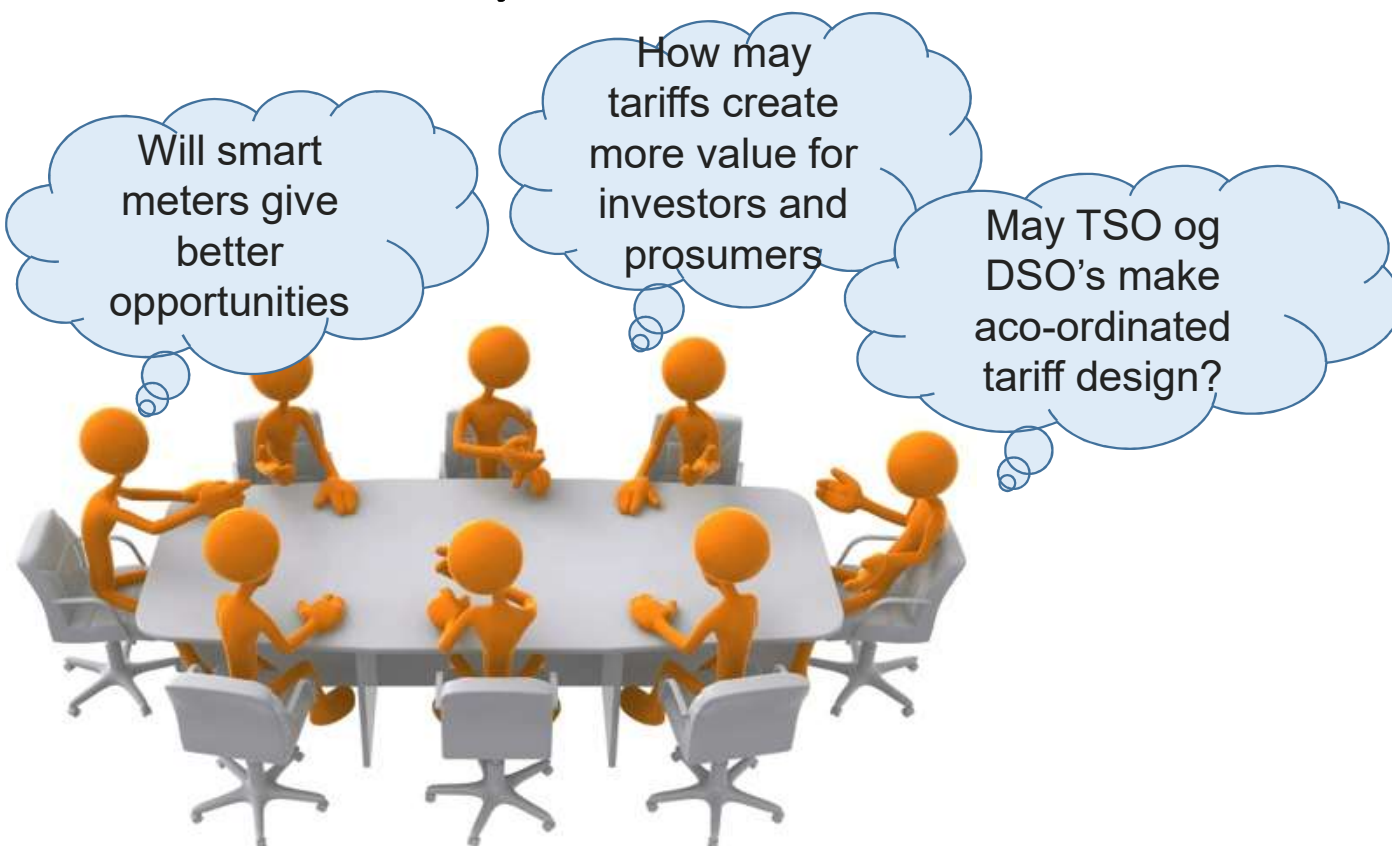


| Time | Hverdage | |
|-------|----------|--------|
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| 0-1 | ● | ● |
| 1-2 | ● | ● |
| 2-3 | ● | ● |
| 3-4 | ● | ● |
| 4-5 | ● | ● |
| 5-6 | ● | ● |
| 6-7 | ● | ● |
| 7-8 | ● | ● |
| 8-9 | ● | ● |
| 9-10 | ● | ● |
| 10-11 | ● | ● |
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| 15-16 | ● | ● |
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| 23-24 | ● | ● |

| Time | Hverdage og weekend* | |
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2.e. Why tariff debate in 2018?



The Danish Energy Association and Energinet has kick-started a dialogue in March 2018. They will now continue doing workshops, interviews and consultation papers among stakeholders

The energy policy agreement post 2020 may suggest a tariff analysis to be conducted

2.f. Position on tariffs – case driven approach

- Getting the price signal right in order to reward customers – time of use tariffs?!
- Tariffs supporting flexibility in terms of infrastructure utilization (power, heat, gas and waste water)
- Tariffs improving business cases (SMEs and more established service providers within heating and transportation, energy services, energy suppliers and flexibility services)
- Case based exploration of opportunities:
 - a. decoupling larger buildings e.g. heating and cooling (Energi Danmark)
 - b. rewarding batteries in EVs when they operate V2G (Parker project: Nuvve-Nissan)
 - c. rewarding power-and-heat integration, low temperature heating by use of heat pumps and gas-hybrids instead of high temperature heating (AVA/Aarhus kommune, HOFOR/Kbh. kommune)
 - c. rewarding the water sector (pumping drinking water and waste water etc.) when they use power at the right time (EnergiDanmark, Blue Kolding, Kiwi)
 - d. rewarding green transition from oil burners to heat pumps etc. (Best Green, OK)

2.g. A DSO-perspective: Radius

Today: Tariffs do not incentivize enhance consumers' better utilization of the grid...

Tariffs are independent of flexibility potential

Tariffs are independent of geographical significance

No incentive for producers/batteries to assist the grid

No products for larger, flexible consumers

Connection with limited network access reserved for customers with electricity for heat production

No products to co-ordinate consumer segments

...but this could change with changed tariff structure and new products

Type of tariff could vary with type of consumer segment

Tariffs and products could vary across DSO geography

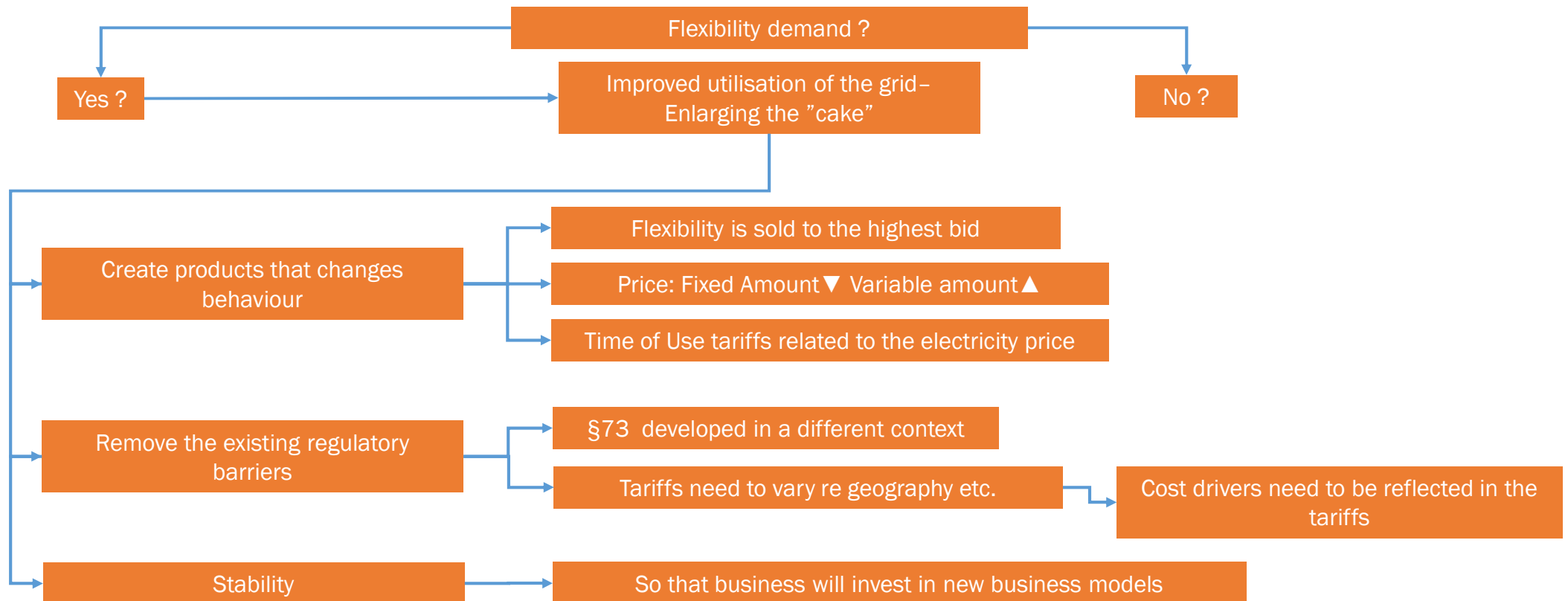
Products for producers 1) assisting when grid is congested or 2) connecting where grid has surplus capacity

Products for larger consumers when grid is congested 1) negative tariffs 2) individual agreements

Costs of connection should reflect the potential of flexibility

Products for aggregators pooling larger groups of flexibility

2.h. An aggregators perspective: Neogrid ApS



3.a. Better framework conditions for new players – market models for aggregators

Single Hourly Order

- ▶ The basic type of Day Ahead Order
- ▶ Price and volume given separately for each hour
- ▶ The order must contain theoretical minimum and maximum price levels
 - -500 €/MWh and 3000 €/MWh
- ▶ The order may contain up to 200 price steps (Incl. max and min)

No price elasticity

| Price \ Hour | -500 | 3000 |
|--------------|------|------|
| 1 | -10 | -10 |
| 2 | -20 | -20 |
| 3 | -40 | -40 |
| | | |
| 23 | 50 | 50 |
| 24 | 10 | 10 |
| Total | -10 | -10 |

PRICE INDEPENDENT

| Price \ Hour | -500 | 100 | 101 | 150 | 300 | 301 | 3000 |
|--------------|------|-----|------|------|------|------|------|
| 1 | | | | | | | |
| 2 | | | | | | | |
| 3 | 0 | 0 | -100 | -100 | -100 | -200 | -300 |
| | | | | | | | |
| 23 | 600 | 600 | 600 | 0 | 0 | 0 | 0 |
| 24 | | | | | | | |
| Total | 600 | 600 | 500 | -100 | -100 | -200 | -300 |

PRICE DEPENDENT

NORD POOL

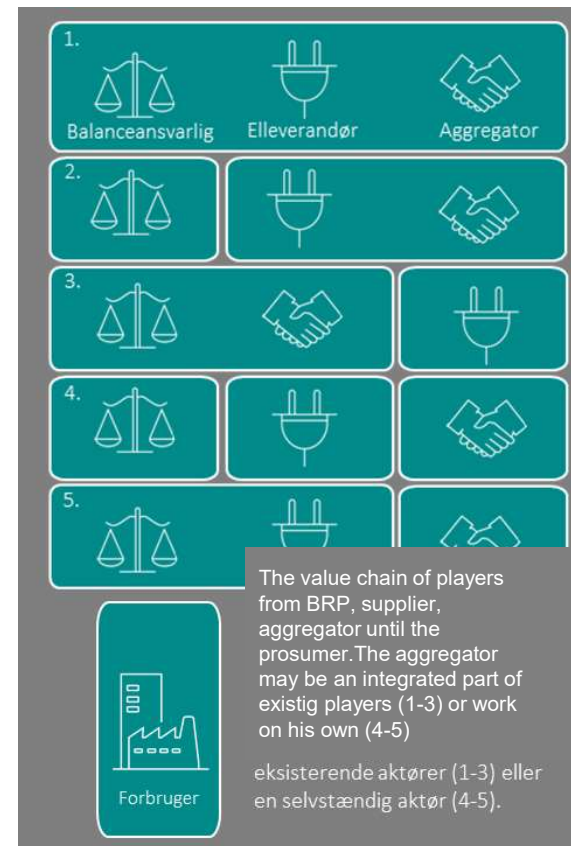
Nord Pool

Helle Juhler-Verdoner, Managing director, The Danish Intelligent Energy Alliance

3.b. Better framework conditions for new players – market models for aggregators

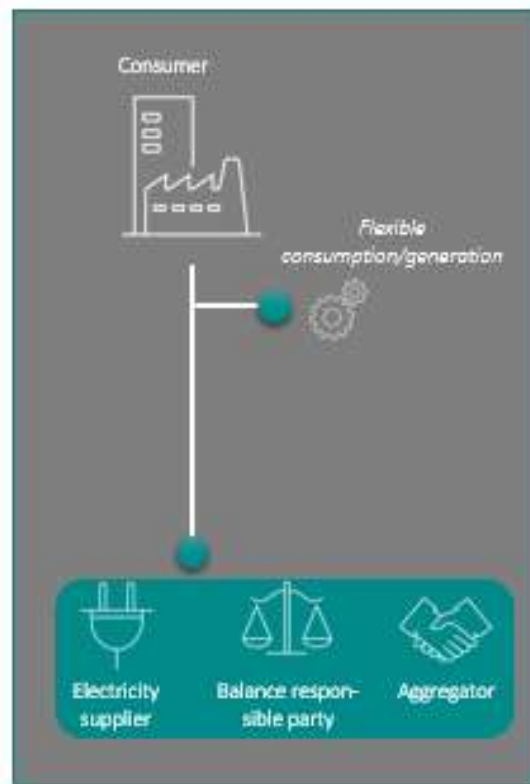
DEFINING AGGREGATOR AMONG THE PLAYERS IN THE ELECTRICITY MARKET – CURRENTLY AWAITS DRAFT DEFINITION

Aggregator: Has made a contract with the consumer about the right to apply the consumers flexible consumption or production in the electricity market. The aggregator aggregates the flexibility for the consumer and offers it as a product in the electricity market to be demanded by TSO, DSO and / or balance responsible parties.



3.c. Better framework conditions for new players – market models for aggregators

MODEL 0 – AGGREGATOR'S CURRENT OPTIONS



Aggregator delivers:

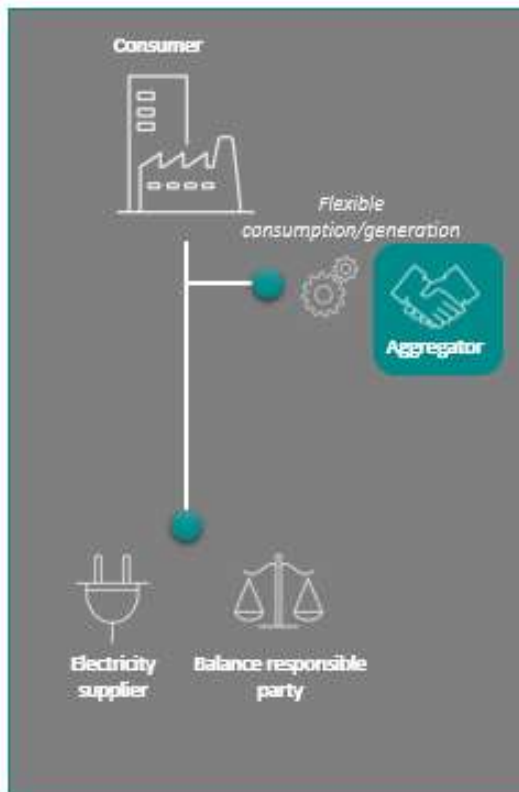
- Service and power to the consumer
- Products to the intraday and reserve markets

Danish case:

- Boilers

3.d. Better framework conditions for new players – market models for aggregators

MODEL 1 – AGGREGATOR DELIVERS FREQUENCY STABILISATION – CURRENTLY AWAITING DRAFT PROPOSAL FROM ENERGINET



Aggregator delivers:

- Service and power to the consumer
- Frequency stabilisation to TSO

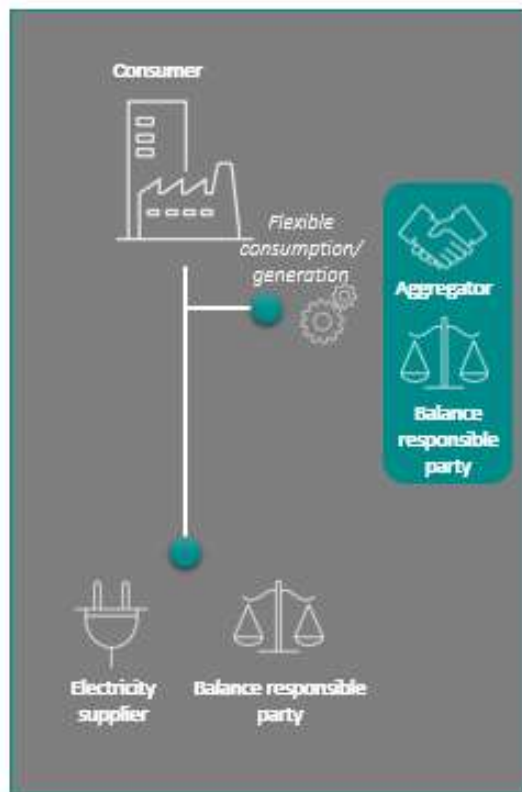
Danish case:

- Electric Vehicles:
 - Frequency stabilisation sold commercially (Frederiksberg og Bornholm)

.R and FCR-D are chiefly power (W), while FCR-N also includes energy supply (Wh). Formerly known as primary frequency reserves.

3.e. Better framework conditions for new players – market models for aggregators

MODEL 2 – AGGREGATOR DELIVERS FLEXIBILITY – CURRENTLY PUT ON HOLD



Aggregator delivers:

- Service to the consumer
- Products to the intraday and reserve markets

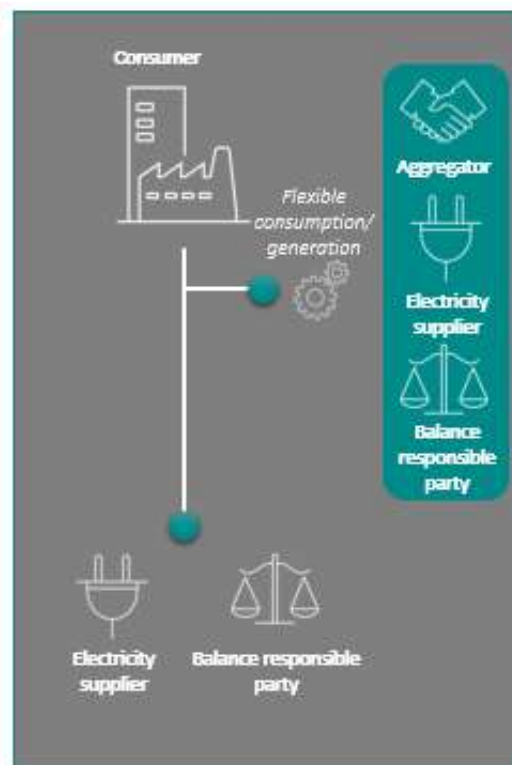
Danish case:

- No commercial interest at the moment – change of model....
- Await the Clean Energy Package's requirement on delegation of (art. 15 of the market design directive: Installations required for activities of the active customer may be managed by a 3rd party for installation and operation, including "metering / data handling" and maintenance)

3.f. Better framework conditions for new players – market models for aggregators

MODEL 3 – AGGREGATOR DELIVERS FLEXIBILITY AND ELECTRICITY

A LIST OF ABOUT 10 AMENDMENTS TO THE STANDARD CONTRACT ON CONNECTIVITY IS BEING DEVELOPED



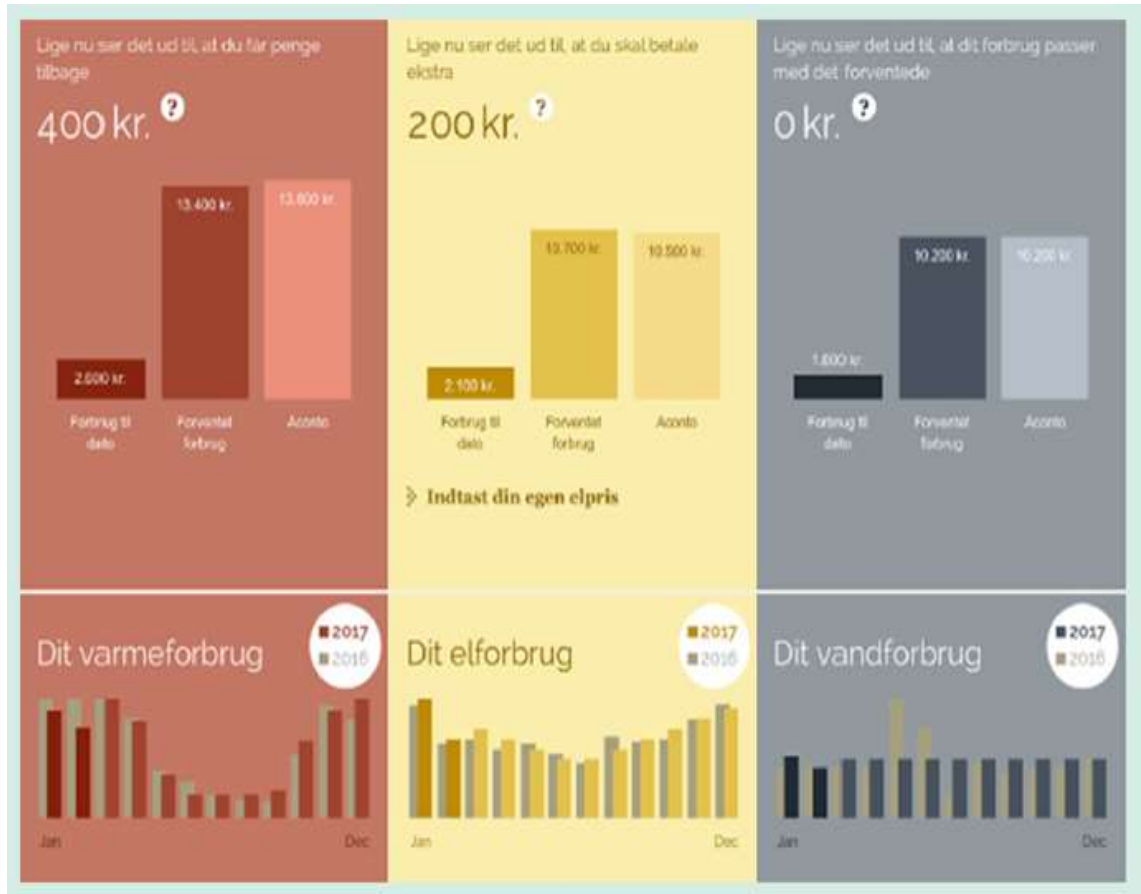
Aggregator delivers:

- Service and power to the consumer
- Products to the intraday and reserve markets

Danish case:

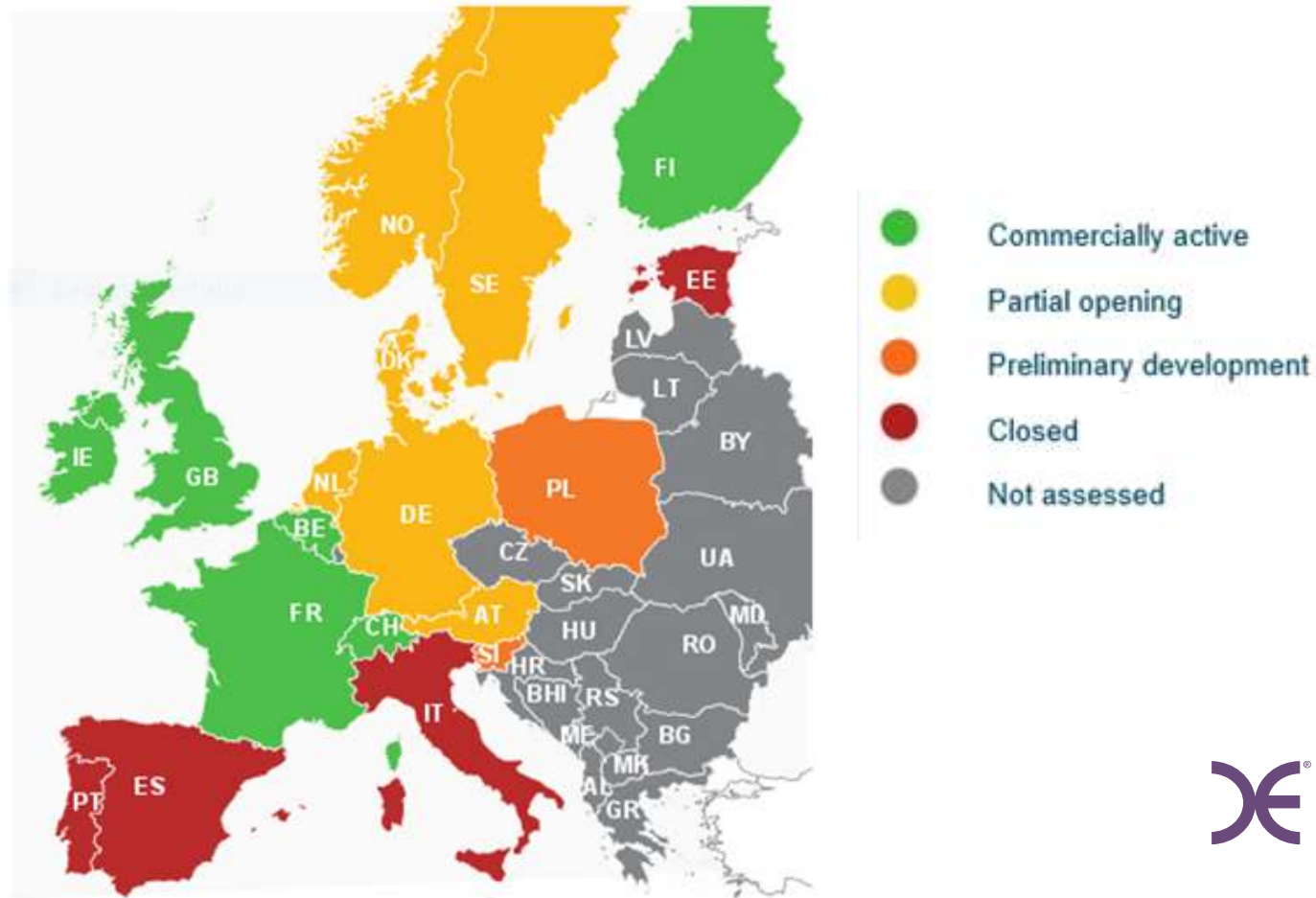
- Best Green – larger buildings
- OK and Sustain Solution – individual homes

4. Access to energy data - activating end-users and enable business opportunities



MV-group: Demonstrating real time data on power, heat and water to end-users

Activating end-users: Commercial players in other EU countries ahead of Danish players



Kilde:
SmartEn 2017

Thank you for your attention

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