The Baltic InteGrid case studies on meshed grids in the South Baltic: Messages for policy and grid developers

Mariusz Wójcik, FNEZ
BIG influence – convince who, how and when?

- Politicians
- Authorities
- TSOs
- Market
- Conditions
- WPP investors

Environmental goals...

Flexibility, balance, secure supply

Baltic Offshore Grid

BIG – Case Studies

February 27th, 2019 Berlin
GOALS:

- Compare an integrated and radial approach for planned OWFs and interconnectors
- Provide potential technical designs with general costs for different alternatives
- Facilitate flexible development of the transmission grid
- Provide general spatial alternatives
- Provide comparison of costs and benefits of different approaches

NOT THE PURPOSE:

- Provide final solutions – those will have to be subject of a full feasibility study and design process
- Provide prognosis for offshore wind development in the region – the PreFeasibility Studies rather focus on how to connect project already in the pipeline.
- Propose final corridors and layouts – these are also subject to detailed analysis.
PFS Methodology

Step 1: Analysis of existing and planned OWF projects and infrastructure

Step 2: Scenario development

Step 3: Technical design

Step 4: Spatial analysis

Step 5: Environmental analysis

Step 6: Cost-benefit analysis

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Outline

- Scenario based analysis
- 6 scenarios per Case Study
- Timeframe 2025 – 2045
- Snapshots with 5 year steps
- Each scenario analysed and compared
- Extremes represented (zero/max integration)
**Scenarios**

**Integration level**

- **Zero Integration**
- **Partial Integration**
- **Max. Integration**

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**Zero integration**

- OWP
- Converter

**Max integration**

- OWP
- Converter

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2045 visions

POLAND – SWEDEN – LITHUANIA

High OWP – 2045

11.2 GW

Low OWP – 2045

5.7 GW

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2045 visions

GERMANY – SWEDEN – (DENMARK)

High OWP – 2045

1,9 GW

Low OWP – 2045

3,7 GW

Commissioning year

<table>
<thead>
<tr>
<th>Year</th>
<th>Color</th>
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<tbody>
<tr>
<td>2025</td>
<td>purple</td>
</tr>
<tr>
<td>2030</td>
<td>blue</td>
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<tr>
<td>2035</td>
<td>green</td>
</tr>
<tr>
<td>2040</td>
<td>orange</td>
</tr>
</tbody>
</table>

948 MW

928 MW

1740 MW

1132 MW

864 MW

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Spatial analysis
• CBA analysis based on the ENTSO-E methodology
Most favorable scenario:

<table>
<thead>
<tr>
<th>High OWP</th>
<th>Case Study 1 (SE/PO/LT)</th>
<th>Case Study 2 (DE/SE/DK)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Partial Integration</td>
<td>Maximum Integration</td>
</tr>
<tr>
<td>Low OWP</td>
<td>Maximum Integration</td>
<td>Zero Integration</td>
</tr>
</tbody>
</table>
How could it look like?

Case Study 1

(High OWP – partial integration scenario)
0,7 GW

Commissioning year
- 2025
- 2030
- 2035
- 2040
- 2045

Connection technology
- HVDC cables
- HVAC cables
- Onshore connection point
- Converter station

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2,2 GW

2030

Commissioning year:
- 2025
- 2030
- 2035
- 2040
- 2045

Connection technology:
- HVDC cables
- HVAC cables
- Onshore connection point
- Converter station

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2035

Commissioning year

2040

2045

2030

2025

Connection
technology

HVDC cables

HVAC cables

Onshore
collection
point

Converter
station

OCP Słupsk

Wierzbięçino

OCP Klaipeda

OCP Hemsjö

OCP Hybro

2045

11,2 GW

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OCP Sventoji

OCP Klaipeda

LITHUANIA

LATVIA

SWEDEN

DENMARK

POLAND

RUSSIA
How could it look like?

Case Study 2

(High OWP – maximum integration scenario)
Analysis did not include tender results from Germany

OWFs will look differently after tender but it should not affect the results
1. A higher degree of integration for scenarios with high offshore wind capacity (higher benefits over system costs)

2. CBA has to be performed on a case-by-case basis

3. A higher level of integration supports additional non-monetarized benefits (e.g. security of supply)

4. Technology is there!

5. More coordination is required in the meshed grid

6. Meshed grid is 3–6 times less cables
• High potential for a meshed grid between Poland–Sweden–Lithuania and Germany–Sweden – proven by CBA analysis

• TYNDP will play a crucial role in coordination! Revision of the scenarios is needed

• Review planned interconnectors after 2030 for potential integration with OWFs (e.g. Hansa Power Bridge 2, DKE–PL1, Fenno–Skan1 renewal, DKE–DE (Kontek2) – examples exist („New Great Britain –Netherlands interconnection”)

• Communication platform between investors, TSOs and politicians → Baltic Offshore Grid Forum

• Meshed grid supports better use of sea space and landfall
For further information:

Mail: info@baltic-integrid.eu
Web: www.baltic-integrid.eu

**Baltic InteGrid represented by the Lead Partner:**

**Institute for Climate Protection, Energy and Mobility (IKEM)**

Magazinstraße 15–16, 10179 Berlin, Germany
Phone: +49 (0) 30 408187015
Mail: info@ikem.de
Web: www.ikem-online.de

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**Mariusz Wójcik | Project Manager**
ul. Bukowińska 24a/14
02–703 Warszawa, Poland
Phone: +48 (22) 412 24 92
Mail: mw@fnez.pl
Web: www.fnez.pl

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Additional slides
### Opportunities

- **High OWF potential and rapid development** (9 GW by 2030 and 35 GW by 2050)
- **OWE supported by** EU CO2 targets, increasing costs of CO2 emission allowances, new RES goals, decreasing technology costs and high industrial potential
- **Projects at early stage of development** (changes still possible)
- **Planned OWF projects at South Middle** (Polish and Swedish)
- **Harmony link** – can pave the way for new interconnector
- Potential for projects between Germany and Sweden.
- **Use of hydropower potential** in Nordic countries
- **Financing opportunities** through Connecting Europe Facility

### Threats

- **If no coordinative action taken:**
  - inefficient wind farm cluster designs, resulting in higher costs for the end-consumer and potential spatial conflicts.
  - locking-in to solutions that rule out integration of OWFs in the future = miss out on the cost reduction opportunities and/or reduce the potential of OWE in the region.
- New project development takes 10 years for a new cable – early discussions with investors needed
- Lack of coordination and not aligned interests between Member States