Regulating wind farms in future offshore grids

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Regulating wind farms in future offshore grids
Market and regulatory framework conditions

EERA.jp Wind sub-programme:
Economic and social aspects of wind integration

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Regulating future offshore grids

Currently, offshore wind parks in Europe are single-country approaches

Future **meshed** offshore grids will interconnect wind parks and countries

**Research Question**
How should production in offshore grids be regulated in terms of

- Market access
- Pricing rules
- Support scheme for RES
Agenda

Regulatory framework challenges

- Wind farms at meshed offshore grids
  - EU legislation, bidding zones, congestion and residual transmission capacity
  - Pricing rules?

- Main future challenges?
EU legislation

- **Priority Access** and **Priority Dispatch** for RES-E as per RES Directive (Directive 2009/28/E)

- **Congestion Management Guidelines** and **EU Target Model** as per the 3th Energy Package legislation
  - electricity should flow between price or bidding zones according to price differences.
  - cross-border flows should not be reduced to solve a country’s internal congestion.
Bidding zones

- **Home country / Fixed bidding zone**: Wind farm treated as any other trader in zone A
- **Primary access / Floating bidding zone**: May choose its bidding zone
- **Offshore hub / Own bidding zone**: Bidding zone separated from zone A and B
Home country / Fixed bidding zone

- "Domiciled" in bidding zone A - Treated as any other trader in zone A
- RES support only in home country
- Limited cross-country cooperation
- Residual inter-connector capacities dispatched by TSO
Fixed bidding zone and congestion

- Flow from A to B
- Flow from B to A
  
  Country A
  50 €/MWh

  Border
  800 MW

  Country B
  35 €/MWh

  200 MW
  200 MW

  Priority leads to reduction in day-ahead interconnection capacity = \textit{residual capacity} = 800 MW

  Congestion

  200 MW
  800 MW
  1000 MW
Pricing rules and congestion compensation

- Lower price in high price zone (±) Higher price in low price zone

- Only **residual** transmission capacity is dispatched
  - Compensation to low price country? Of 200 MW or ???
  - Always the lower price to the Wind park? The high price zone buys all capacity from low price zone?

- Who should pay? Subsidy to wind in order to displace conventional emitting power - not to increase export
Wind park’s viewpoint:

**Increased value of wind park.**

Higher income from choosing the highest price at any time.

2) Primary access

- Floating bidding zone
- Wind park can choose its bidding zone
- Production is integrated into the most attractive of the neighbouring countries
- RES support in all countries
- Residual interconnector 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
Discussion: future challenges

Regulatory re-thinking

- Wind farms at meshed offshore grids
  - Bidding zones, congestion and residual transmission capacity
  - Pricing rules? Support and burden sharing
  - Who should pay? Subsidy to wind in order to displace conventional emitting power - not to increase export

- Market Design:
  - From passive to active dynamic generation / market actors. Value of ancillary services
Thank you for your interest

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Questions?
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

Managing **Negative** balancing Prices

Case: Down ward regulation — 9 August 2014
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
Last year with active participation of wind turbines in Day Ahead market.

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 considerably lower than expected
  - Wind turbines were used actively and did not stop at all.