

Power Hub at Market, Pricing & Smart Grid Workshop

Aarhus, January 31st 2013



Ivan Kristian Pedersen, Programme Manager
Products & Pricing International
International Sales



DONG Energy: Leading energy group in Northern Europe



We are headquartered in Denmark

Our business is based on procuring, producing, distributing and trading in energy and related products in Northern Europe.

We have approximately 7,000 employees and generated DKK 57 billion (EUR 7.6 billion) in revenue in 2011.

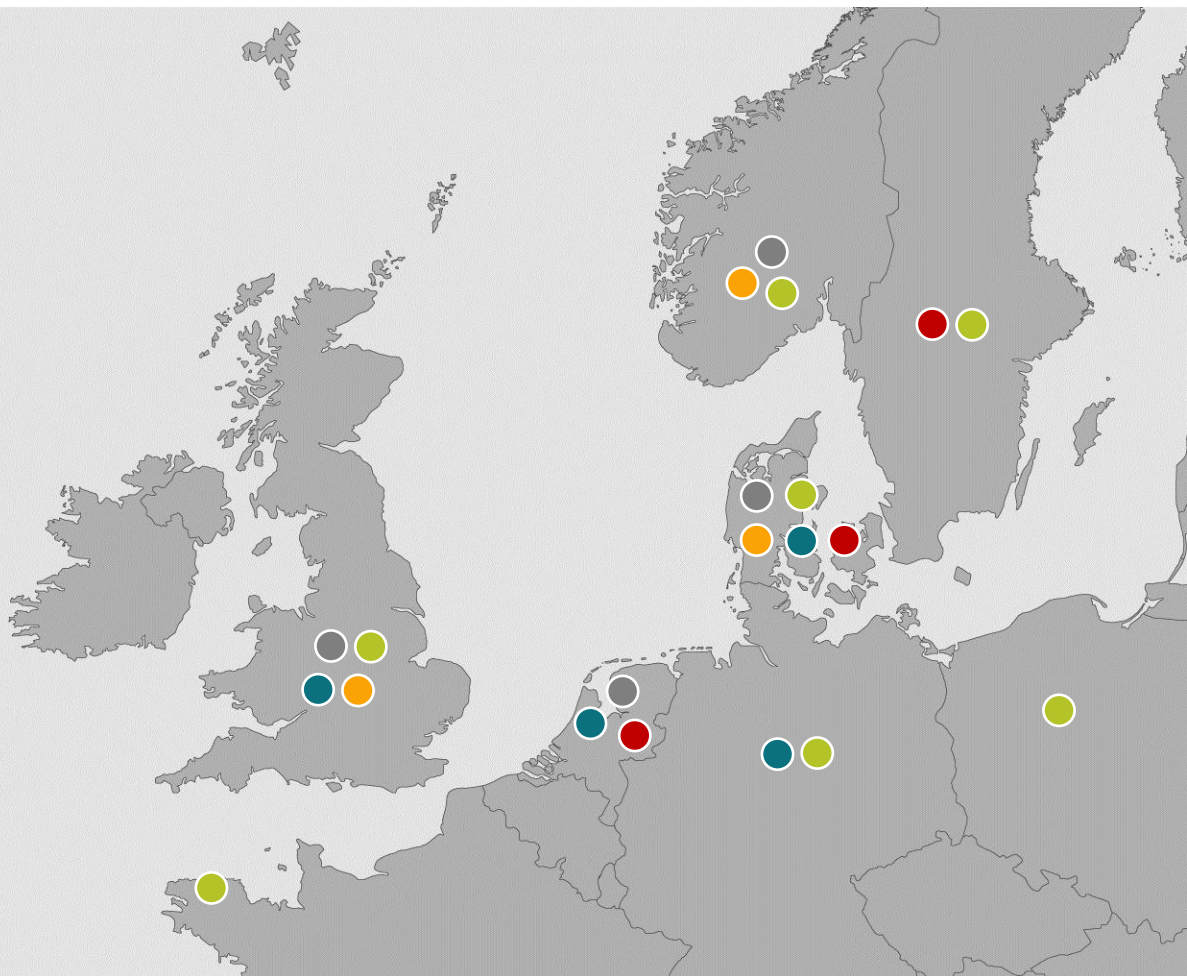
● EXPLORATION & PRODUCTION

● WIND POWER

● THERMAL POWER

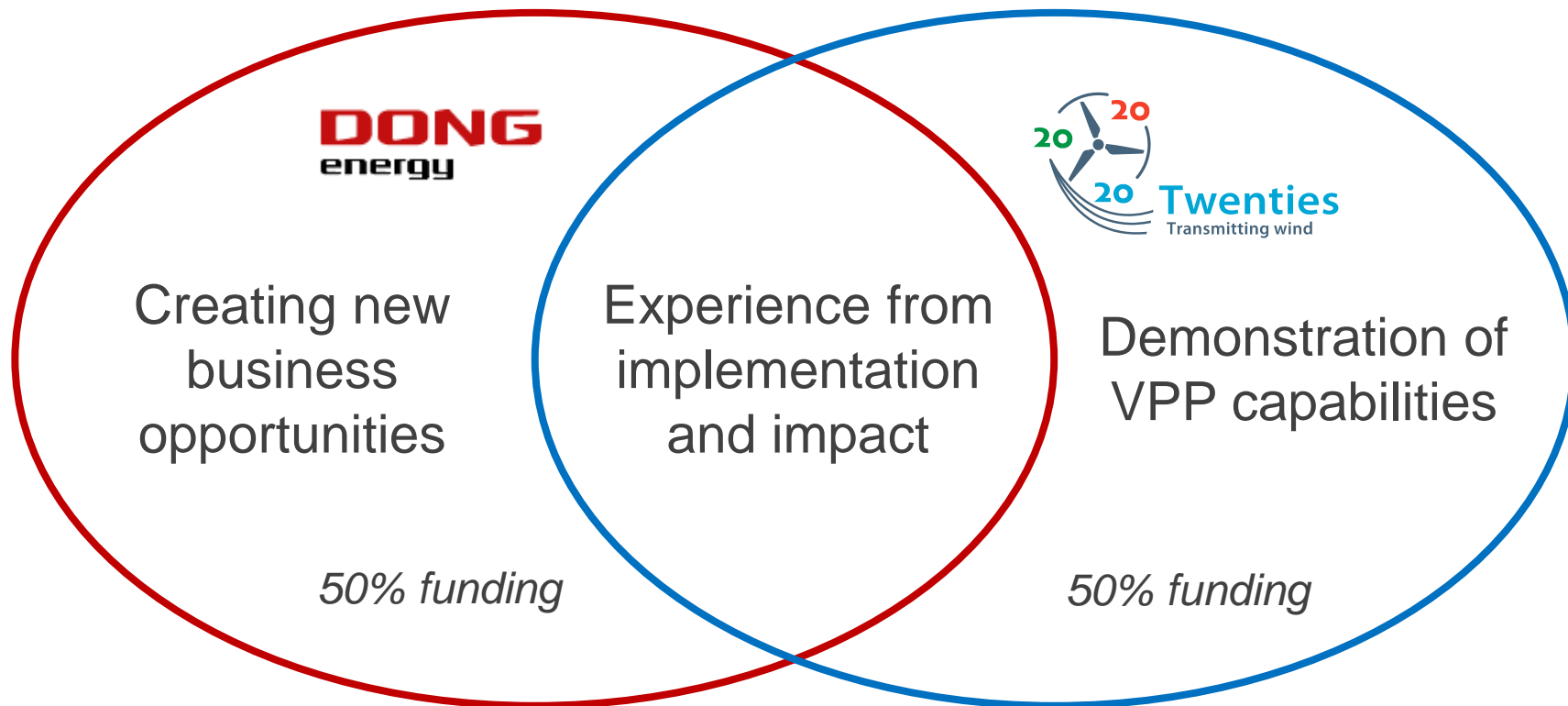
● ENERGY MARKETS

● SALES & DISTRIBUTION



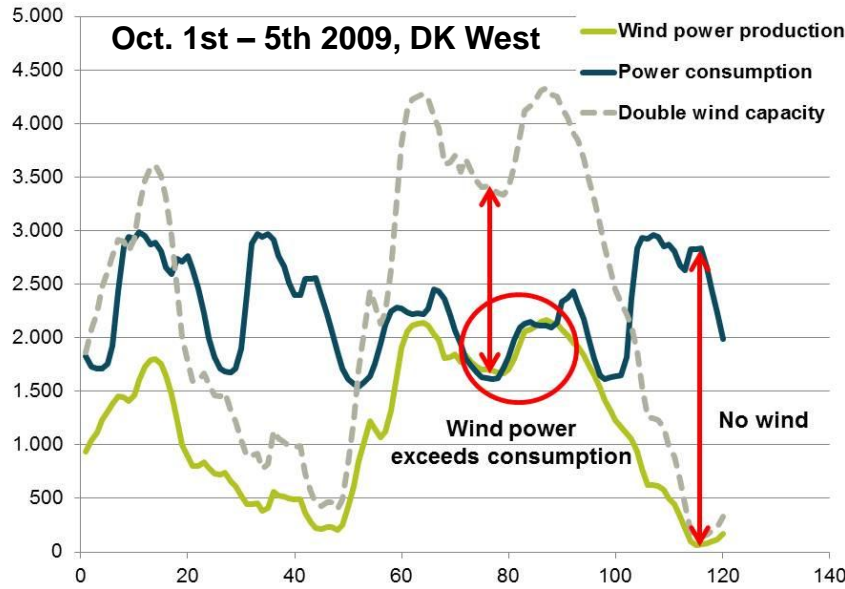
The VPP project - Power Hub - is part of Twenties

Largest EU FP7 funded energy R&D project



Transmission system operation **With** large penetration of wind and other renewable **Electricity** sources in **Networks** by means of innovative **Tools** and **Integrated Energy Solutions**

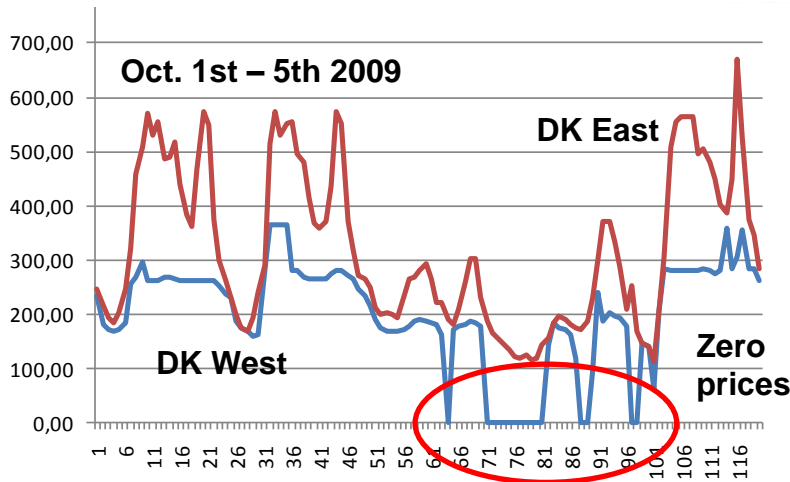
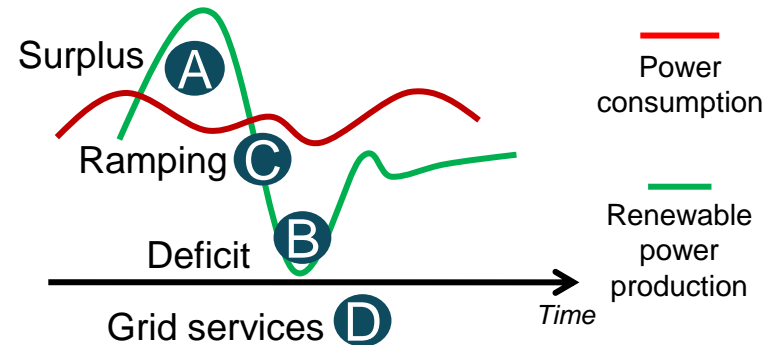
The key challenges of renewable energy



Conventional assets are pushed out of market



New flexibility providers required to handle challenges

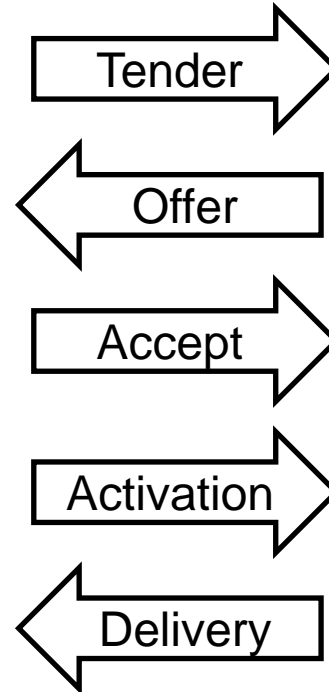
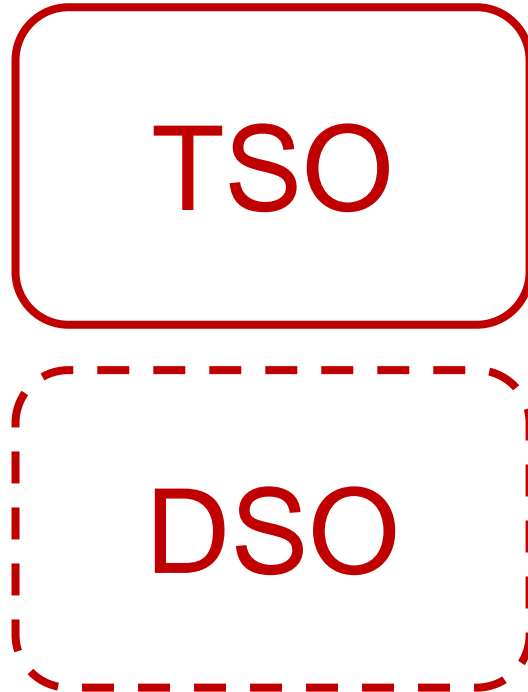


A solid link between existing demand and supply side

Well functioning reserves markets linking demand and supply

Demand side
Balancing services

Supply side
Only generation

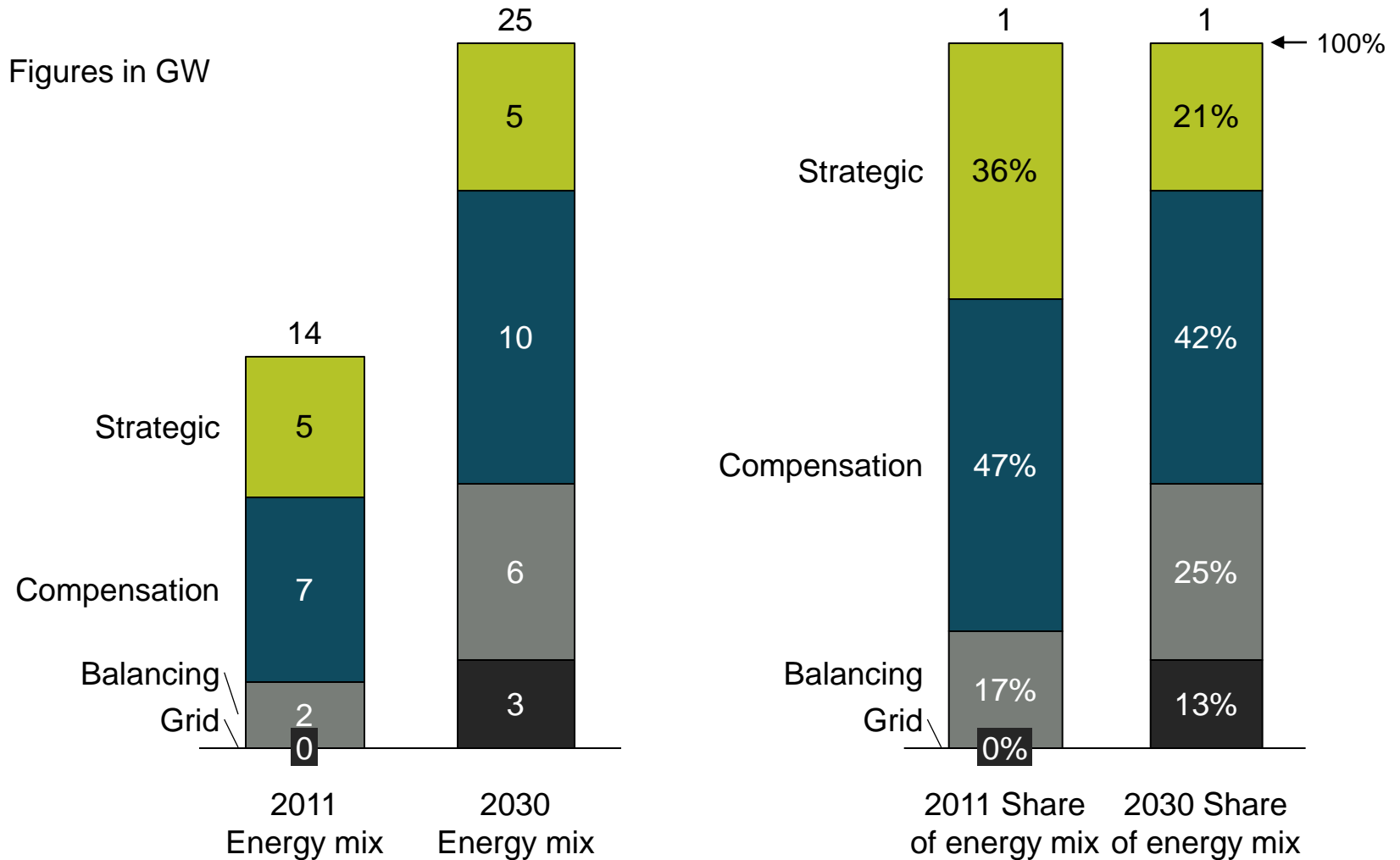


Structured services
based on reliability

Structured and
deterministic behaviour

Changing flexibility requirements in the Danish system

Flexibility requirements will triple and will by large become forecast driven



A broken link between future demand and supply side

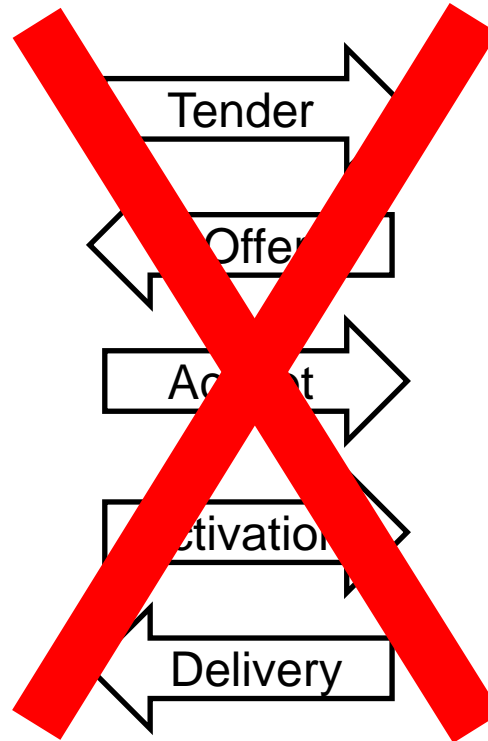
A new linking mechanism is required to aggregate and market flexibility

Demand side

Balancing services

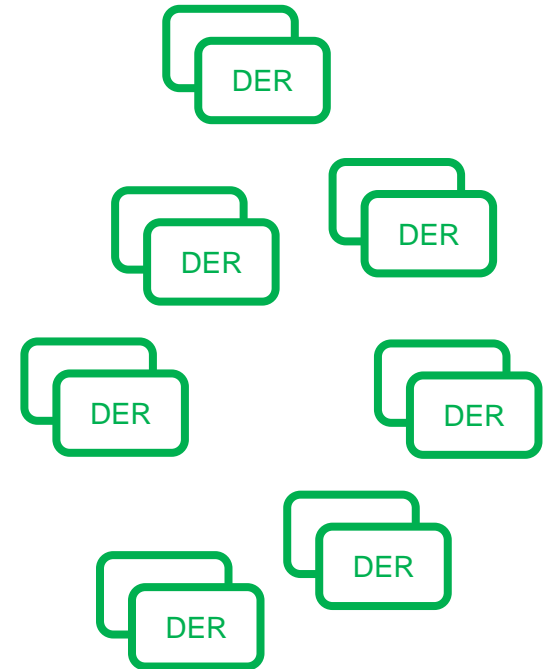


Structured services
based on reliability



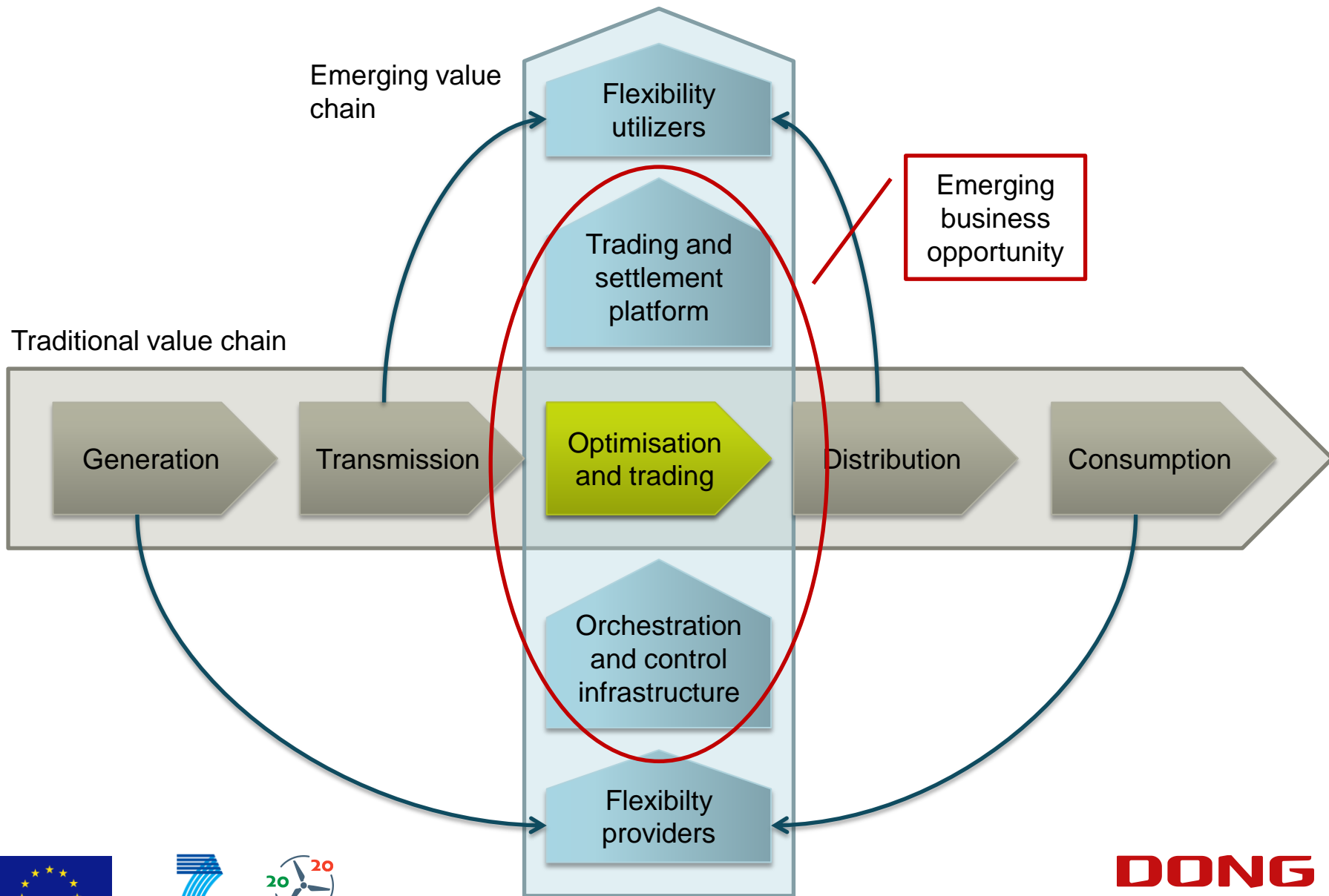
Supply side

Both generation and consumption



Fragmented and
stochastic behaviour

The traditional and the emerging value chain



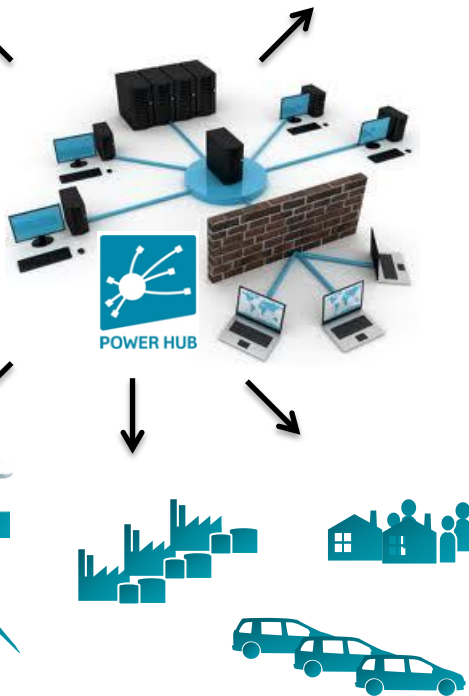
The virtual power plant – Power Hub

Providing the link between distributed energy resources and system operators

Energy and reserves markets



- IT system
- Infrastructure
- Organisation
- Biz.processes



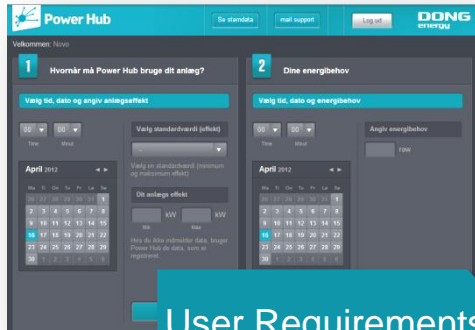
Assets – Individual or aggregated

Create value from trading flexibility

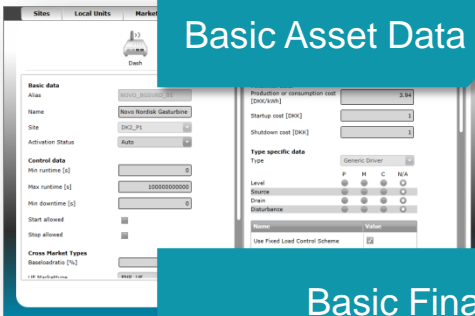
Enable new business

Orchestrate operations of assets

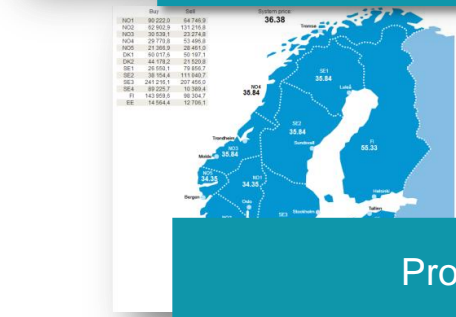
Power Hub optimises the market value of assets



User Requirements



Basic Asset Data



Basic Financial Data

Prognosis

Technical Restrictions

Cross Market Optimisation



Market Bids

Market Contracts

Schedules & activation



Components in Power Hub value proposition

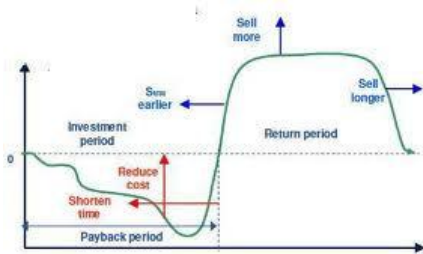
The key drivers for owners of distributed energy resources



- Improve green image / Smart Grid Ready
- Reduce CO² footprint
- Enable higher renewable penetration



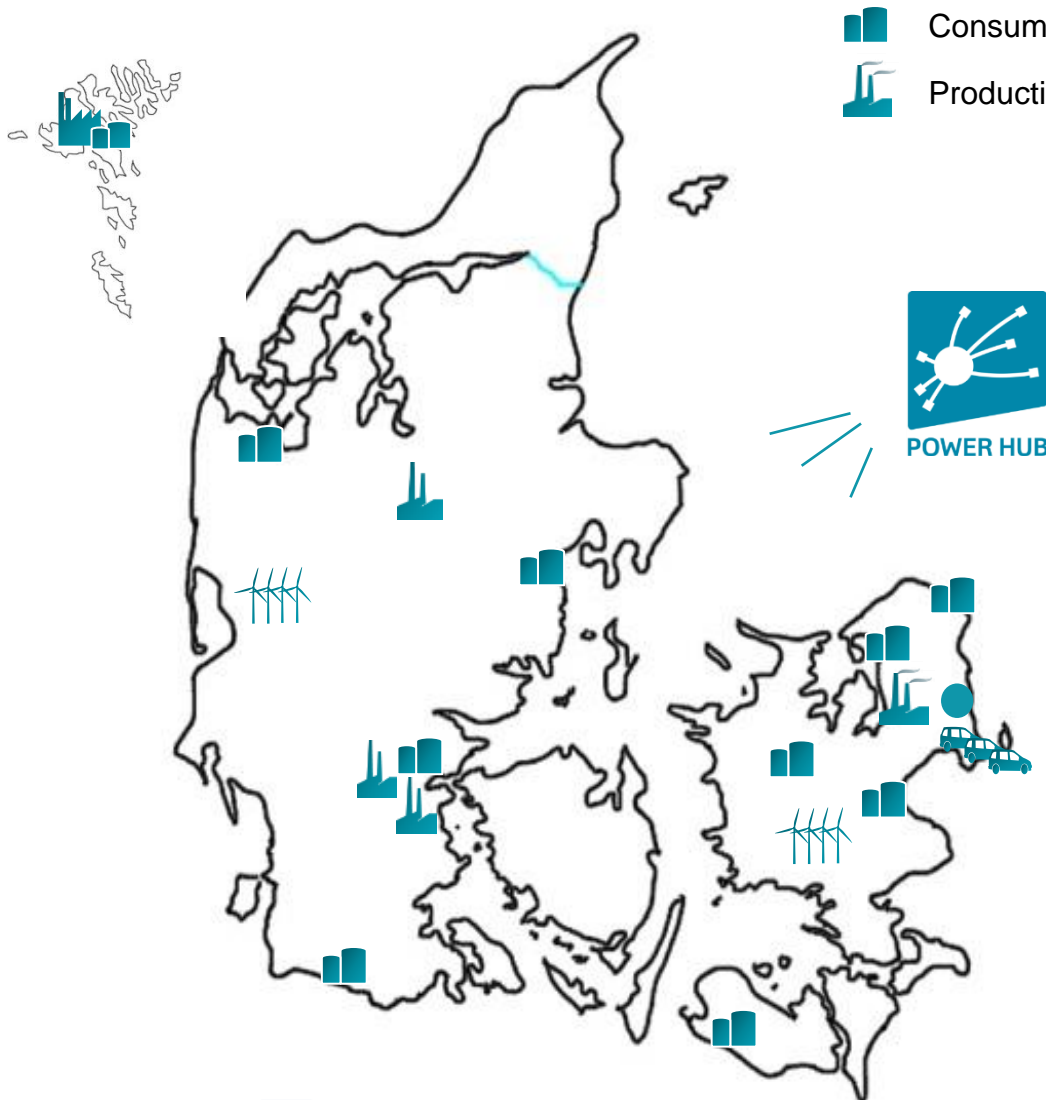
- Decrease cost of energy consumption
- Increase revenue of energy generation
- Create revenue from ancillary services
- Decrease labour costs by automation





- Automate operational processes
- Increase safety and compliance
- Increase lifetime expectancy of asset

Power Hub operates a diverse portfolio today

Providing all types of ancillary services and reserves to the Danish system



 Consumption
 Production

ENERGINET / DK

NORD POOL
 THE NORDIC POWER EXCHANGE

| | |
|-------------------------|--------|
| Capacity available | 38 MW |
| Flexibility controlled | 31 MW |
| Units integrated | 47 |
| Technologies integrated | 15 |
| Energy supplied | 26 GWh |
| Flexibility reserved | 10 GWh |

Customer Case: Novo Nordisk

Demonstration site for Power Hub

- Utilizing excess generation capacity for balancing purposes



Photo courtesy of Novo Nordisk A/S

Customer Case: Furesoe Water Company

Demonstration Site for Power Hub

- 35.000 customers using 1.700.000m³ of drinking water
- 5 water works based on fresh groundwater, aeration and sand filtration
- 1.075.000 kWh annual electricity consumption



KRÜGER

Customer Case: Tange Hydro Power Plant

Demonstration site for Power Hub

- Providing renewable energy and frequency support to the Danish electricity system



Customer Case: Lem Kær Wind Farm & Energy Storage

Demonstration site for Power Hub

- Providing all ancillary services from a wind farm and energy storage



Customer Case: Faroe Islands

Demonstration site for Power Hub

- Providing sub second frequency demand response and distributed energy resource reserves to an isolated energy system



Conclusions!

Power Hub shows it can be done, but strong barriers to commercialisation prevail

- Complexity rules in the real world
 - Building the operational platform and business process integration is not trivial
 - Varying DER regulation capabilities and control technology impacts mobilisation
- DER owners awareness of capabilities and potential
 - Flexibility, ancillary services and reserves markets are not commonly known topics
 - Linking flexibility to business processes rather than technology is paramount
- Standardisation and Smart Grid enabling
 - Necessary modifications to DER control technology often ruins the business case
 - Of the shelf Smart Grid enabled/compliant units could accelerate smart grid roll out
- Market reforms and regulatory changes
 - Restructuring markets in terms of bid size, duration and gate closure
 - TSO approval of a VPP as a single unit instead of approval of every unit in portfolio
 - Unbundling of supplier and balance responsible party

Questions/Answers

Ivan K. Pedersen (ivkpe@dongenergy.dk)

