Economic support mechanisms and design of markets

Skytte, Klaus

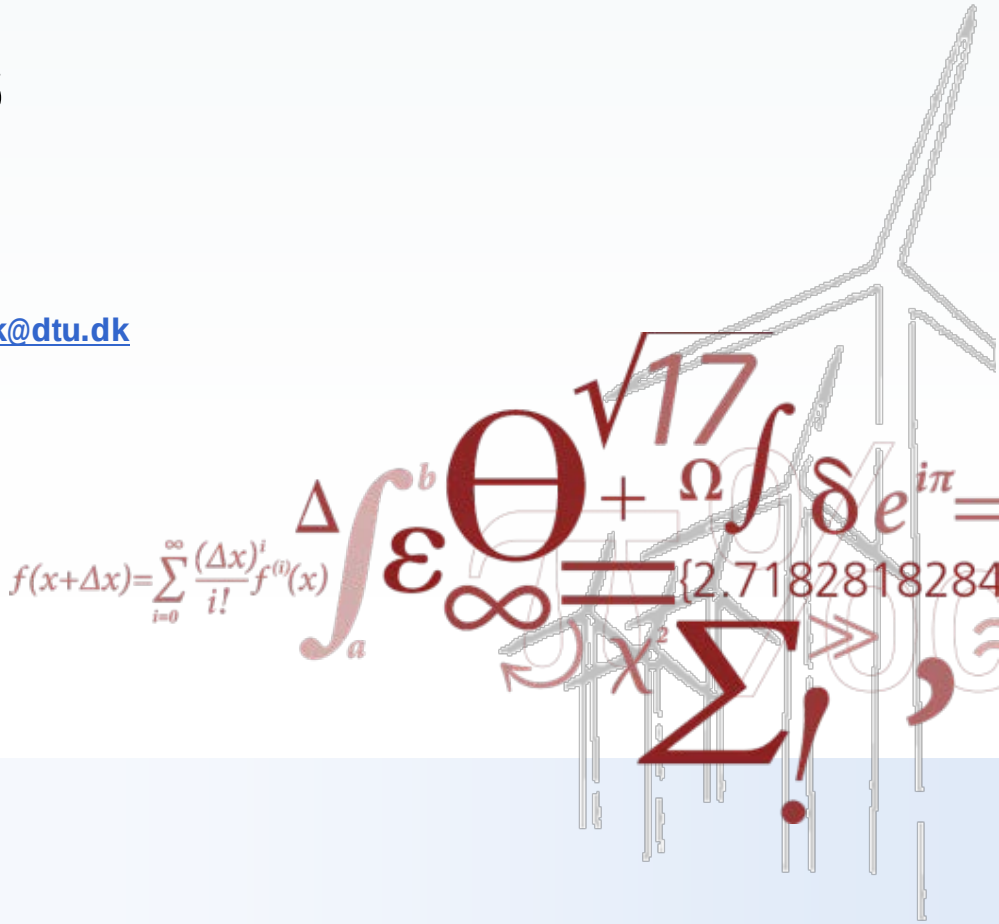
Publication date:
2014

Technical University of Denmark

Economic support mechanisms and design of markets

Klaus Skytte Klsk@dtu.dk
DTU Management Engineering
Energy Systems Analysis

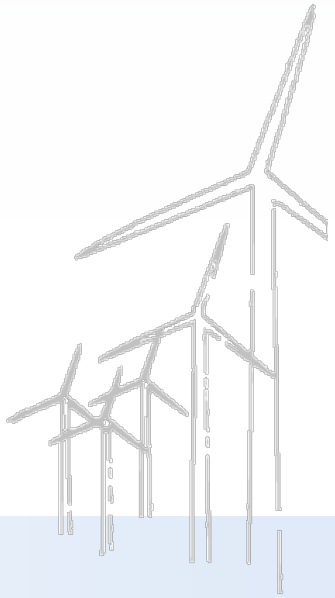
Sub-Programme on Economic and Social aspects of wind integration
26 September 2014



DTU Management Engineering
Department of Management Engineering

Agenda

- Research motivation
- Support mechanisms
- Market Design: Regulatory framework challenges
  - Research case 1:
    From passive to active dynamic generation / market actors
  - Research case 2:
    Regulating future offshore grids

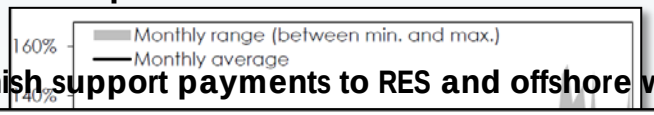


Research motivation

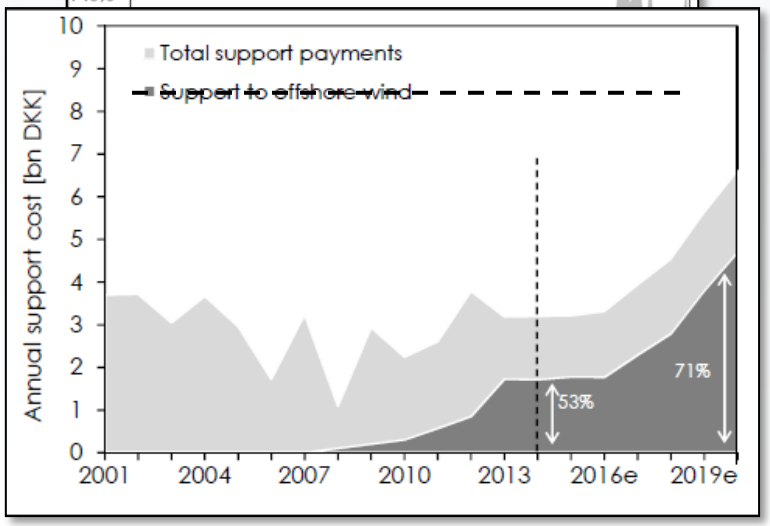
- The new electricity systems: From centralised and fossil-intensive systems to sustainable and integrated
- Increasing shares of renewable energies (RES)
- Total support costs expected to increase

⇒ *important that the right* ***support mechanisms*** *are used and the* ***support levels*** *are adequate*

Wind production share in DK-West



Danish support payments to RES and offshore wind

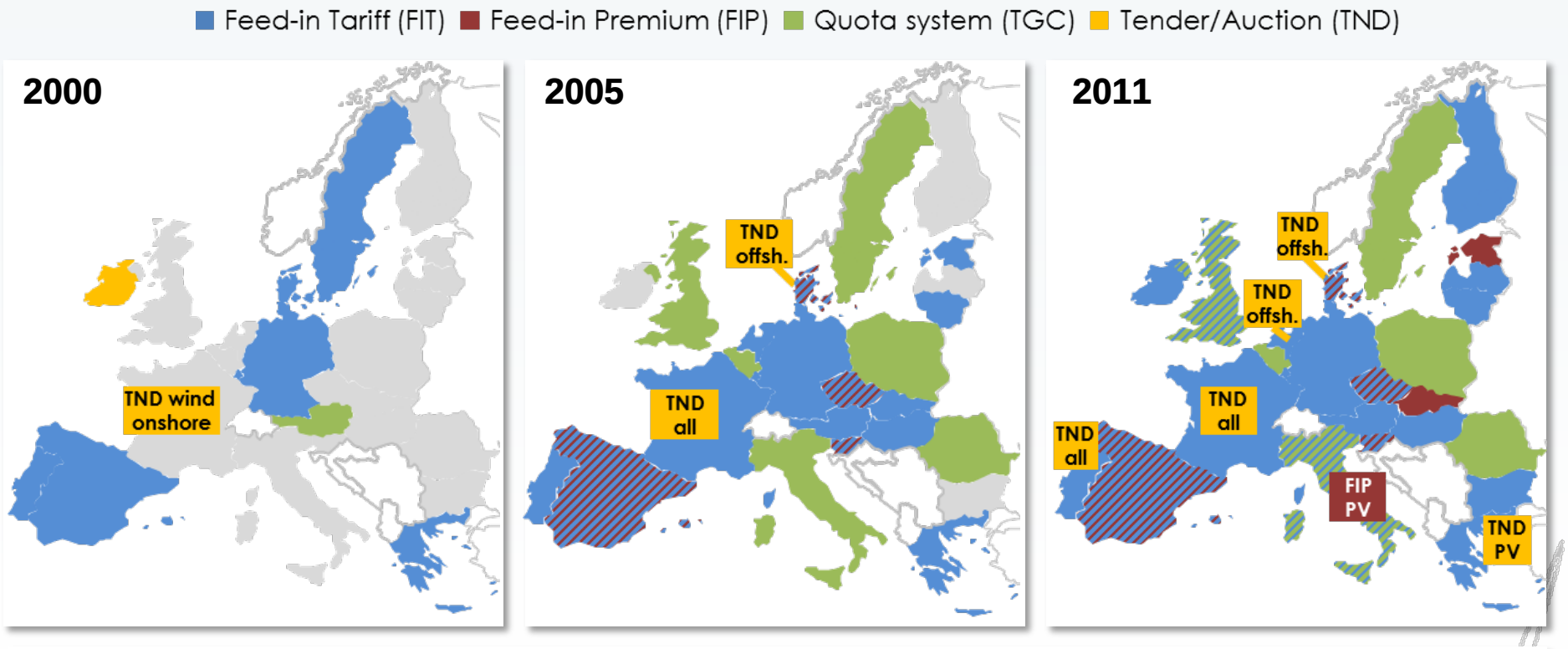


Wind power provided a world record 41.2% of Danish electricity consumption for first 6 months of 2014

- National support schemes are rapidly changing, with new instruments being introduced and existing instruments being adapted
- Trend to more ***market integration*** and need of more ***flexibility***

⇒ ***Research is needed for analysing the effects of different regulatory framework conditions, both qualitatively and quantitatively***

Development of support schemes in the EU-27



- **Feed-in Tariffs by far dominant (21 countries)**
- **Feed-in Premiums have recently surpassed quota systems**
- **Investment grants, tax breaks, financing support are used as supplementary support instruments in all countries**
- **Application of different instruments in parallel: From on average 1 in 2000 to 3 instruments in 2011 (Denmark uses 6 instruments – highest in EU)**

Regulatory framework challenges

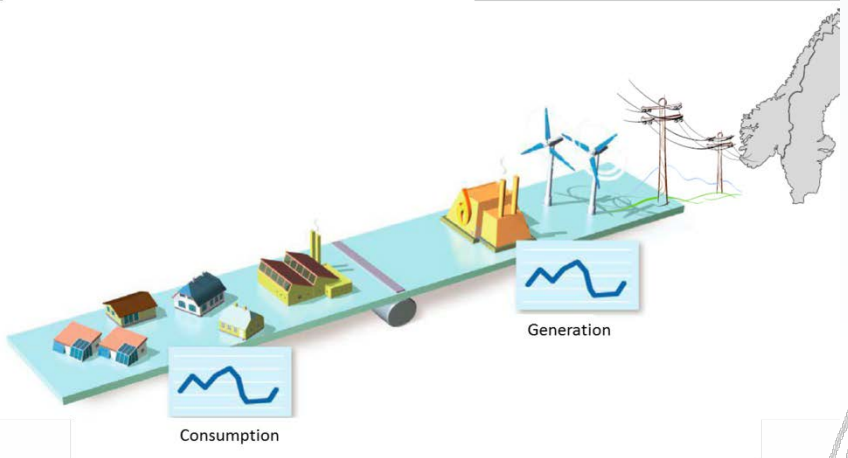
Market integration and flexibility

From passive to active dynamic generation / market actors

- Act to negative prices at the spot market (day-ahead)
  - Case: Change in market design from 2009: negative prices at NordPool
    - Close down of wind turbines in hours with neg prices = saved costs
- Active at the balancing markets

  Close down of wind = down regulation

☺ **Case Denmark**: New wind turbines gets a Feed In Premium in certain full load hours (depending on size). When down-regulation, the not "used" full load hour with support can be used later.



☹ **Case Denmark**: Some existing off-shore tenders have no incitements for WTs to be active in down-regulation.

☺ One (Anholt) doesn't receive FIT when negative prices.

Managing **Negative** Spot Prices

Case: Sund & Bælt wind farm – 16. March 2014

Elspot prices

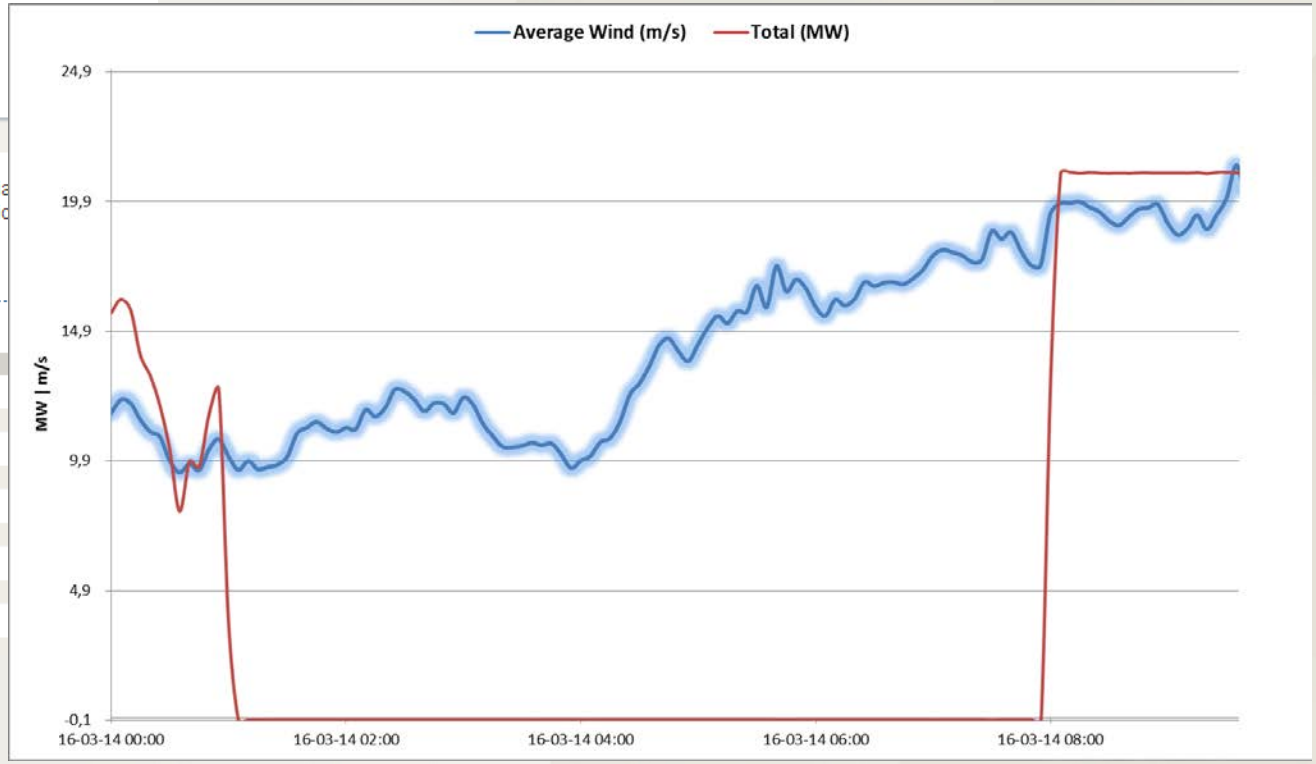
ALL SYS NO SE FI DK EE LT LV

- further details -

Please note that changes in the Norwegia
comparison between present and historic
the area change log pdf.

EUR/MWh

	DK1
16-03-2014	
00 - 01	-0,02
01 - 02	-25,08
02 - 03	-25,06
03 - 04	-60,26
04 - 05	-50,65
05 - 06	-50,12
06 - 07	-25,08
07 - 08	-25,00
08 - 09	0,05
09 - 10	10.77



NEAS ENERGY

Managing **Negative** balancing Prices

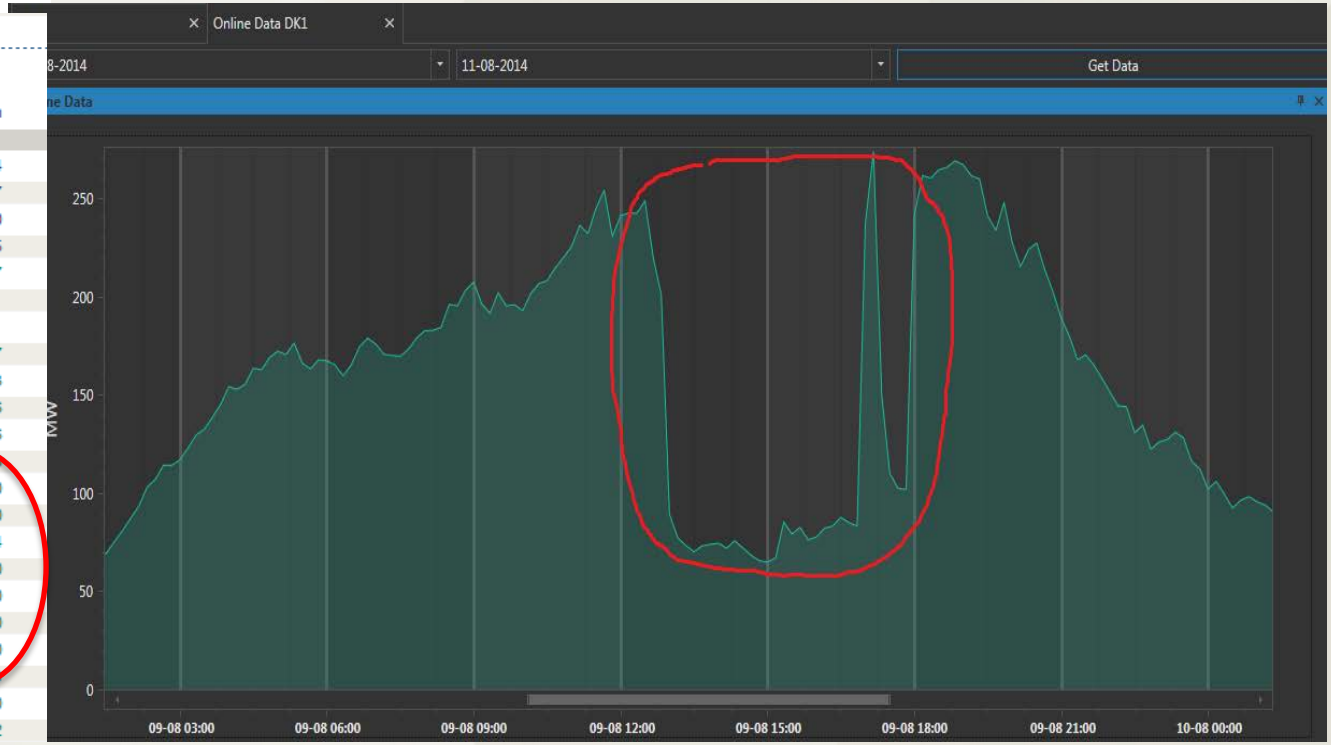
Case: Down ward regulation – 9 August 2014

Regulating prices

ALL NO SE FI DK

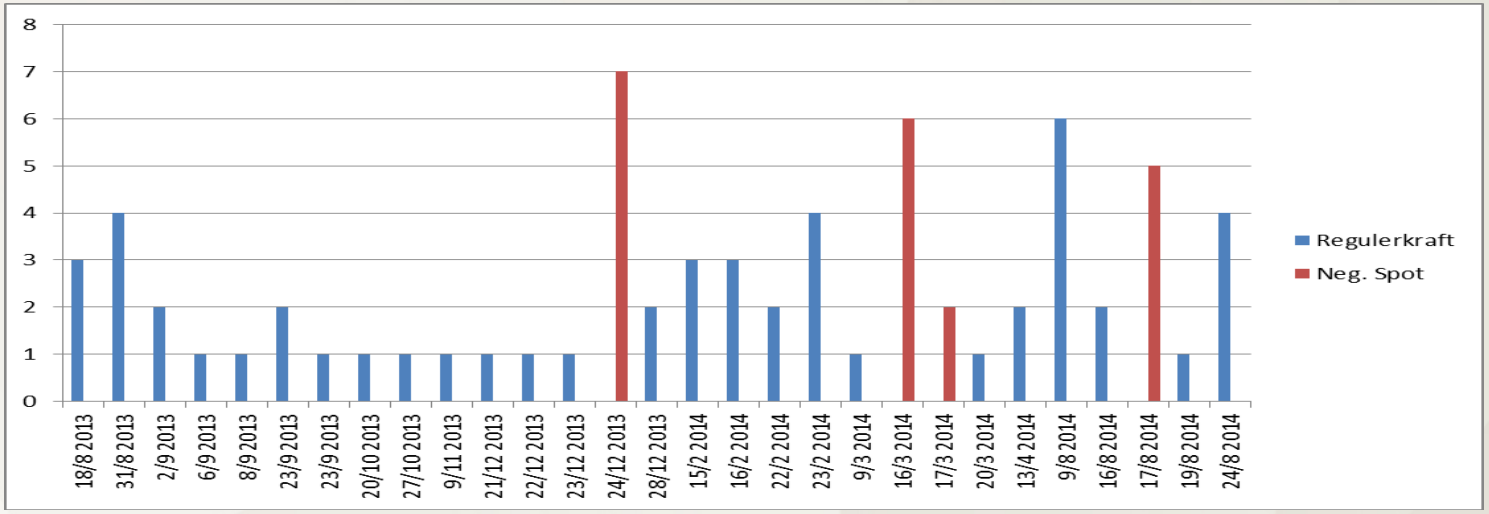
DKK/MWh

	DK1	
	Up	Down
09-08-2014		
00 - 01	248,34	247,34
01 - 02	213,27	213,27
02 - 03	200,90	200,90
03 - 04	196,95	196,95
04 - 05	188,60	138,07
05 - 06	183,38	124,71
06 - 07	179,65	124,71
07 - 08	194,04	138,07
08 - 09	200,15	151,43
09 - 10	204,25	178,16
10 - 11	207,91	178,16
11 - 12	207,31	178,16
12 - 13	200,68	-90,00
13 - 14	189,05	-90,00
14 - 15	186,06	-541,94
15 - 16	200,75	-90,00
16 - 17	200,82	-90,00
17 - 18	191,88	-90,00
18 - 19	225,42	-50,00
19 - 20	240,26	155,82
20 - 21	246,22	182,70
21 - 22	249,20	193,82



NEAS ENERGY

Last year with active participation of wind turbines in ancillary service



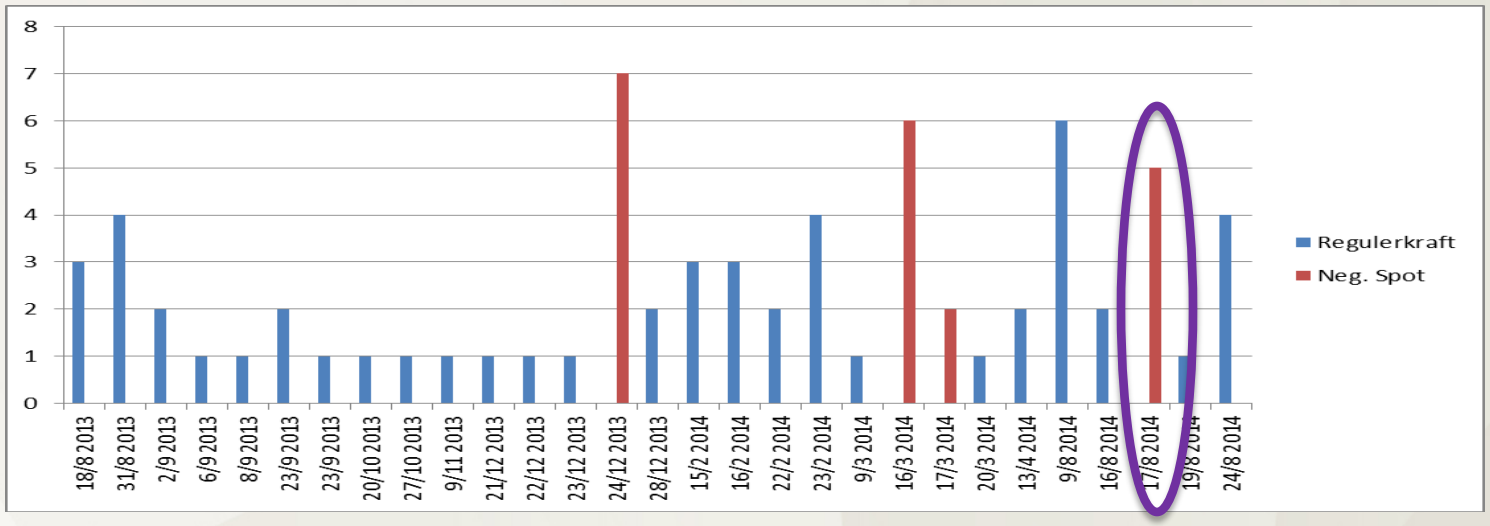
Activations where negative regulating prices are below -50 DKK/MWh.

- 25 times
- 51 hours

NEAS ENERGY

Last year with active participation of wind turbines in Day Ahead market.

Hours

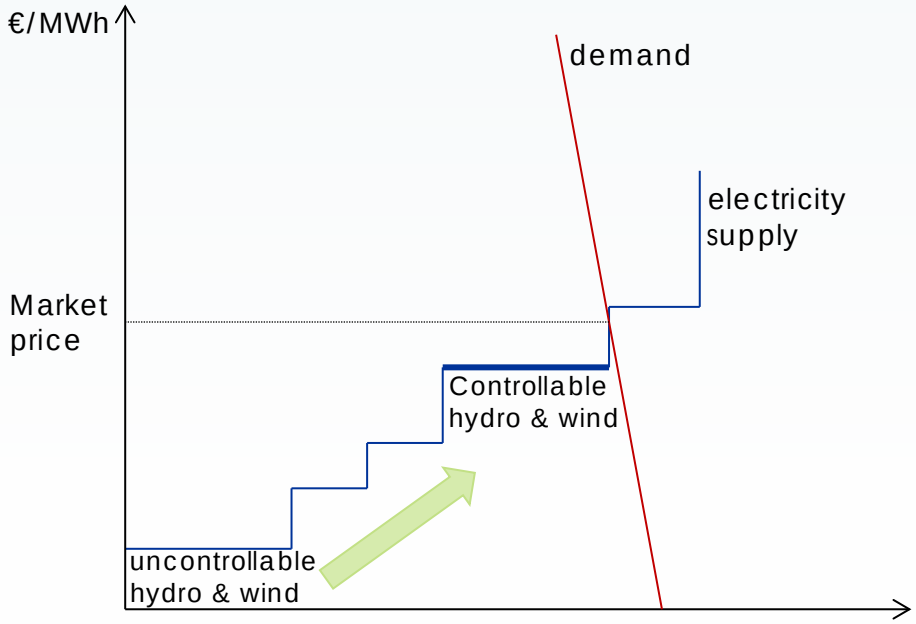


Protection against negative spot prices 17. august 2014.

- Day Ahead trading resulted in negative spot prices
  - Wind production was expected at high level
  - Wind production considerable lower than expected
  - Wind turbines were used actively and did not stop at all.

Wind value

- Similar to water, you can talk about a **wind value** when the generation becomes active at the market



- Goal to create adequate **regulatory framework conditions** and **market designs** that facilitate and stimulate active wind participation
  - Reach the highest wind value possible

Regulating future offshore grids

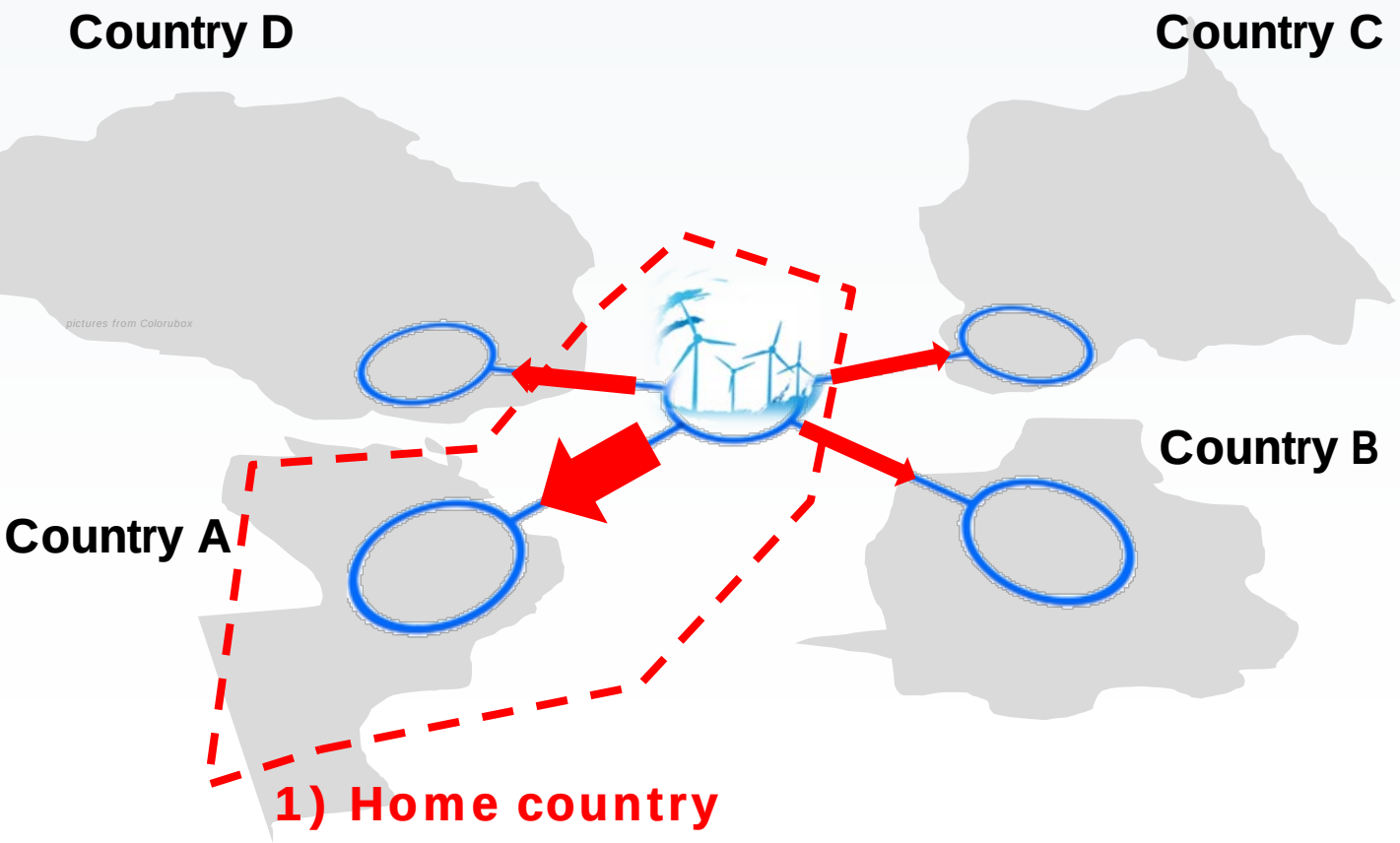
- Currently, offshore wind parks in Europe are single-country approaches
- Future meshed offshore grids will interconnect wind parks and countries
- Current research mostly from a macroscopic perspective

Research Question

How should production in offshore grids be regulated in terms of

- Market access
- Pricing rules
- Support scheme for RES

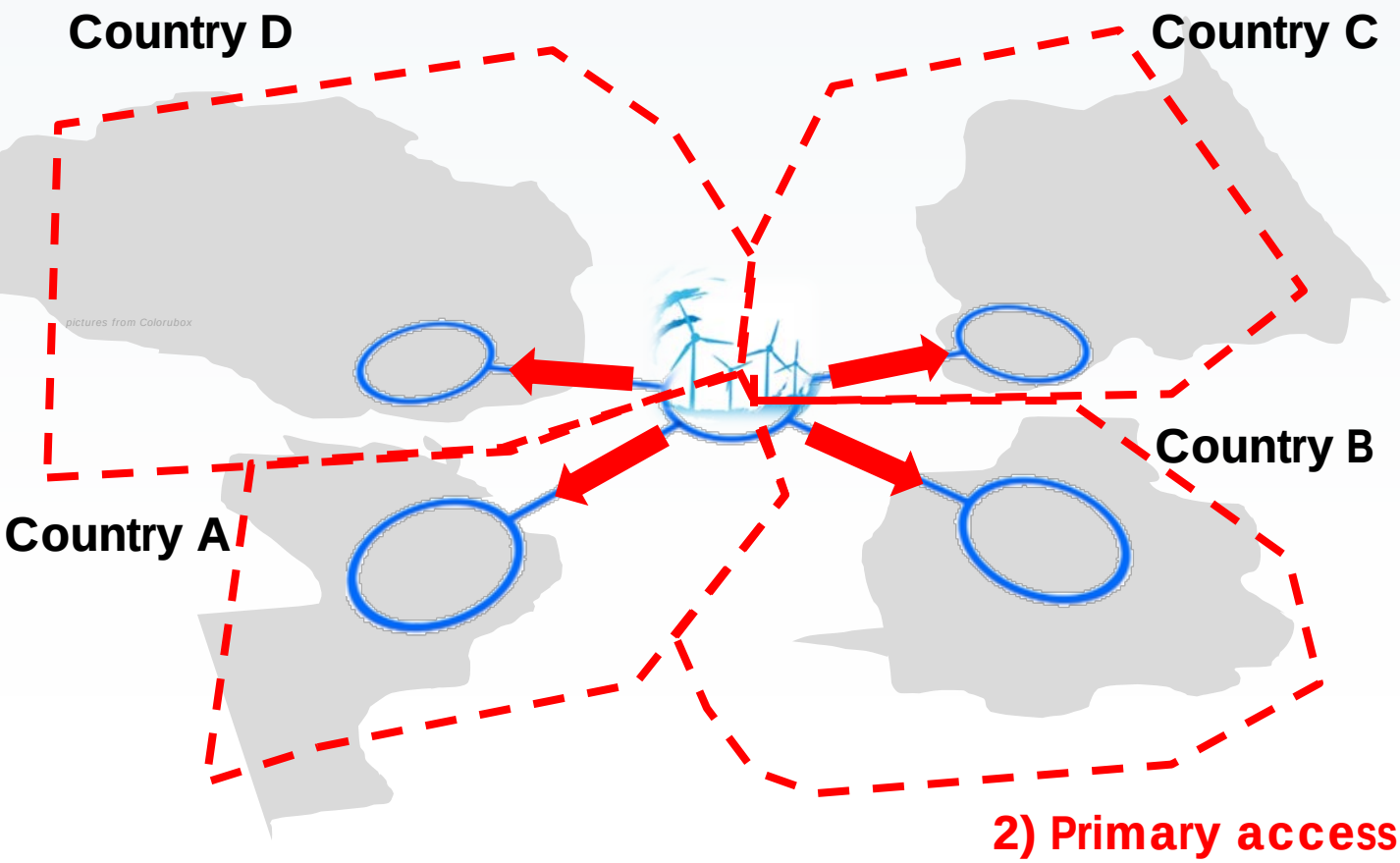
Market access & Pricing rules: Option 1



1) Home country

- Production mostly integrated into the home market
- Wind park can choose alternative marketing region if attractive
- RES support only in home country
- Limited cross-country cooperation
- Remaining inter-connector capacities dispatched by TSO

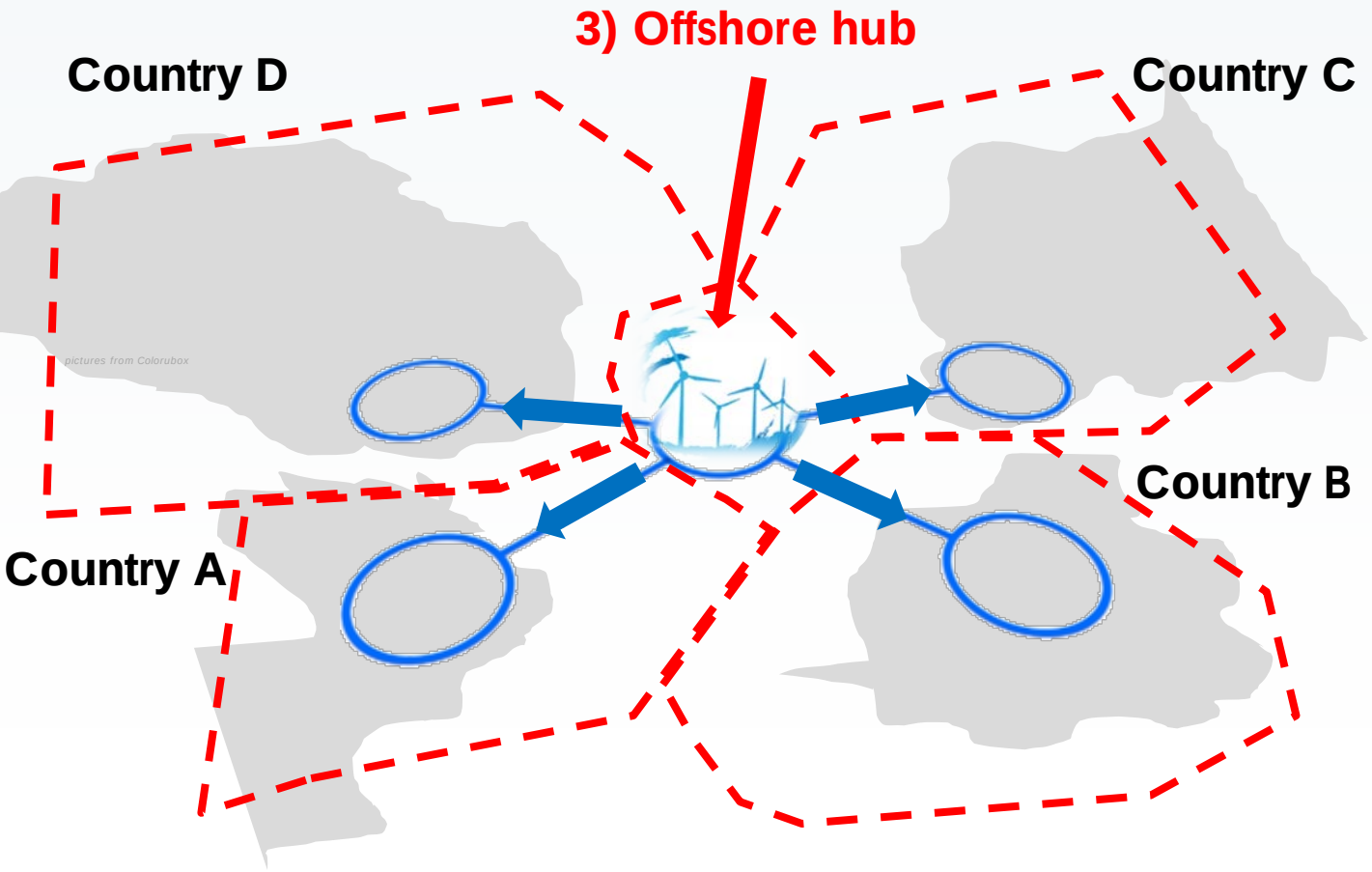
Market access & Pricing rules: Option 2



2) Primary access

- Production is integrated into the most attractive of the neighbouring countries
- Wind park can choose its marketing region
- RES support in all countries
- Remaining inter-connector capacities dispatched by TSO

Market access & Pricing rules: Option 3

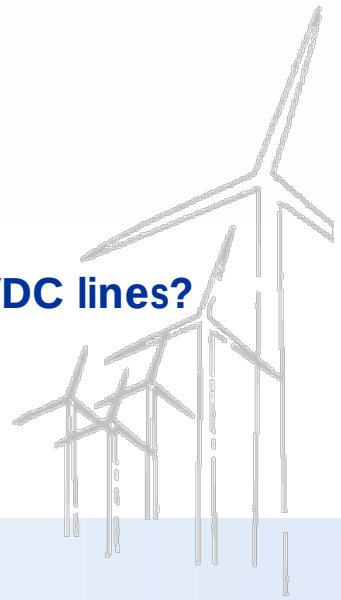


3) Offshore hub

- Production of wind park forms its own market area
- No market choice for the wind park
- Joint RES support for the new market area
- All interconnector capacities dispatched by TSO

Agenda

- Research motivation
- Support mechanisms
- Market Design: Regulatory framework challenges
  - Research case 1:
    From passive to active dynamic generation / market actors
    - Research question: **What contributes to the Wind Value?**
      » and how to maximise it?
  - Research case 2:
    Regulating future offshore grids
    - Research question: **Optimal conditions for Off-shore at HVDC lines?**



Thank you for your interest

Questions ?

email: klsk@dtu.dk