INTERMITTENT RENEWABLES, BALANCING POWER AND ELECTRICITY MARKET DESIGN (INTREPED)

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AGENDA

1. **Background: Some future challenges for the electricity market**
2. Overview of the project INTREPED
3. Congestion Management by Dispatch or Re-dispatch: Flexibility Costs and Market Power Effects

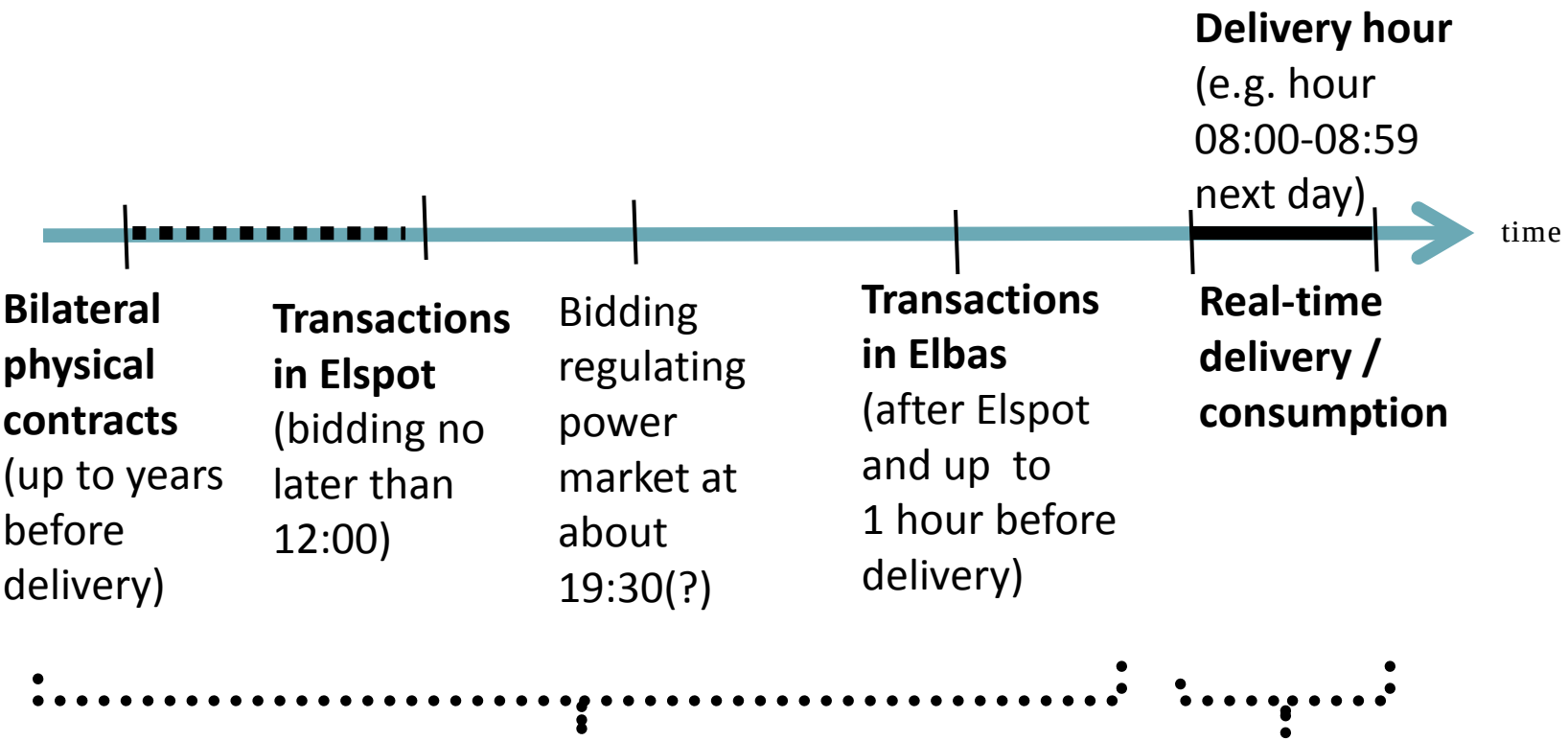
CHANGING CONDITIONS

- Higher shares of intermittent power
- More interconnected Nordic and European power markets
- Higher demand for balancing services
- Investment needs

→ A transition fram a situation of abundant balancing capacity, to a scenario of more scarcity due to higher demand for these services

→ Redesign of pricing mechanisms necessary to meet these challenges

TIMELINE SHORT-TERM DELIVERY MARKETS



CHANGING CONDITIONS

Does current market design give incentives

Short run

- to allocate **sufficient** capacity to balancing services?
- to allocate the **right** capacities to balancing versus planned production?
- to **mobilize flexibility** in consumption as well as in production?
- to **avoid imbalances**
- for **optimal cross-border trade**

Long run

- to optimal investment **levels** in production, demand appliances, network capacities
- to optimal **portfolios** of capacities

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CHALLENGES FOR MARKET DESIGN

INTREPED has a goal of contributing to a Nordic power market design:

- –that efficiently allocates and remunerates existing Norwegian power resources
- –that contributes to integrate and increase the utilization of new renewables in Europe and Norway
- –that give incentives for long-term investments in power generation, infrastructure and demand side measures that promote economic and environmental efficiency and security of supply

WORK PACKAGES INTREPED:

WP1 WIND POWER FUNDAMENTALS: PREDICTABILITY AND VARIABILITY

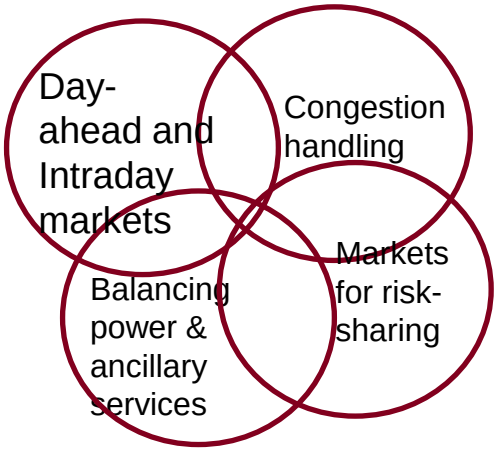
- Insight into wind power variation in time and space
- Implications for the need of balancing power
- Implications for market design

WP2 POWER SYSTEM FUNDAMENTALS: TIME EFFECTS, DYNAMICS, STOCHASTICS AND SECURITY OF SUPPLY

- Modeling dynamic and stochastic aspects of the power system to study market design – e.g. timing of markets, dynamic mechanisms, etc.

WP3 **MARKET DESIGN AND BALANCING SERVICES: AUCTIONS**

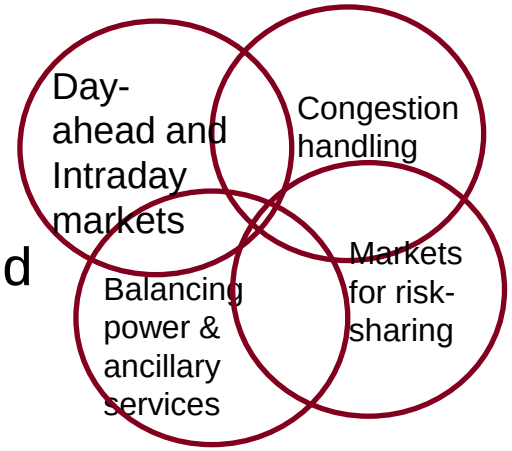
- How can the auctions for balancing power (e.g. regulating power) be designed to promote efficient **allocation** of capacity, efficient **investment signals**, and correct **remuneration** of the resources?



  - Using the right capacities the right places
  - Two-price structures?
  - Observing the interaction of day-ahead markets, intra-day markets, congestion management and balancing markets

WP4 **MARKET DESIGN AND BALANCING SERVICES: SPATIAL CONSIDERTIONS**

- Objective to analyze the **efficiency of alternative market mechanisms for congestion management and balancing services** in handling geographically dispersed intermittent power production.



  - Analyze different congestion management methods under different hydro power and wind scenarios
  - Analyze interaction of chosen methods for zonal and intra-zonal congestion handling

WP5 MARKET DESIGN AND BALANCING SERVICES: INTERCONNECTORS TO NON-NORDIC MARKETS

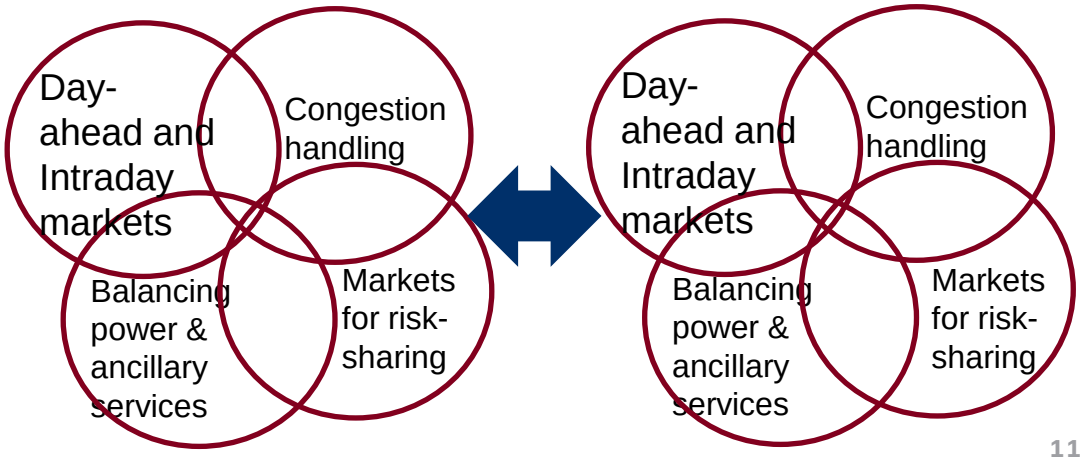
- How can efficient mechanisms/auctions for balancing services be implemented in the organization of a more integrated Nordic-European market?

CAPACITY ALLOCATION FOR POWER TRADE OVER INTERCONNECTORS:

- Day-ahead allocations: Implicit auctions in coupled day-ahead auctions

versus

- Capacity allocation / integrated auctions for balancing services supplied via interconnectors?



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CONGESTION AVOIDANCE AND CONGESTION ALLEVIATION

Spot market with congestion avoidance

e.g.
- Nodal pricing
- Zonal pricing
- (Uniform price)

Congestion allieviation

e.g.
- Counterpurchase
- Redispatch auction
- Use of reserves list

Reasons for inadequate congestion handling:

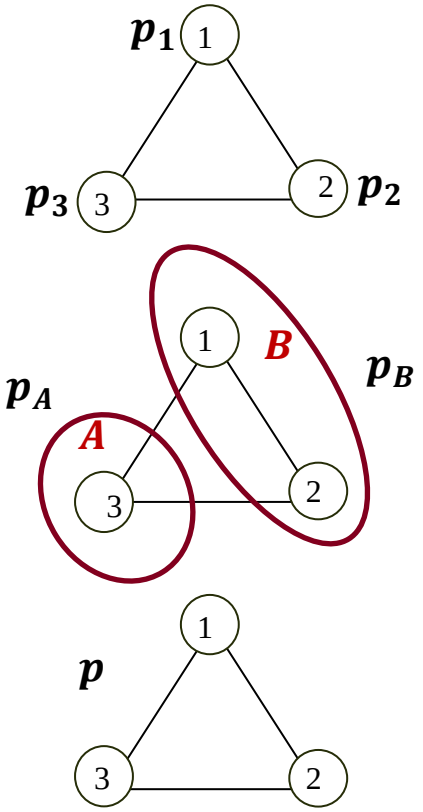
- Congestion within areas
- Power flows according to physical laws, «Loop-flow» not included in market clearing

SPOT MARKET: Congestion method

Nodal pricing
- Nodal differentiated prices
- Optimal and feasible flow

Zonal pricing
- Zonal differentiated prices
- Flow may not be feasible

Uniform pricing
- Uniform price
- Flow may not be feasible



Re-dispatch not needed

Re-dispatch necessary to achieve a feasible flow due to 'internal' congestion

Research questions (1)

Efficiency of congestion management methods (CMM):

- Implication of spot market CMM for re-dispatch needs
- Efficiency of re-dispatch methods (RDM)
- Overall efficiency of CMM and RDM

Efficiency Issues of Dispatch and Redispatch

Model:

- Spot market: nodal, uniform or zonal pricing
- Re-dispatch: locational merit order
- Network: 'DC' approximation

Some preliminary results:

- Dispatch + Redispatch optimal only under strict assumptions
- **Spot + re-dispatch model inefficient**
  - **if limited participation in re-dispatch**
  - **if extra costs of re-adjustment**
- Side effect: Flexible and expensive capacity used for handling congestion known 'long time' in advance

Research questions (2)

Market power

What are the implications of simplified congestion management methods (e.g. uniform or zonal pricing) on the ability to exercise market power?

Market power in Dispatch and Redispatch

- Often claimed: Non-segmented markets with uniform prices will restrict the ability to exercise market power
- We study market power in the nodal pricing market set-up, as well as in the combined set-up of a spot market and a re-dispatch market

Some preliminary results:

- **When the strategic player operates in two markets (dispatch and redispatch) the consequences of market power can be even more severe and difficult to detect**

THANK YOU FOR YOUR ATTENTION!