



Intelligent Energy through flexibility across energy systems and activating flexibility in buildings

**EGRD workshop
Oslo, Norway
4. June 2015**

 **INTELLIGENT
ENERGI**

Content of presentation

- **Briefly about the Danish Intelligent Energy Alliance**
- Current situation and policy drivers
- What have been decided – not yet implemented
- What needs to be decided
- What impacts will it have on DR-potential within buildings
- What is the next step – smart Energy

- Established in March 2012
- Vision to make Denmark the internationally leading smart energy hub
- Mission to unite essential stakeholders to make it happen

The Danish Intelligent Energy Alliance – who are we today:



Helle Juhler-Verdoner, Branchechef, Intelligent Energi

Our key messages – Intelligent Energy requires:



Ensure implementation of cost-effective energy savings

Operation and monitoring

Grid
Communication

Service provider/
Aggregator

Enable integration of all energy systems

Fully integrate renewable resources

Incentivise investments in smart systems

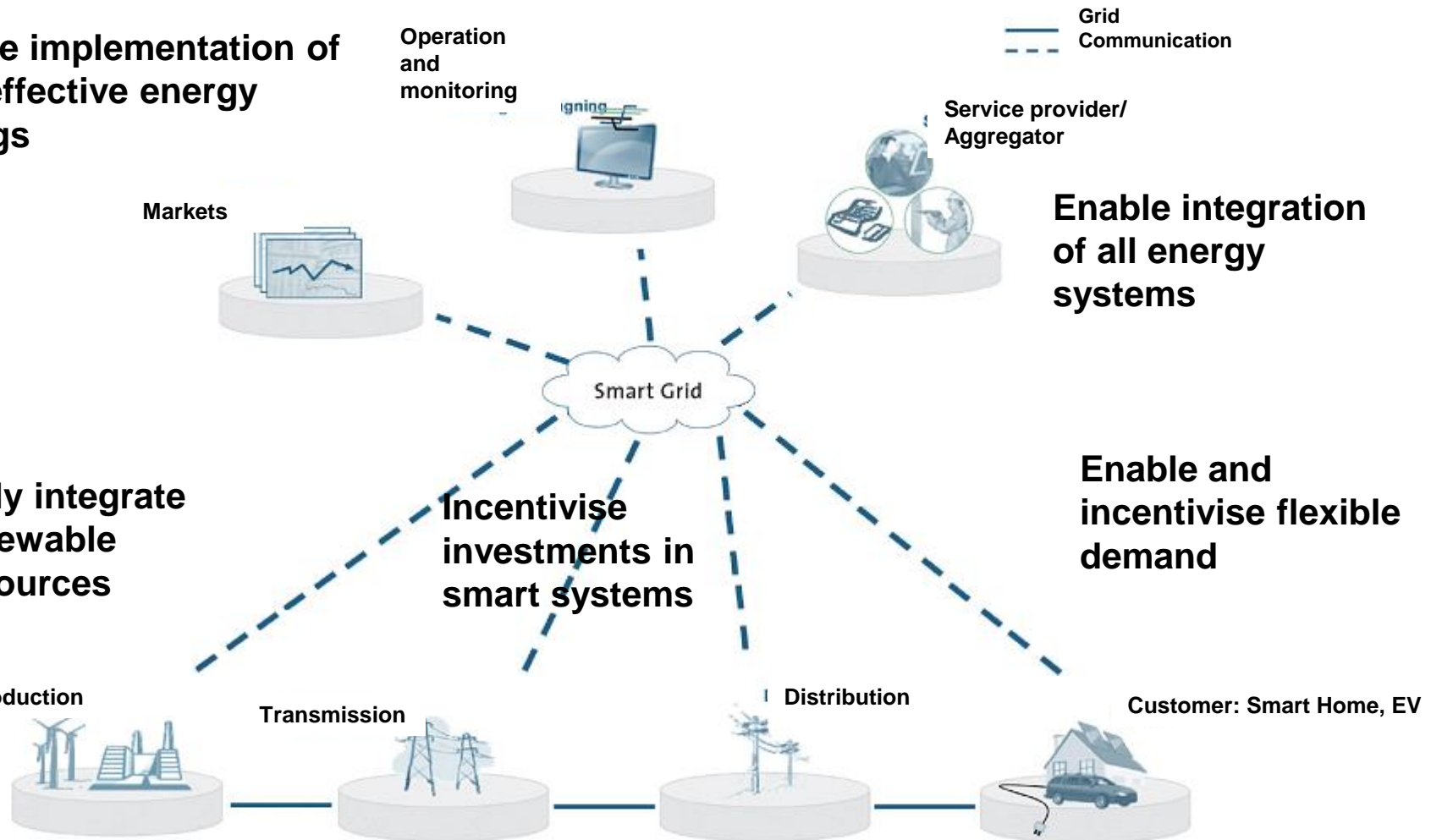
Enable and incentivise flexible demand

Production

Transmission

Distribution

Customer: Smart Home, EV



Content of presentation

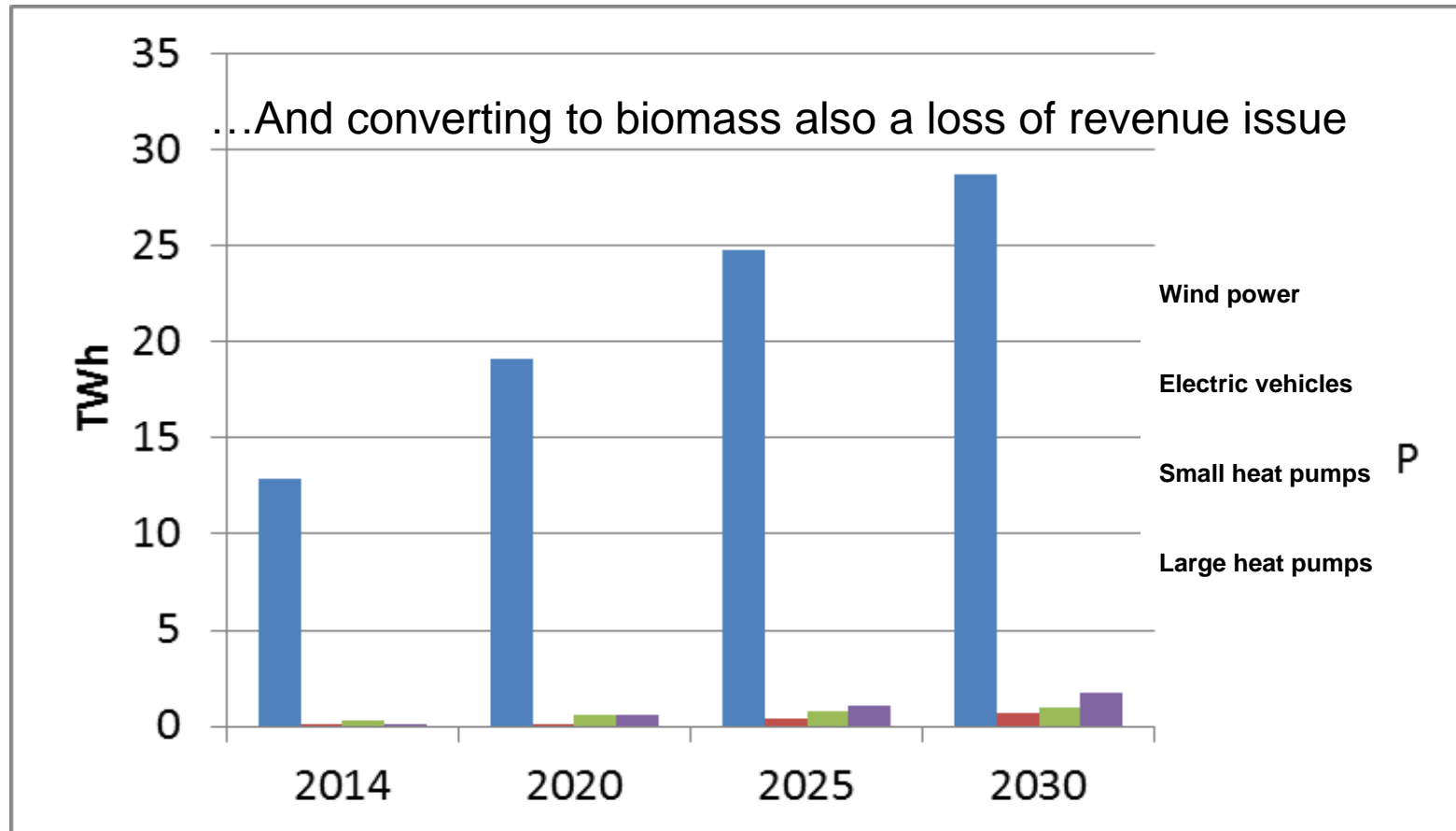
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Current Government's Green Targets

- 2020: 50% Electricity from wind power generation
- 2020: 40% Reduction in emission of CO₂ compared to 1990.
- 2030: Coal in power plants, and use of oil for heating is phased out
- 2035: 100% renewable energy for electricity and heating
- 2050: 100% renewable energy in all sector.
- 2050: Reduction in energy consumption with 30%



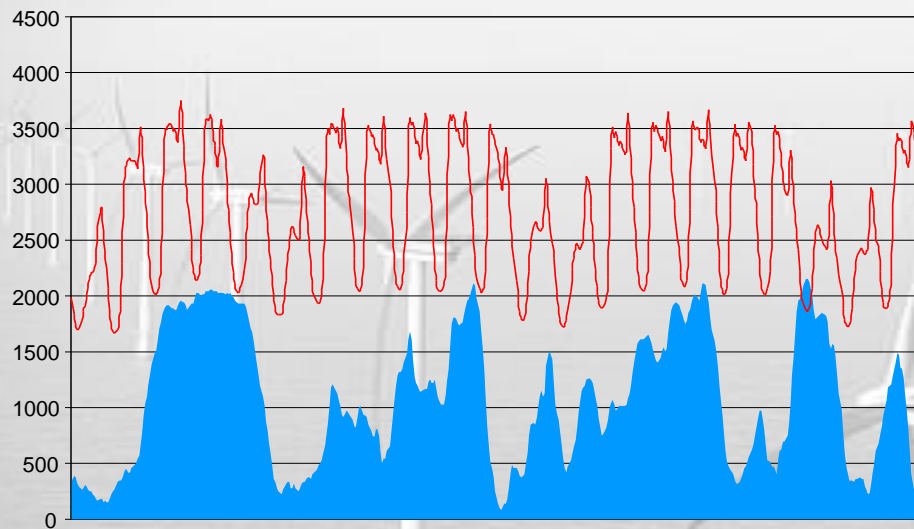
Focus on power supply – Need focus on the demand side going forward



Source: Energinet.dk: Analysis Assumptions 2014-2035

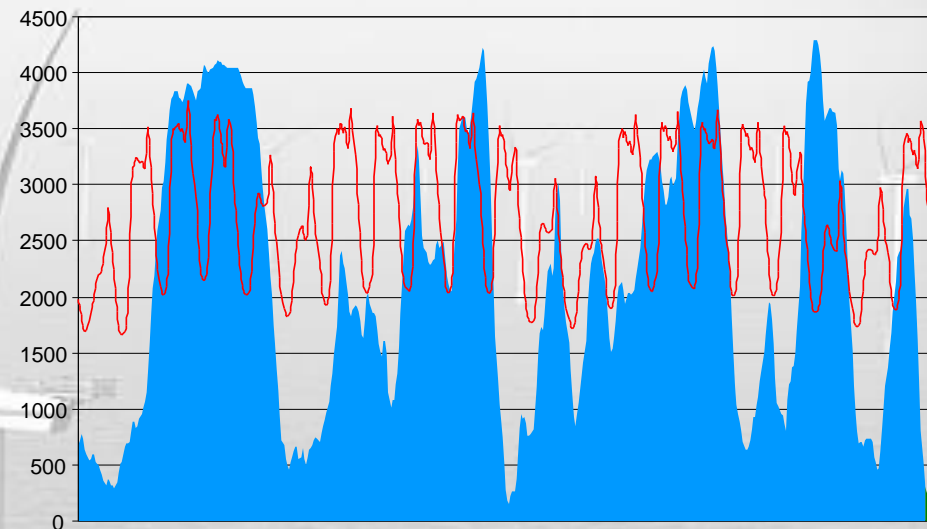
Wind power as the base-load in the power generation

Today wind (2010)



Wind covers electricity consumption in 200 hours
(Vestdanmark)

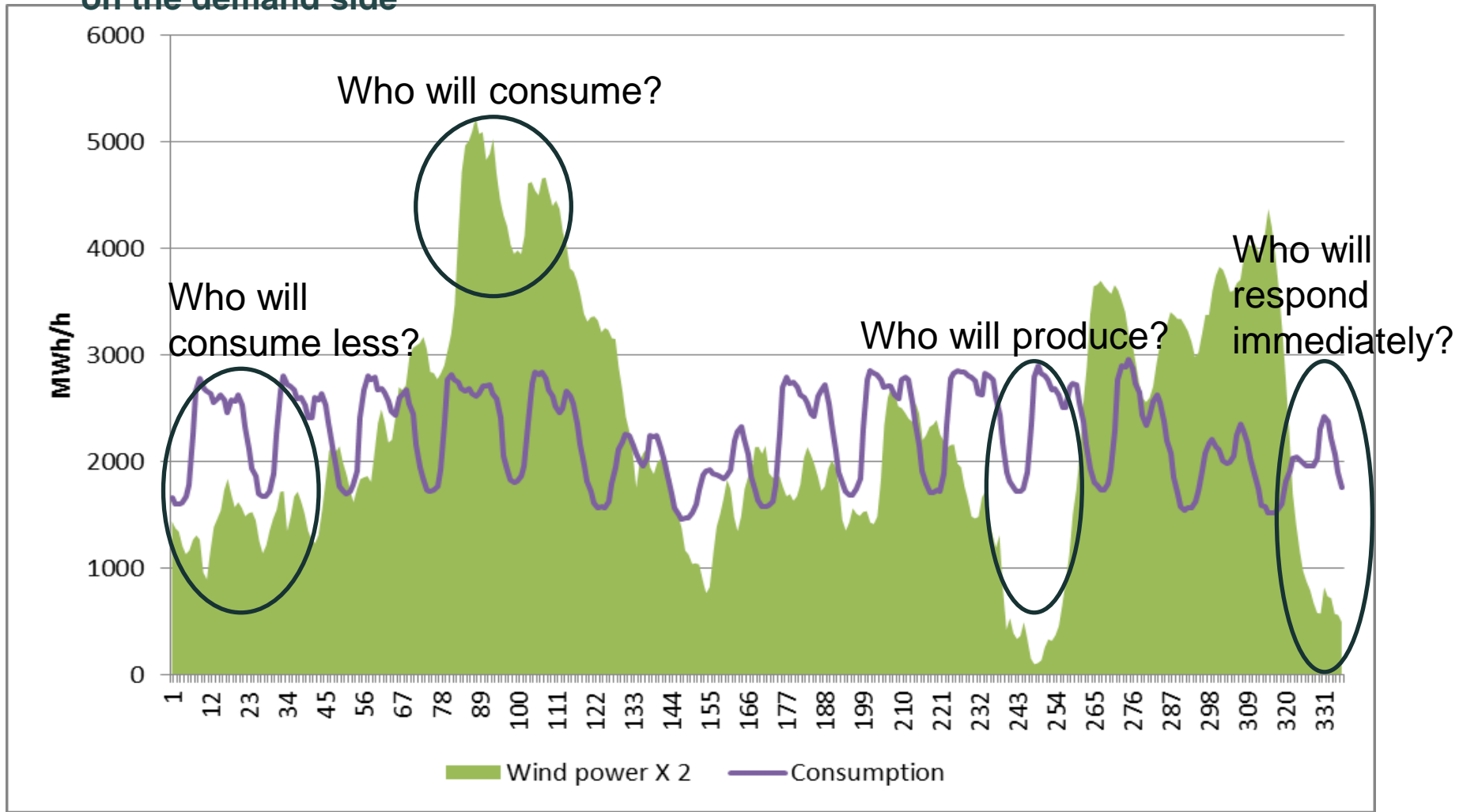
Tomorrow 50% wind (2020)



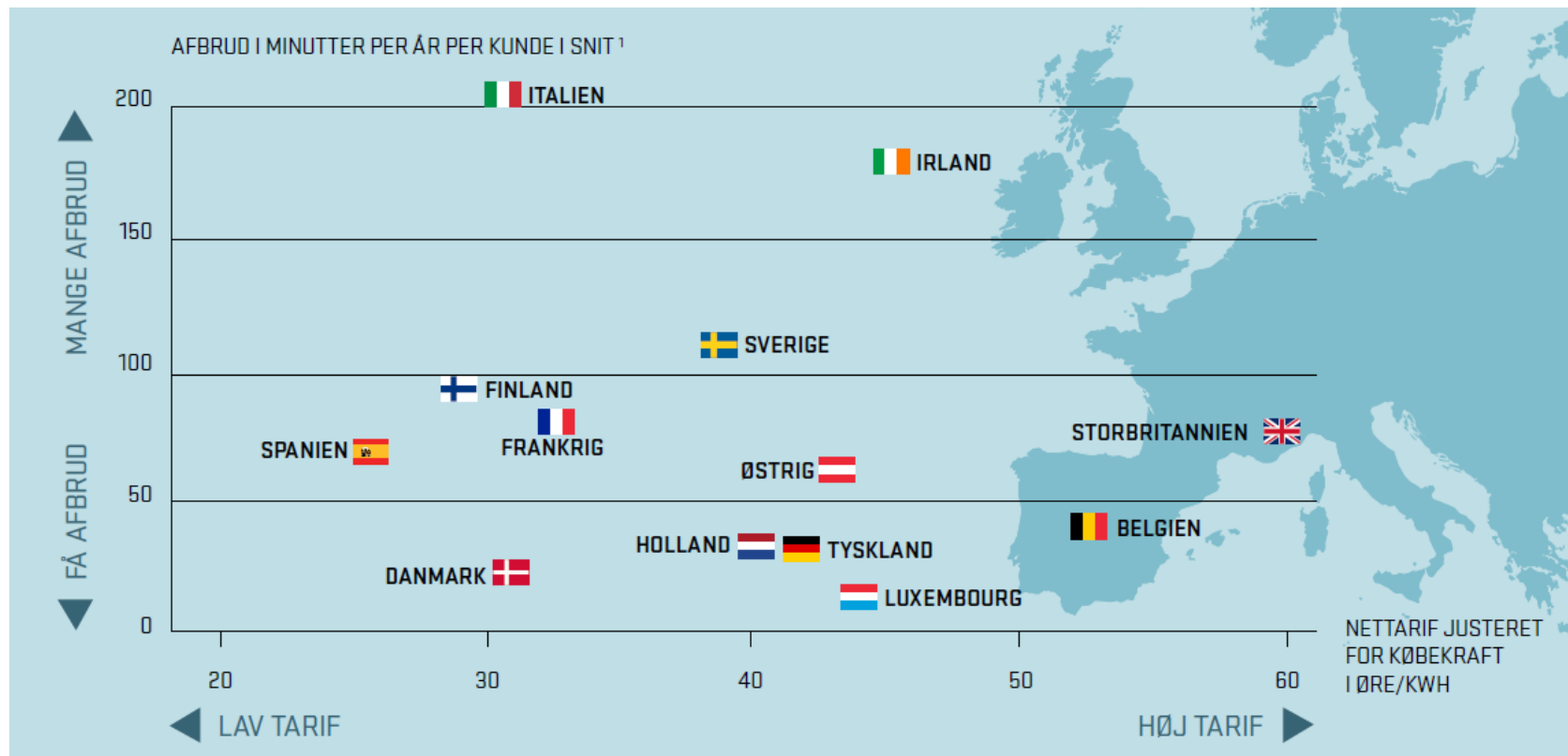
Wind covers electricity consumption in more than 1000
hours (Vestdanmark)

Adapt to the New Normal Situation

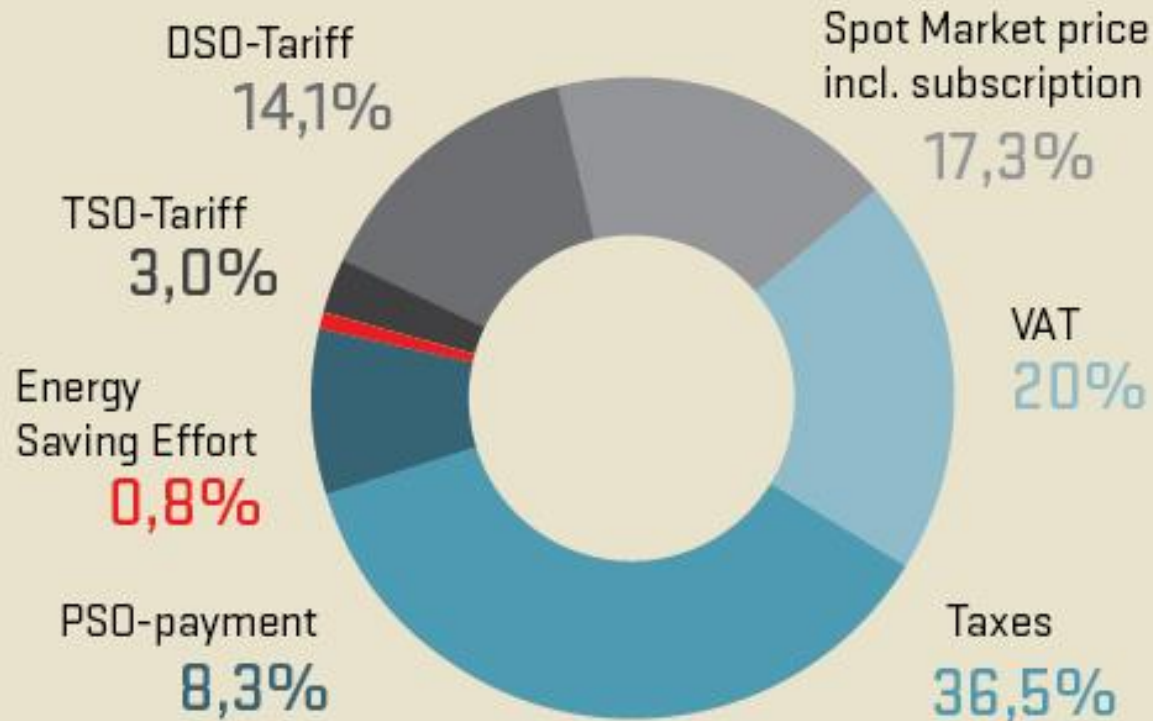
Buildings, transport and integration of energy systems have a major role
on the demand side



Point of departure – very high security of supply



Household Electricity price, 2014



**Taxation accounts for more than 50% of the price,
no flexibility in the price offer - yet**

Increasing investment need in EU smart grid

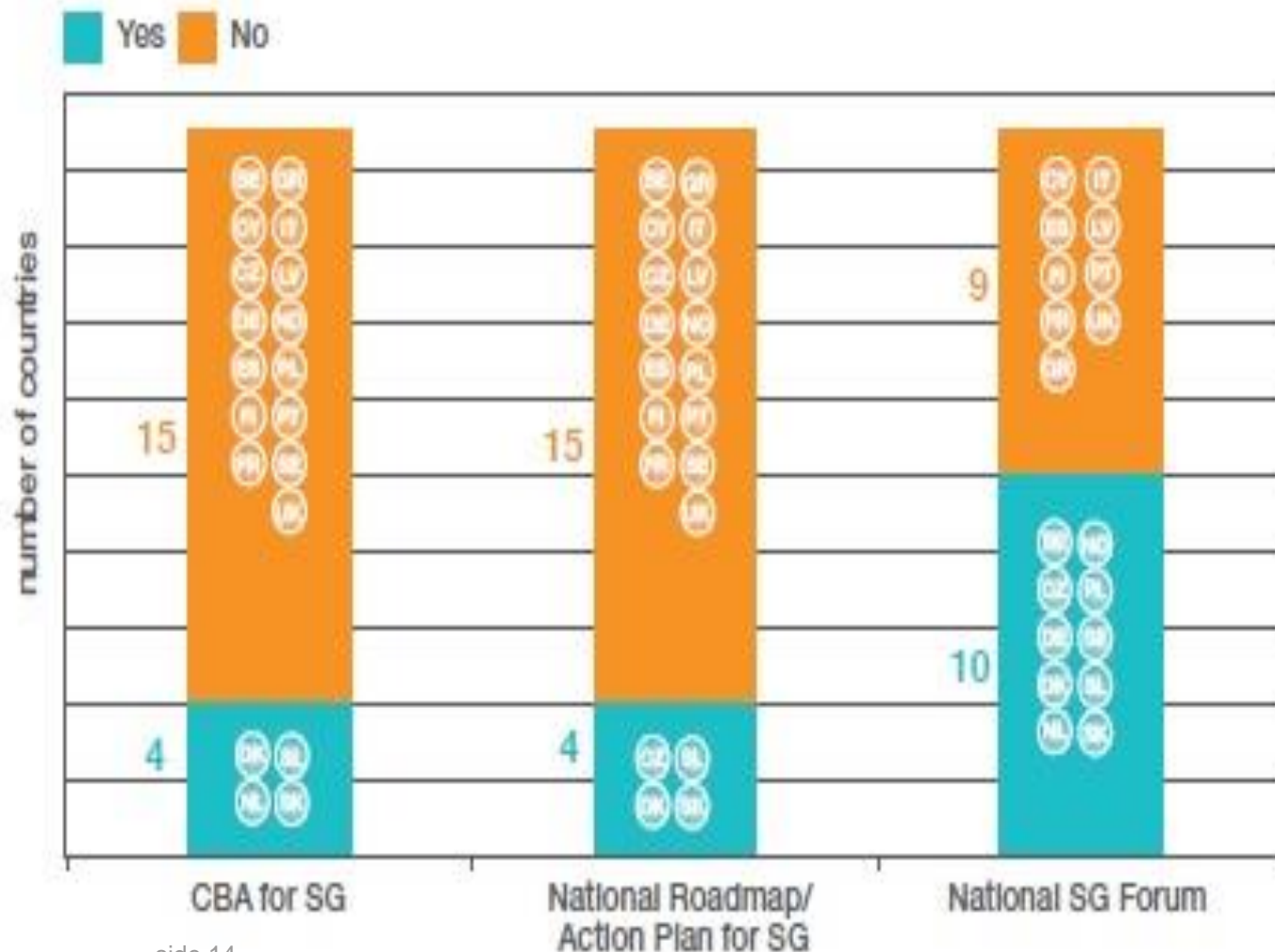
- EU's power sector needs investments of **€600 billions towards 2020. Two third's of these in the distribution system.**
- **8 Danish DSO's** (70% of the electricity system) expects investments around **€1,9 bill. towards 2020** and € 6,4 mia. towards 2040
- **What is driving investments?:**
 - Integration af **intermittant resources** (PV and wind)
 - **Maintanance** of the quality of supply
 - **Smart grids ad intelligent meters** (DSOs invest in smart meteres due to legislative requirementsin most EU countries, but also du eto DERs, Evs and customers expectations)

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Figure 15: Has a smart grid CBA been conducted or does a national smart grid roadmap or forum exist in your country?

Denmark has early on had a national road map and SG fora...



Source: Eurelectric
DSO declaration, June 2014

Figure 21: Status of the smart metering roll-out (2012)



Smart meter penetration (% of customers) in 2012

Source: Eurelectric
DSO declaration, June 2014

And we are well on track to implement it smart meters in all house holds

But to drive investments in smart grid - need to change the regulation of DSOs in order to provide the right smart grid incentive going forward – DSOs today are punished if the invest in smart grid instead of larger cables

Phasing in Smart Meters and Hourly based payment – towards 2020

- "Engrosmodel" April 2016 – gradual transition to flexible payment measured by the hour it is consumed in
- Support from the centralised Datahub

Expected implementation of smart meters in Denmark						
2014	2015	2016	2017	2018	2019	2020
1.839.000	2.025.050	2.132.169	2.497.247	2.925.568	3.247.383	3.267.988

New tariff model – vision/KPIs

- A model implemented by all Danish DSOs (harmonization) – April 2016
- Fit for the new market model in Denmark:
Two-bill to one-bill model (communication)
- Create a model with the right incentives for costumers in a future with increased electricity consumption (Demand Response)
- Internally we are analysing consequences and proceeding on next step for tariff models along the lines laid out in the new tariff model

Demand level => “traffic light”

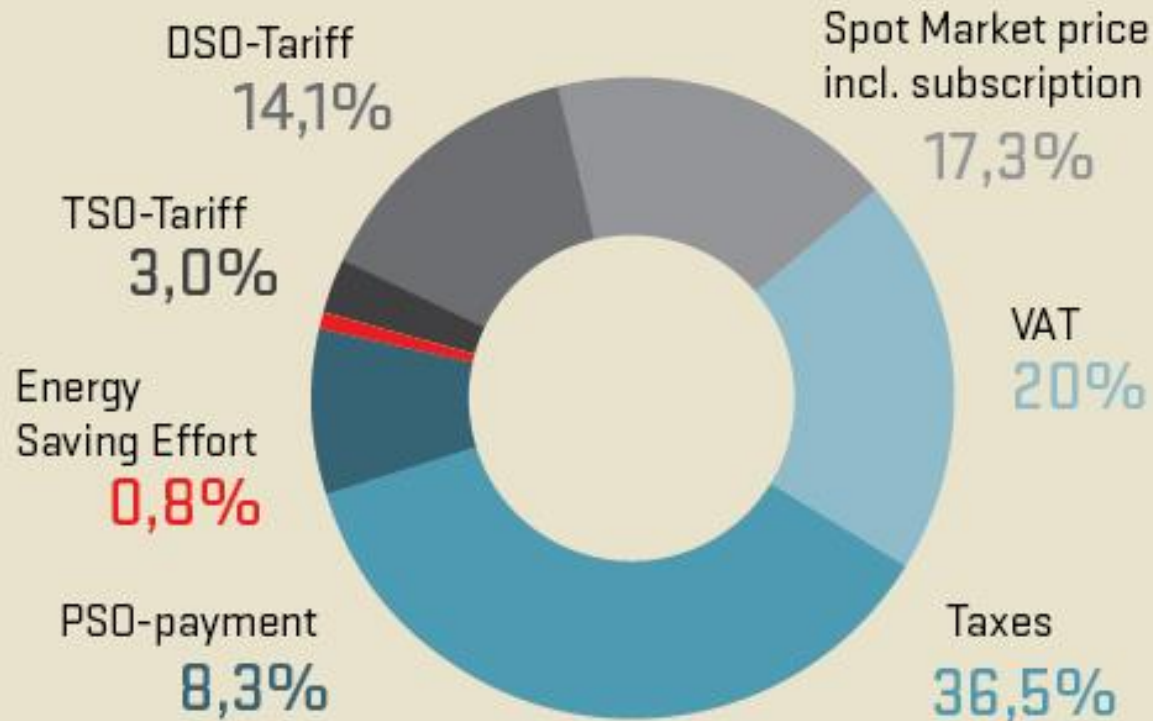
Industrial costumers:

Hverdage		
Time	Vinter	Sommer
0-1	●	●
1-2	●	●
2-3	●	●
3-4	●	●
4-5	●	●
5-6	●	●
6-7	●	●
7-8	●	●
8-9	●	●
9-10	●	●
10-11	●	●
11-12	●	●
12-13	●	●
13-14	●	●
14-15	●	●
15-16	●	●
16-17	●	●
17-18	●	●
18-19	●	●
19-20	●	●
20-21	●	●
21-22	●	●
22-23	●	●
23-24	●	●

Household customers:

Hverdage og weekend*		
Time	Vinter	Sommer
0-1	●	●
1-2	●	●
2-3	●	●
3-4	●	●
4-5	●	●
5-6	●	●
6-7	●	●
7-8	●	●
8-9	●	●
9-10	●	●
10-11	●	●
11-12	●	●
12-13	●	●
13-14	●	●
14-15	●	●
15-16	●	●
16-17	●	●
17-18	●	●
18-19	●	●
19-20	●	●
20-21	●	●
21-22	●	●
22-23	●	●
23-24	●	●

Household Electricity price, 2014



Conclusion – with no policy changes:

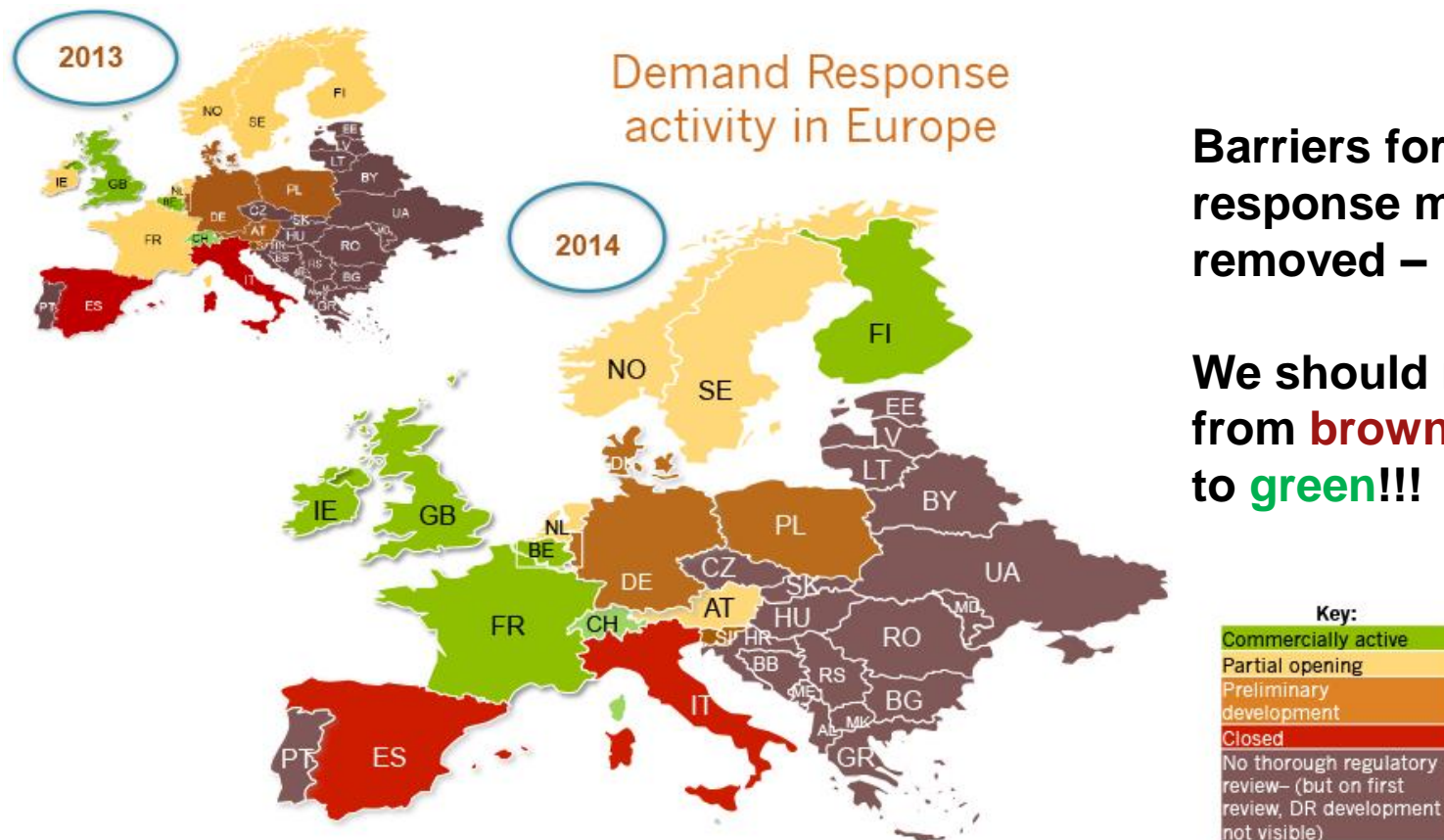
- Towards 2020 spot market price and DSO-tariffs will support demand response linked to wind power
- But taxation will reward biomass....

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The Electricity market must reward flexibility!!!

- The Danish TSO - Energinet.dk – has initiated a work called MARKET MODEL 2.0.

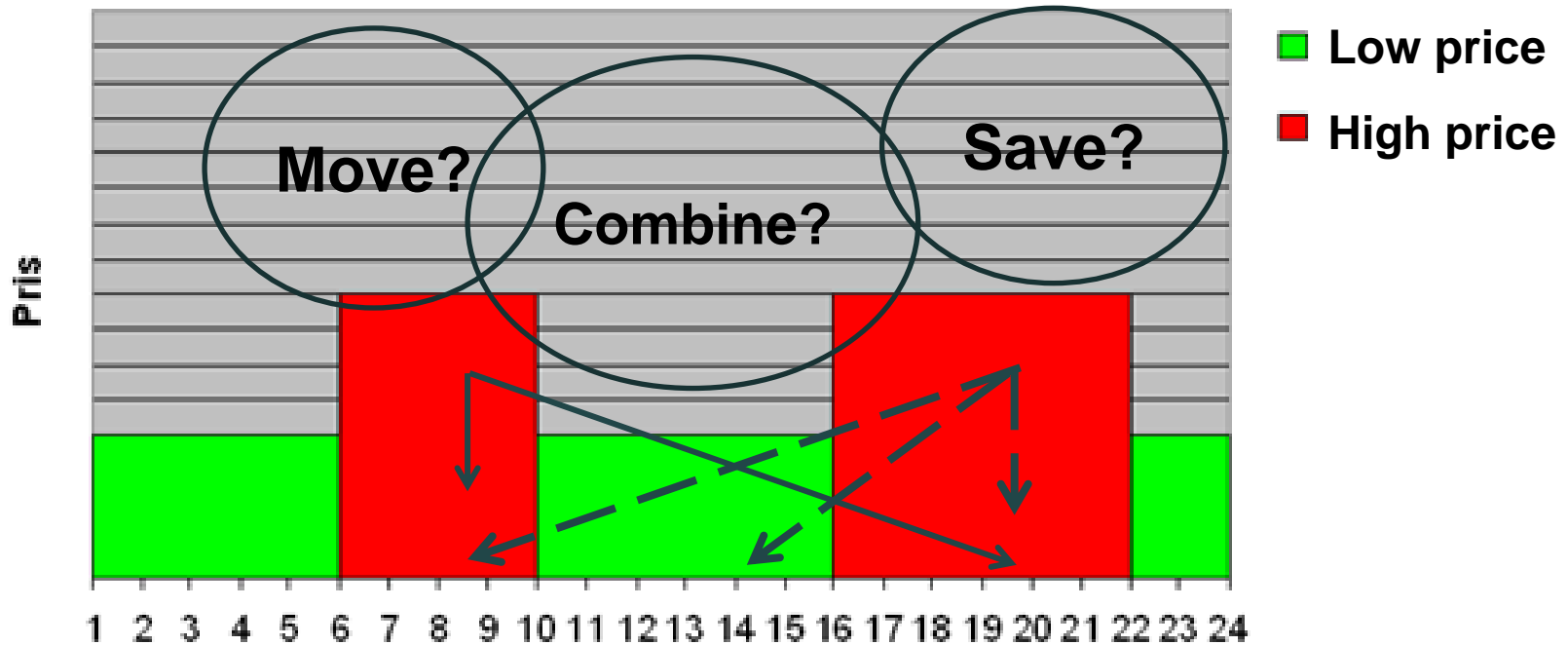


Barriers for demand response must be removed –

We should move from **brown** to **green**!!!

Source: Smart Energy Demand Coalition

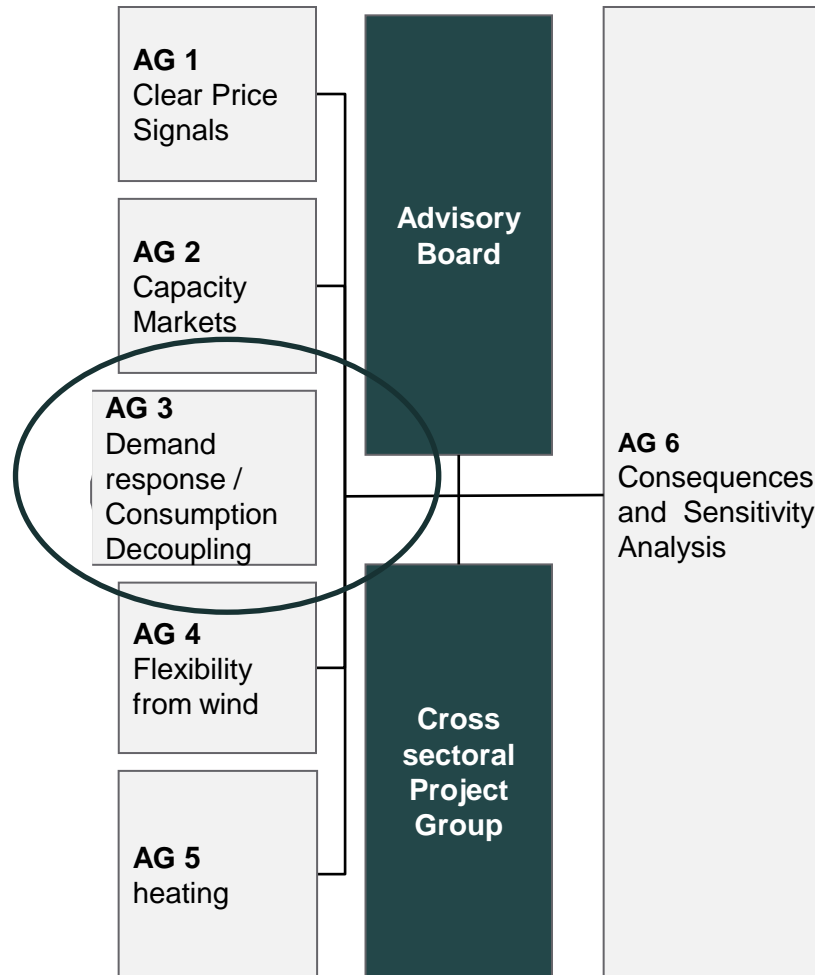
Price variation in electricity



**Energy efficiency and
energy flexibility have a
central role in a smart
energy system and must
go hand-in-hand**

Market Model 2.0. – Multiple Working groups

– One about Demand Response / Consumption Decoupling

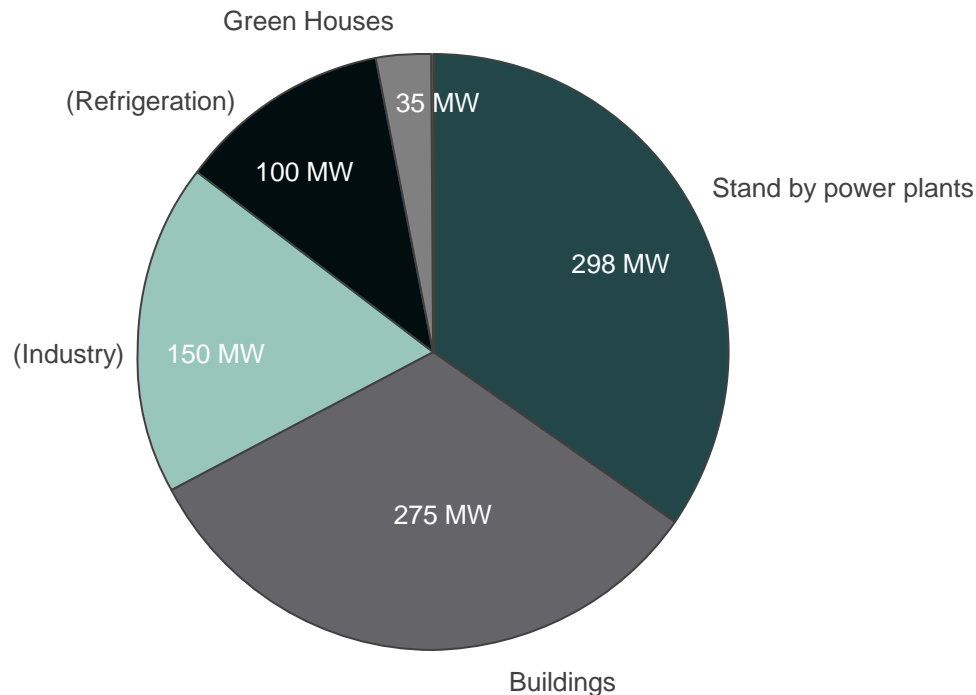


MARKET MODEL 2.0 – TECHNICAL POTENTIAL of DR

Focus on B2B – a first, conservative estimate was 840 MW

Fleksibel forbrugsafkobling pr. sektor (B2B)

MW *



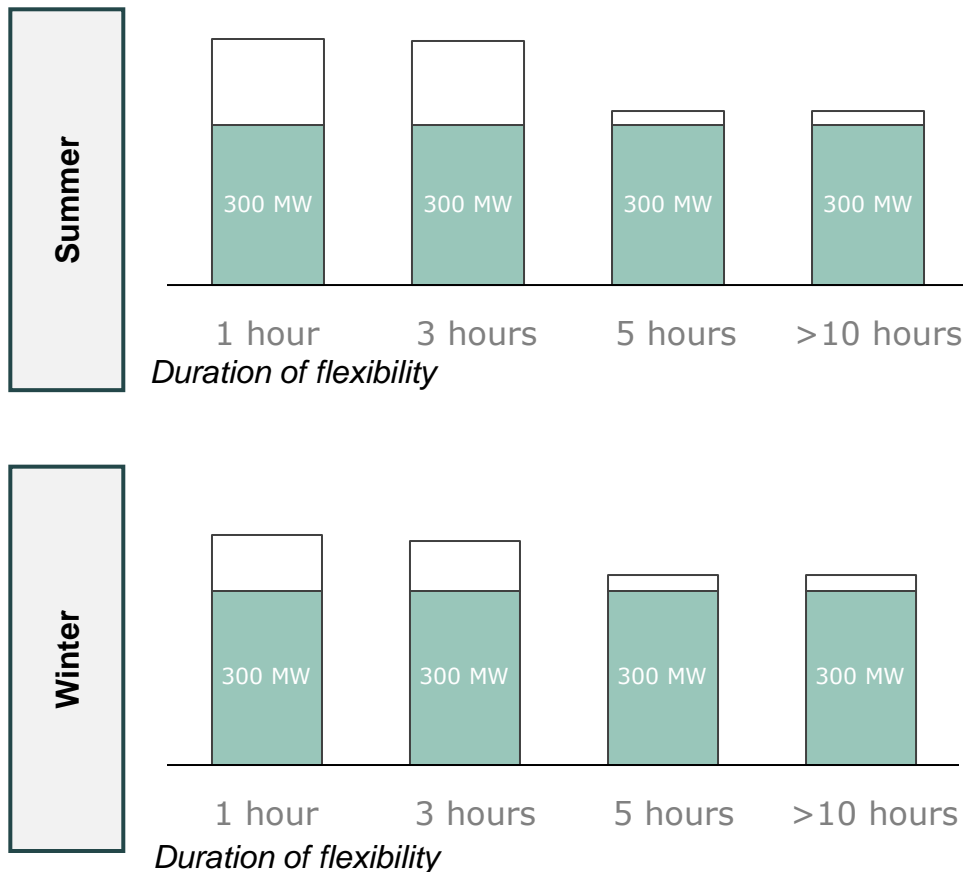
Kilde: ENDK, DE/iEnergi, DI m.fl.

An even more conservative estimate remains: the potential for flexibility is due to about 200-250 existing stand-by power plants

Potential for consumption decoupling

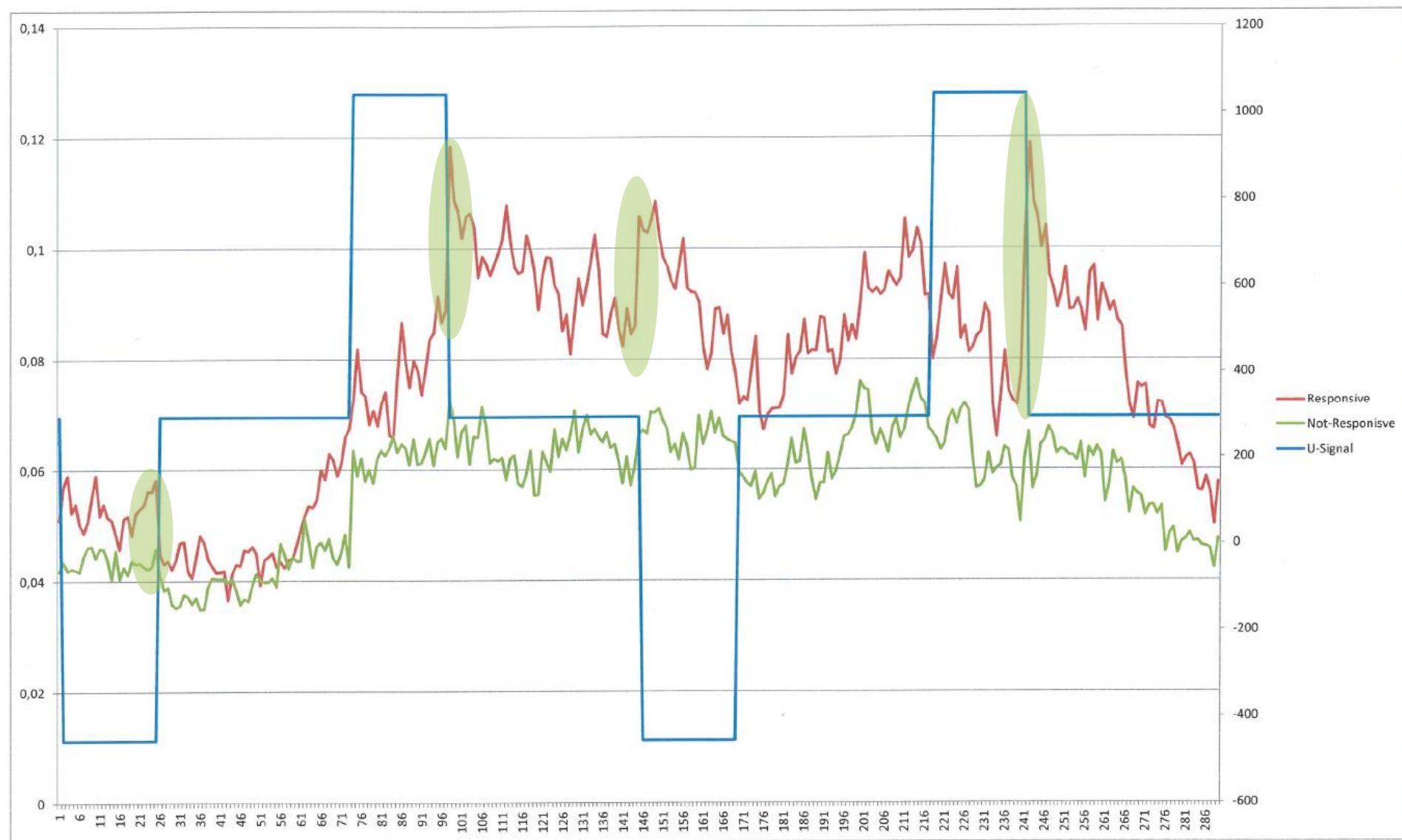
MW capacity with 10 hours of notification (all days between 07h – 20h)

- Additional potential from various sectors
- Stand-by power plants



- The geographical distribution of stand-by capacity is expected to be:
 - West-Denmark 100-150 MW
 - East-Denmark 150-200 MW
- The additional potential comes from buildings and power-intensive industry. According to ENDK the business case is in general not good, so the initial estimate has been reduced further to:
 - Buildings~130 MW
 - Power intensive industry~30 MW
 - New stand-by capacity

B2C potential is not included in Market Model 2.0
But it is there – see e.g. EcoGrids preliminary results :



Remove barriers to Demand Response (1)

- **Lack of knowledge about the power market, e.g. owners of buildings, waste water sector, super markets etc.:**
 - Day-ahead and intra-day market - no regulatory barriers, but lack of knowledge and limited business case
- **Product design and Product conditions** for participation in the market:
 - Volume (required size of bids) must move from 10MW to 1MW (*Tertiary Market - Regulerkraft*)
 - Flexibility in terms of duration of power consumption decoupling/-flexibility (1-2 hours should be possible to offer) and flexibility in terms of duration of contractual commitment (from years to e.g. 6 months or one year) (*New capacity market and Secondary reserve market*)
 - Remove requirements about symmetry (*Primary reserve market*)
 - Validation of smaller units (from online measurements to statistical solution)

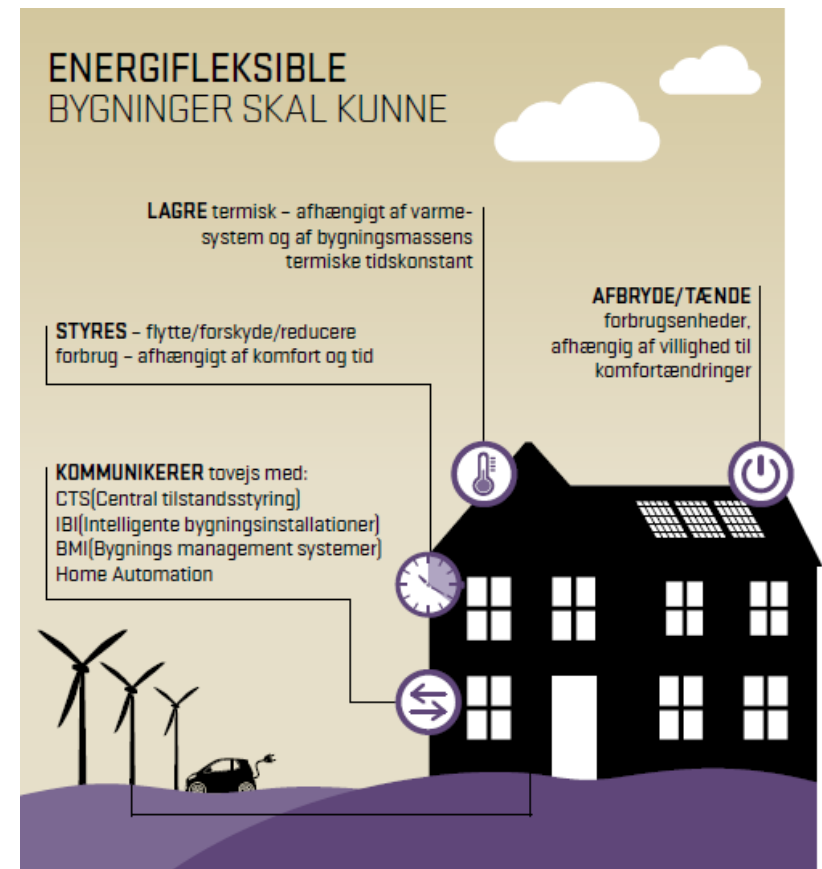
Remove barriers to Demand Response (2)

- **Lack of business case** (how to improve this – removal of barriers and support schemes / lower tariff of transmission ?! A new tariff model is introduced in 2016)
- **Dialogue required between aggregator and Balance Responsible Party (BRP)** (The rule is one BRP per meter)
 - iEnergI's assessment indicates no need for standard contracts but further dialogue on problem and potential solutions

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Removing barriers in the Power market - paving the way for Buildings – other policy measures needed too (building requirements 2020, labelling of smart grid ready buildings etc.)



Smart Energy through Smart Buildings

– What does it take? Building requirements

EE and SG together:

Energy Efficiency combined with Energy flexibility investments – a stronger business case

Flexible buildings

- Components
- Installations
- Smart metering to support the business case



Strong market

- Product development
- Product offering

Informed customers

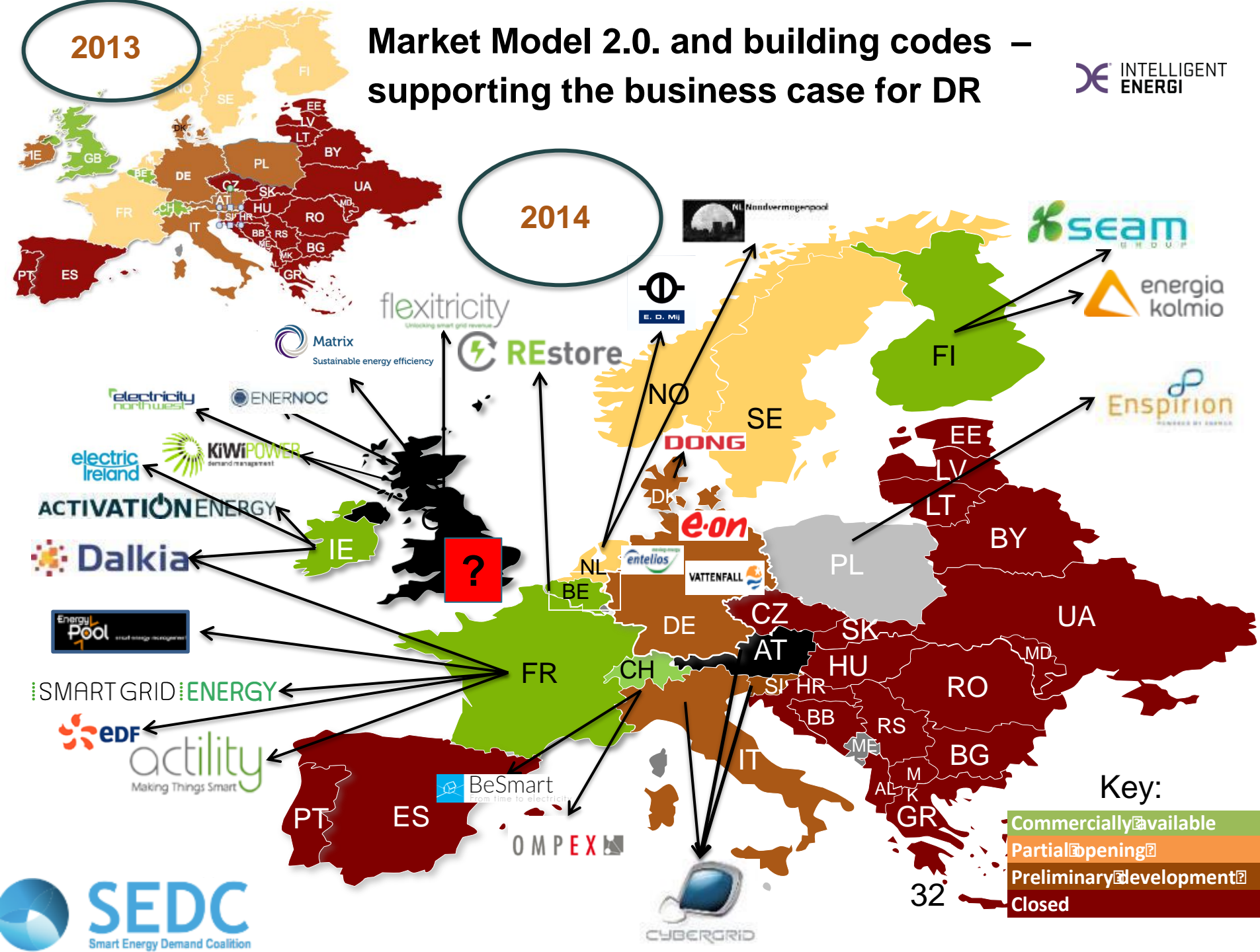
- Information
- Visibility
- Labelling

2013

Market Model 2.0. and building codes – supporting the business case for DR

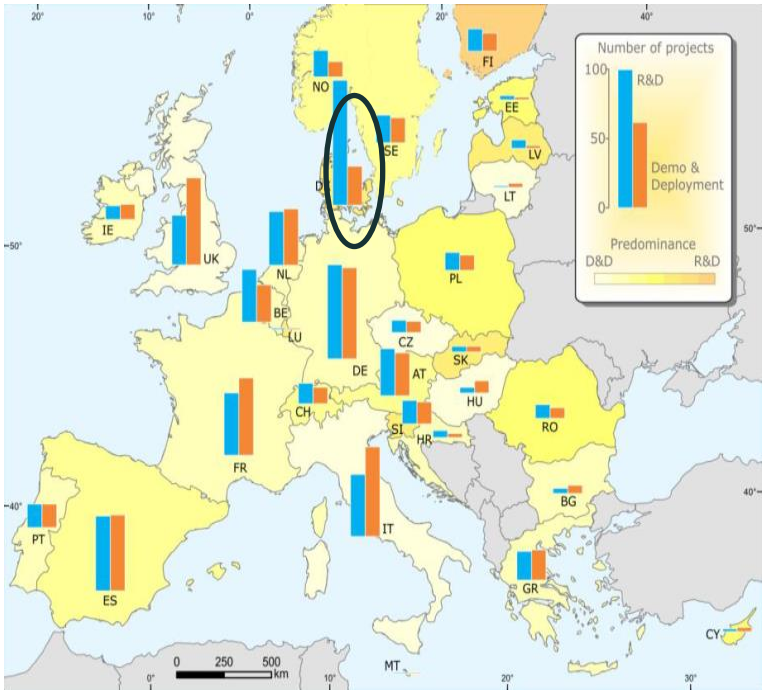


2014

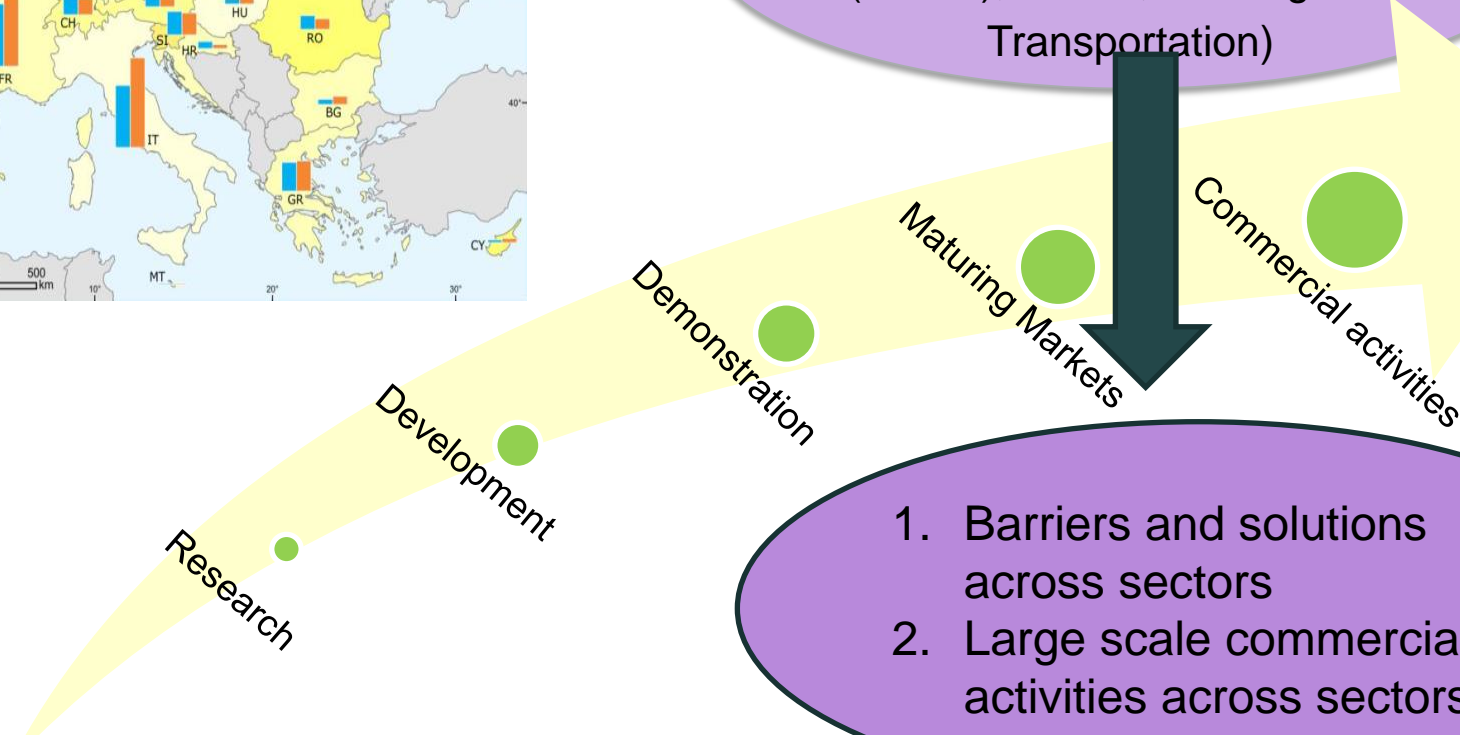


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Platform for Smart Energy
(Power, Heat, Gas, Water
(Waste), Waste, buildings and
Transportation)



- 1. Barriers and solutions across sectors
- 2. Large scale commercial activities across sectors

CONCLUSION: 3 MAIN RECOMMENDATIONS

- **Market flexibility needs to be strengthened** (e.g. market design issues incl. smart meters, product design in the power market etc.)
- **Adaptation of existing legislation to support smart grid readiness** (revise building codes (2015/2020) to include smart grid readiness and make buildings demand response ready)
- **Customers and other stakeholders must have more knowledge about smartgrid readiness** – (e.g. smart grid labelling) and about **benefits of integration across energy systems**



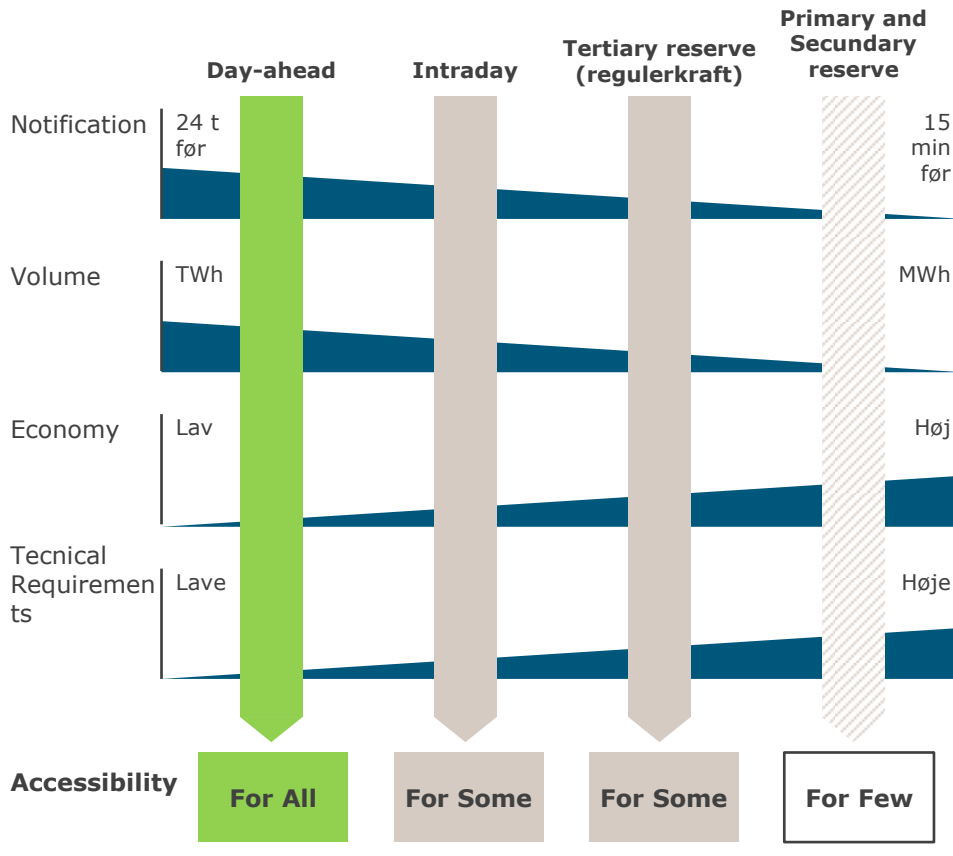
Thank you for your attention

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Barriers to Demand Response in various Power markets...

Potentiel Market for Demand Response



Capacity market?