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BEMIP OFFSHORE WIND STUDY
OPPORTUNITIES FOR OFFSHORE WIND IN THE BALTIC SEA

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The Baltic Wind Energy Cooperation study assesses the **potential** and **barriers** for offshore wind in the Baltic Sea

Study supporting the creation of an
initiative to support the development of offshore wind power
under BEMIP*

Main tasks:

- **Gather information** on framework conditions for offshore wind
  - Assess **offshore wind potential** and identify locations in the Baltic Sea Region,
  - Model the impact on **markets** and **grid congestions**
  - Assess **opportunities** for and **barriers to coordinated development** of offshore wind in the BSR
- Propose a **Roadmap** for the implementation of a coordinated offshore wind strategy in the region

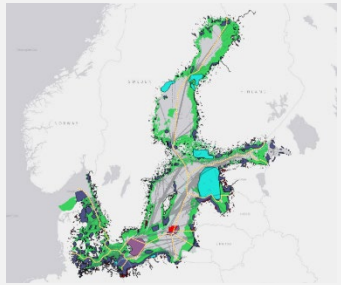
** The project is a response to the inclusion of renewable energy within BEMIP as a new working area, and to the Working Group on renewable energy's mandate to the European Commission to launch a study that will establish the basis for future cooperation.*

Clear benefits of regional coordination of offshore wind power development in the Baltic Sea Region

- Baltic offshore wind power could be a cost-effective alternative of renewable generation
  - Grid parity reached in some areas already by 2030
  - Levelized costs fall and the market value increases due to, inter alia, increasing EUA prices
- Efficient deployment requires regional cooperation and coordination
  - Effort sharing policies would more efficiently realise the offshore wind power potential of the region as a whole
  - Offshore wind power and network investment planning should be considered together
  - Efficient integration of offshore wind in the Baltic Sea Area requires careful consideration and coordination of interconnectors as well as internal grid development
- A number of administrative and regulatory barriers need to be addressed

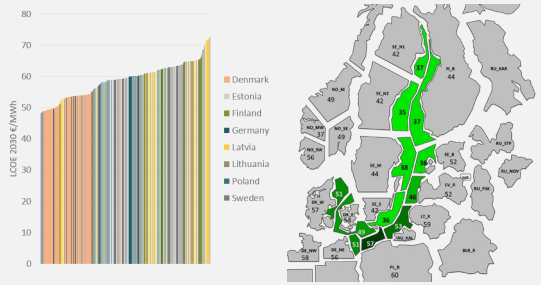
Based on the identified potentials and costs, we evaluate the role and value of Baltic offshore wind power in the European power market, and its impact on onshore grids

Resource and potential



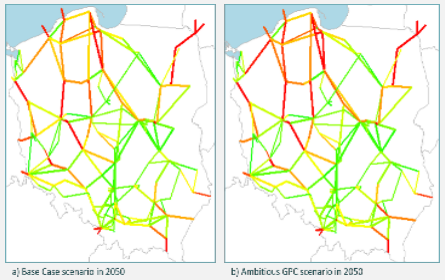
- Potential capacity
  - 93,5 GW, 325 TWh
- Cost estimation

Market model



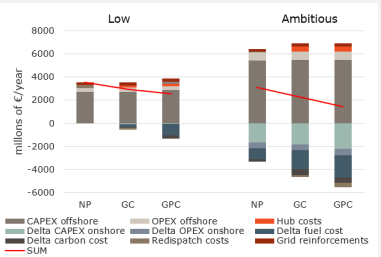
- Offshore wind deployment scenarios
- Energy market model

Grid model



- Cost of internal congestions / reinforcements driven by offshore wind

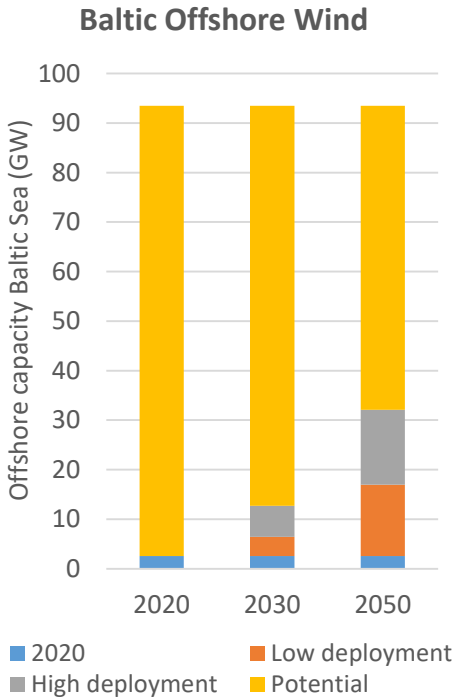
CBA



- Cost benefit analysis

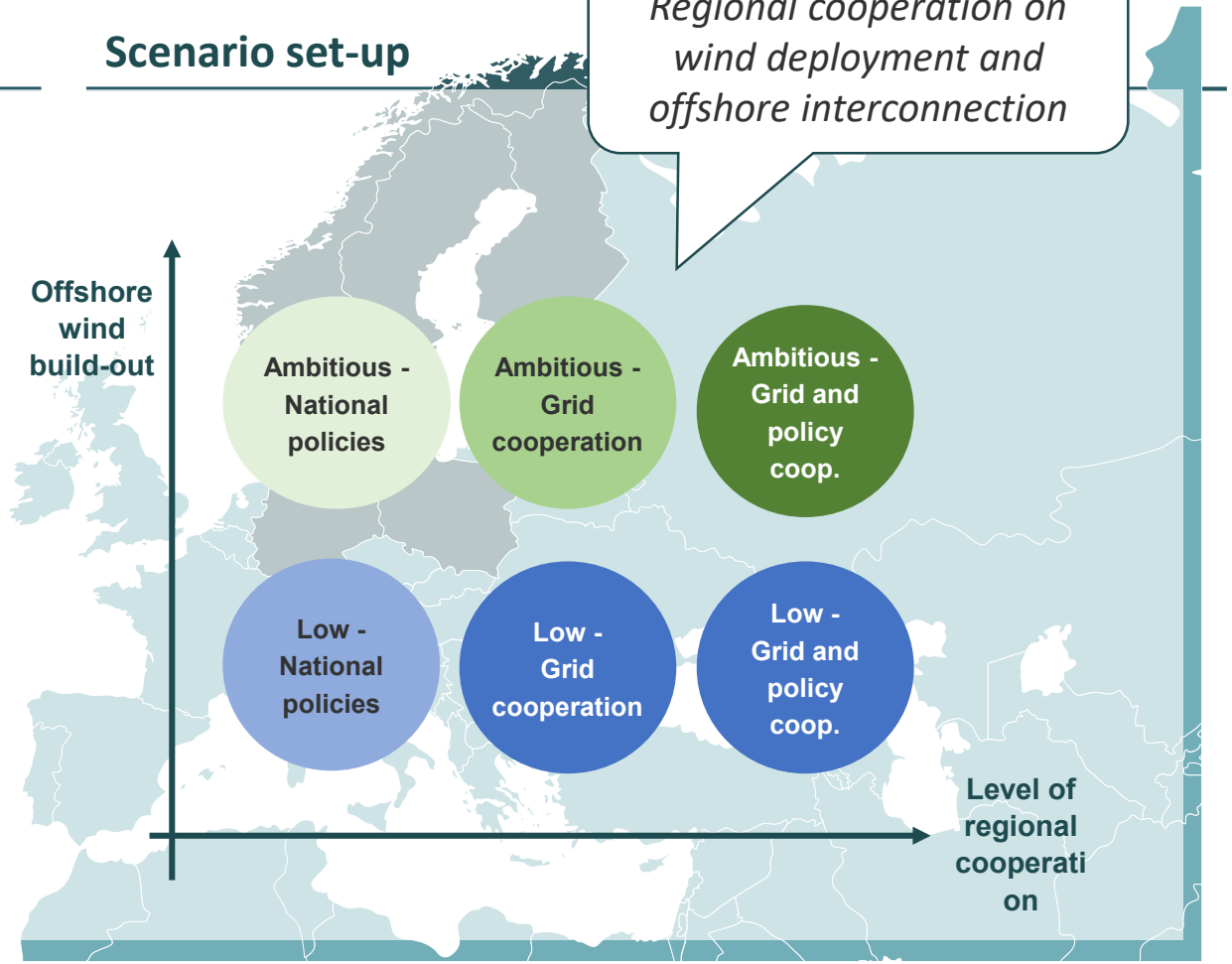
Modelling based on different scenarios for offshore wind power ambitions and levels of regional cooperation

Only a third of total potential deployed even in the ambitious scenario



Scenario set-up

Regional cooperation on wind deployment and offshore interconnection



Grid Cooperation scenario considers cooperation on **regional hubs**. Grids and **Policy Coordination** replaces national targets with **regional targets**.

Different levels of cooperation

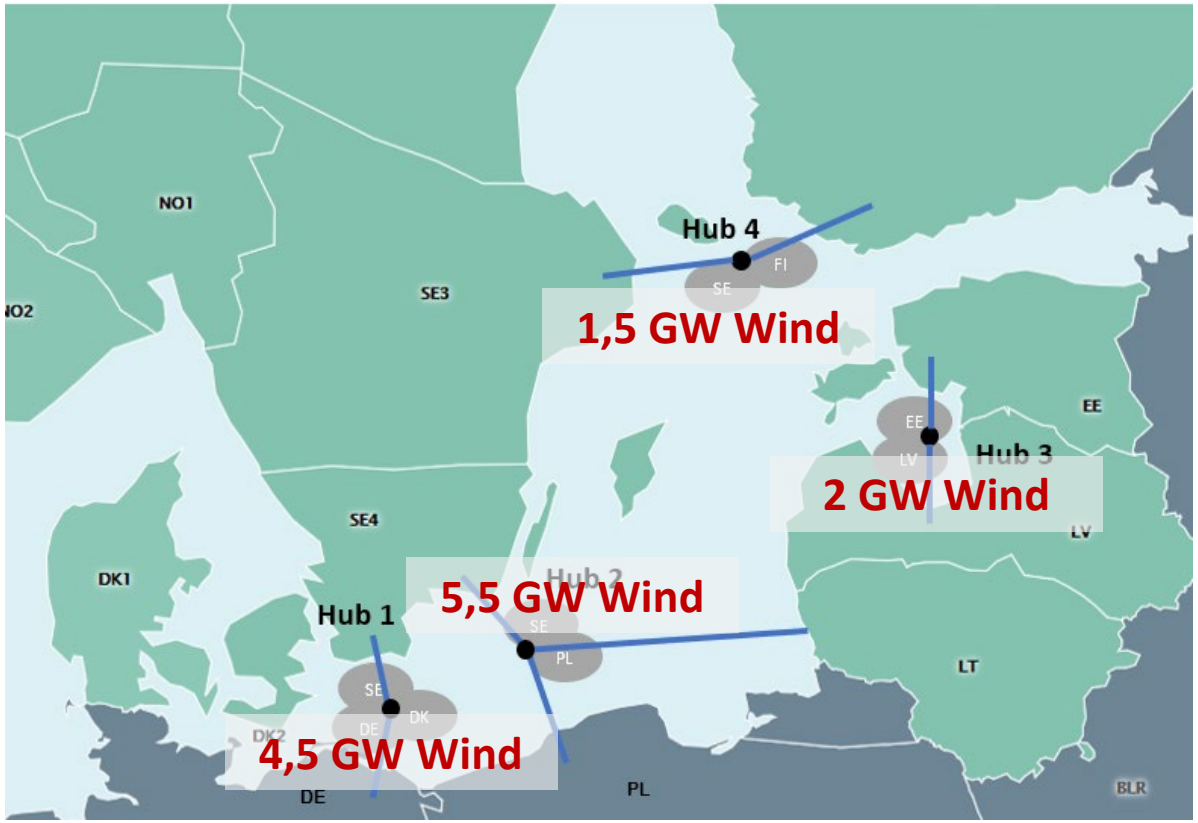
1. Grid cooperation (GC)

- **Cooperation on 4 offshore hubs**
- Remaining offshore wind power deployed according to national policies

2. Grid and policy cooperation (GPC)

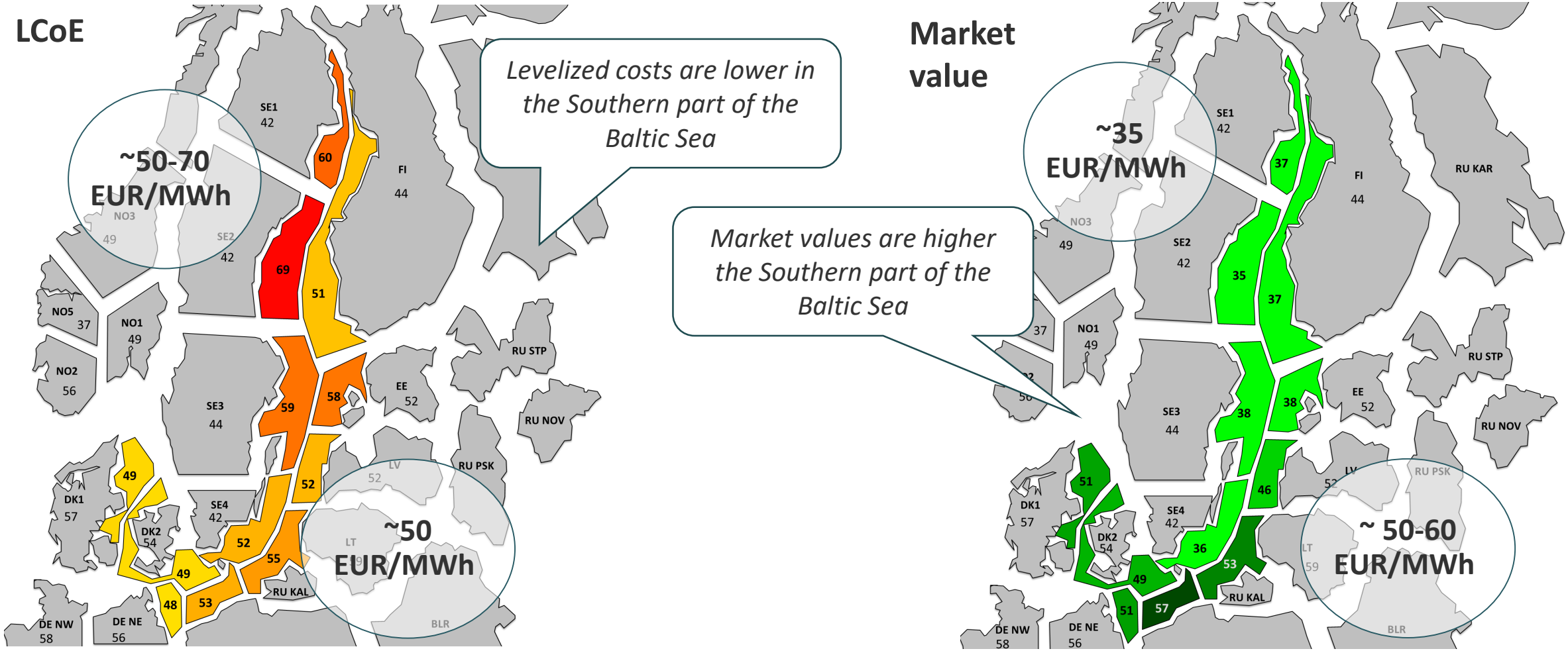
- Cooperation on 4 offshore hubs
- **Regional mechanisms to choose best sites for deployment** of offshore wind power across the entire Baltic Sea

Four hubs considered in the study



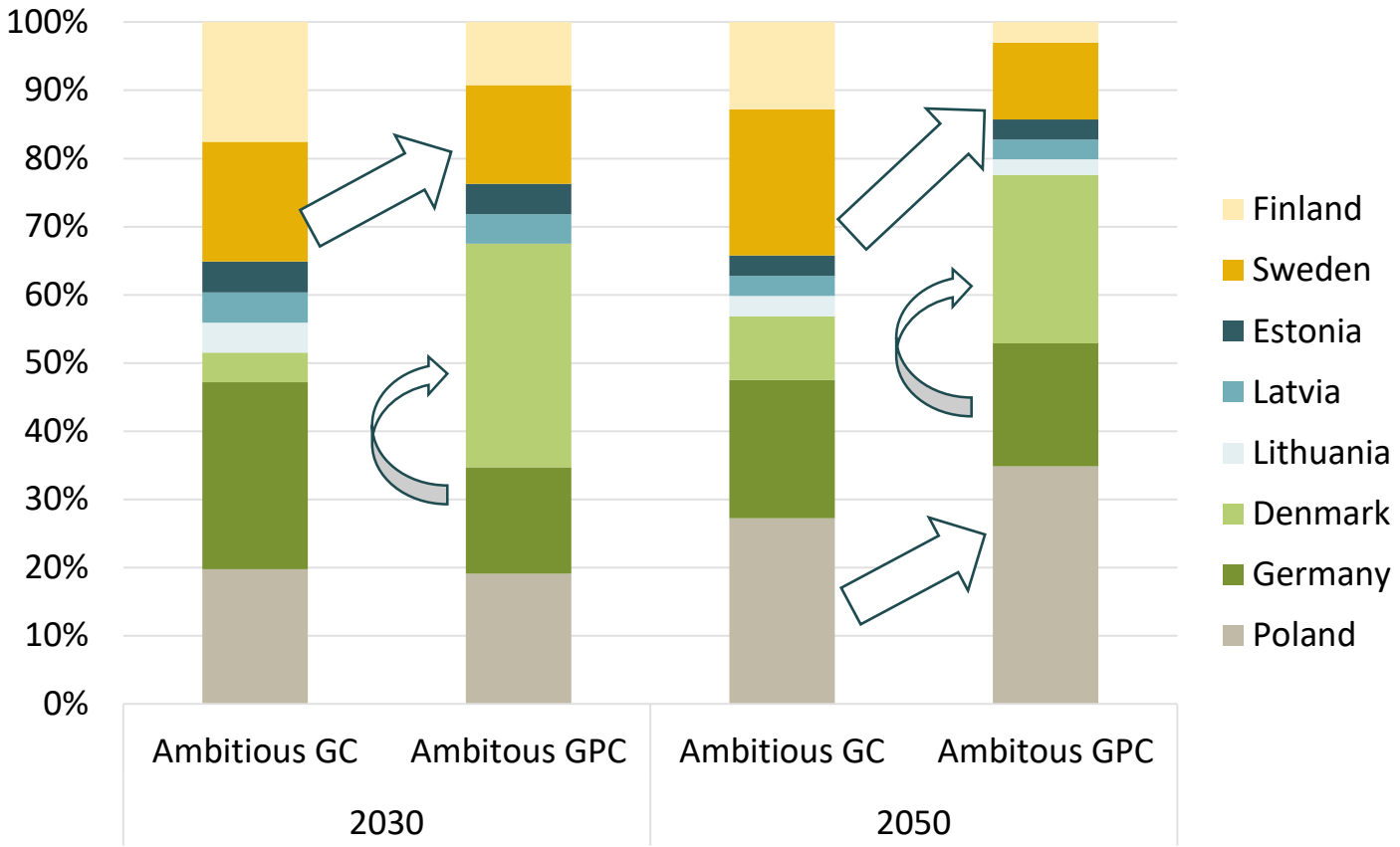
Benefits of regional deployment driven by differences in LCoE and market values

*Results for **2030**, national policies, low deployment scenario*



Significant shifts in deployment with cost-efficient cooperation in the Baltic Sea region

RELATIVE SHARES OF CAPACITY BETWEEN THE AMBITIOUS SCENARIOS



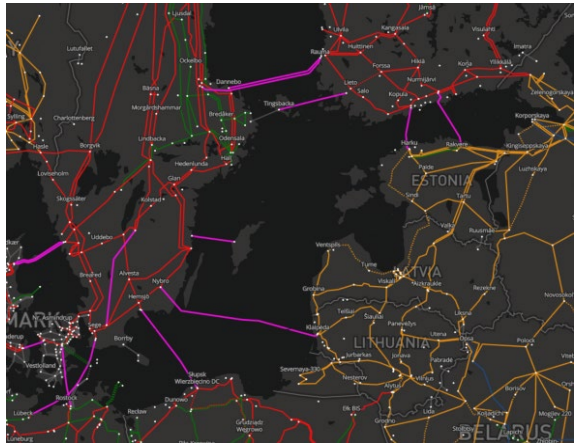
CHANGES IN ALLOCATION

- Same allocation in National Policies (NP) and Grid Cooperation (GC)
- Lower relative share in the Northern countries (Finland, Sweden)
- Also some shift between Germany and Denmark due to good conditions in Denmark
- Relatively more wind in Poland, especially towards 2050

Transition implies significant investments in onshore grids
Offshore wind alters optimal grid investments – coordination is key

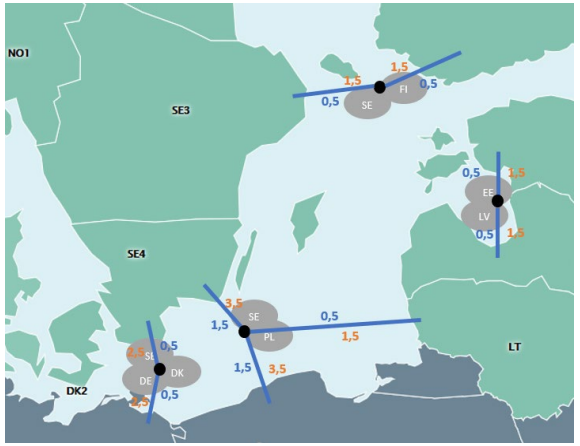
Detailed Grid Model of all BEMIP countries

- Detailed grid modelling of all BEMIP countries solved using a linearized power flow.
- Assessing the same offshore wind connections as in rest of modelling.



Modelling simple and advanced offshore connections

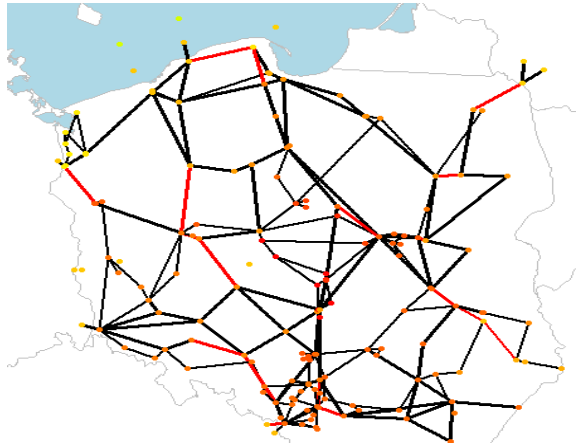
- Aligned assumptions with the power modelling results
- Modelling of advanced connection options developed in collaboration with EA.



Detecting congestions due to offshore wind deployment

Identify, for all scenarios, a list of:

- Areas with congestion
- Congested lines
- Cost estimates for upgrades
- Critical offshore projects driving congestions

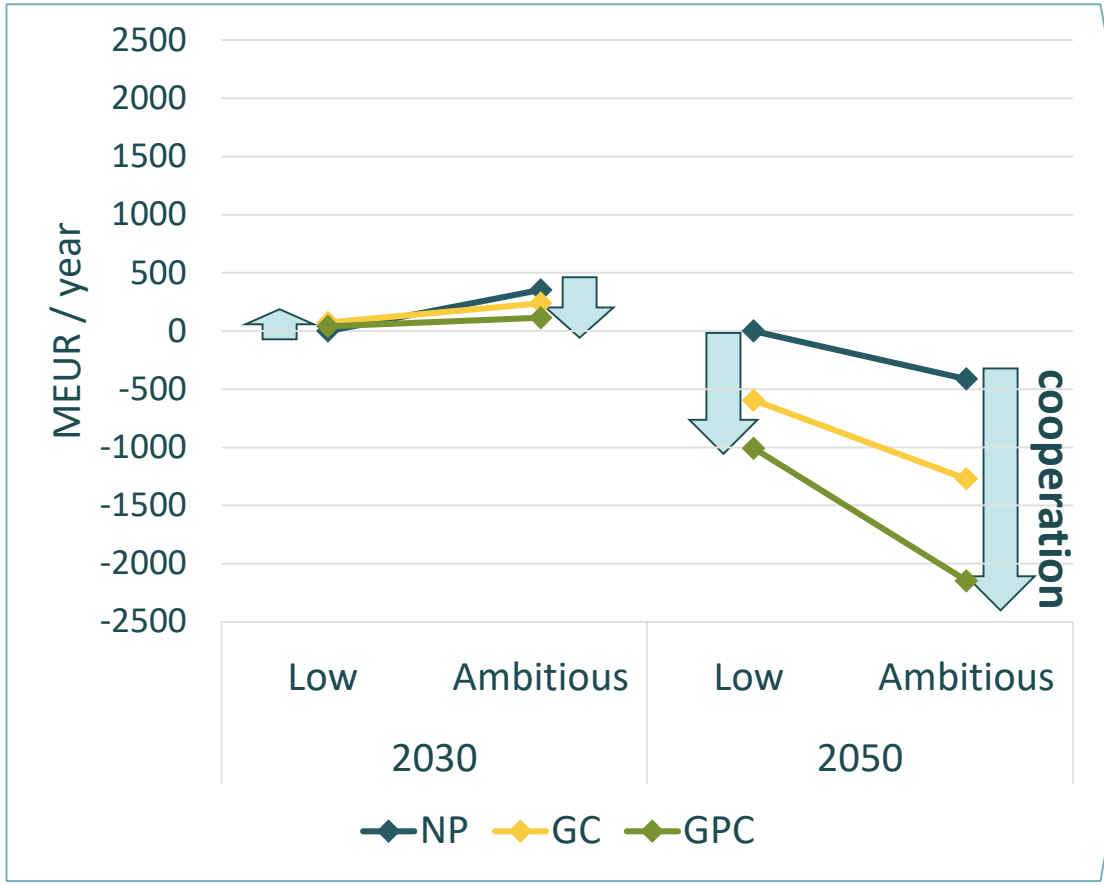


Cost Benefit Analysis

- Report detailing the cost and benefit elements of the possible grid investments

Clear scope for *increased* offshore wind power ambitions through cooperation

Total annualised costs compared to Low NP scenario



Efficiency gains from ambition and cooperation

- Clear reduction in **offshore deployment costs** through cooperation already in 2030
- Clear reduction **total system costs** in the long term
  - Offshore wind competitive
  - Market effects increase the efficiency of renewable energy utilization in general
- **Highest total benefits** realized in the **ambitious** scenario with **cooperation** on grid *and* policies
- Possible additional returns to optimized hub configurations

Barriers in national frameworks for offshore wind distort investment decisions – efficient regional deployment requires development of more common approaches

Licencing procedures and data quality	Substantial variations in licencing procedures among the BEMIP countries Substantial variations in access to and quality of necessary data Complicated and unclear licencing procedures for multinational projects
Maritime spatial planning	National frameworks for MSP vary – but more convergence is expected
Grid connection regimes	Approach to and principles for grid connection charges for offshore wind power vary
National policy mechanisms	National policy mechanisms not always *open to* offshore wind power *Multinational projects* are often effectively excluded

And regional cooperative mechanisms need to be developed

Clear long-term vision	A clear common vision of the role for offshore wind power in the Baltic Sea area is a necessary basis for the development of cooperative solutions Policy uncertainty prevents beneficial investments
Common tendering	Common tendering to ascertain efficient deployment of resources from a regional point of view
Maritime spatial planning	Formal cooperation on regional spatial planning in the Baltic Sea area
Allocation of costs and benefits	Mechanisms for allocation of costs and benefits necessary to incentivize all members to take part in the common realisation of the vision benefiting the entire region
Regulatory framework for hubs	Advanced hubs fall under different regulations as interconnector and cross-border RES projects and are subject to regulations on the national as well as the EU level

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