Interconnected Offshore Grid: Barriers & Solutions

Minutes of the Stakeholder Workshop

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Stakeholder Workshop – Interconnected Offshore Grid: Barriers & Solutions

Stakeholder Participants

- Ana Aguado Cornage; Friends of the Supergrid
- Andreas Wagner; Stiftung Offshore Windenergie
- Claudia Grotz; Siemens AG
- Manfred Dittmer; DONG Energy
- Markus Rieck; Alstom
- Marta Mituta, Federal Network Agency
- Paul Wilczek, European Wind Energy Association (EWEA)
- Philipp Härtel; Fraunhofer IWES
- Sascha Schröder; EWE Netz
- Stephanie Bätjer; Renewables-Grid Initiative
- Urs Wahl; Offshore-Wind-Industrie-Allianz (OWIA)
- Wilfried Breuer; TenneT Offshore
- Wilfried Hube; Offshore Wind Farm Riffgat – EWE

Project Partners

- Dr. Fabio Genoese; CEPS
- Paul Kreutzkamp, 3E
- Dr. Ioannis Konstantelos; Imperial College Consultants
- Jaap Jansen; ECN
- Muhammad Jafar; DNV GL
- Anna-Kathrin Wallasch, Deutsche WindGuard
- Gerhard Gerdes; Deutsche WindGuard
- Leif Rehfeldt, Deutsche WindGuard
1 Introduction/ Background

This document gives an overview on the results gained during the first stakeholder workshop of the IEE project NorthSeaGrid. The consortium has invited stakeholders to the workshop with expertise in the field of regulatory, technical and financial issues. Among the participants were TSOs, offshore wind farm (OWF) operators, manufacturers (turbines and grid technology), regulatory authorities and associations. This wide range of expertise led to a fruitful discussion with valuable input from several different viewpoints.

In the following section, the main recommendations that were given by the stakeholders are summarized. Moreover, the decisions made by the consortium based on the discussion with the stakeholders are listed. Section 4 summarises the discussion for the different agenda points.

2 Decisions/ Recommendations/Main comments/ results

The following table summarizes important decisions and recommendations made at the workshop.

<table>
<thead>
<tr>
<th>#</th>
<th>DECISION/RECOMMENDATIONS</th>
<th>EXPLANATION</th>
<th>Responsible Partner</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Nuclear power still considered in the scenarios for 2030 for Germany</td>
<td>Nuclear power is supposed to be phased out by 2030, but is still considered as an input in the scenarios of NSG. This should be adapted in the scenarios or it should be explained why nuclear power does not fade out. Such scenario will be an easy target for anybody who questions the final project results</td>
<td>ICON</td>
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<tr>
<td>2</td>
<td>Cost allocation</td>
<td>A more detailed discussion of the cost allocation at this stage is needed, as CA is considered one of the main project results.</td>
<td>ECN</td>
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<tr>
<td>3</td>
<td>Cost sharing</td>
<td>For the final report, recommendations on how the major barrier can be surmounted, i.e. significant benefits go the parties which do not cover the cost. The project should always keep in mind the importance of such results.</td>
<td>ECN</td>
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<td></td>
<td>Cost used in DNV GL model are to low</td>
<td>Stakeholders expect the costs to be significantly higher than currently suggested in the cost model</td>
<td>DNV GL</td>
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| 5 | Barriers to the offshore grid development according to the stakeholders | - There is no real technical barrier. Of course offshore operators are still learning a lot and in particular operational costs were highly underestimated (extremely expensive and frequent maintenance was needed in some cases). Therefore maybe some operational experience is needed (about 5 more years), but with that experience all technical barriers should be surmountable.  
- The main barrier is that the regulatory framework does not give a stable framework for solid financial planning. Furthermore the current regulatory frameworks are unclear about certain aspects or do not cover these at all (in particular integrated solutions).  
- Financing: Collecting the money is in general not the problem. The problem is that the return on the investment in the current regulatory frameworks is sometimes not sufficiently save (In Germany e.g. the interest rate is e.g. recalculated every 5 years)  
- Cost allocation: A good cost allocation is urgently needed. ACER started on a cost allocation proposal that is however not translated in national regulation.  
- The implementation of an all-covering regulatory framework however will take a while. | DWG |
<table>
<thead>
<tr>
<th></th>
<th>DC breakers</th>
<th>DC breakers will be available if needed</th>
</tr>
</thead>
<tbody>
<tr>
<td>6</td>
<td>Type of integrated solution</td>
<td>It was highlighted that a three country study should absolutely be part of the scope. Here a lot can be learnt and the three-leg finally is the first step towards a meshed offshore grid.</td>
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<td>7</td>
<td>Cooperation</td>
<td>TSO-TSO cooperation is the best approach at the moment.</td>
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<td></td>
<td>Support scheme compatibility</td>
<td>Further work needed on aligned support schemes to build cross-border infrastructure. The question of paying of feed-in rates can be solved by implementing a clearing system between the states participating in an interconnected offshore grid – this way every wind farm gets the national feed-in rate of the country it belongs to</td>
</tr>
<tr>
<td>8</td>
<td>Support scheme compatibility</td>
<td>Regulator cooperation is of course equally important but due to the organization structure and responsibilities of a regulator it is very difficult for these authorities to take a front runner position. Regulators are in particular always bound to political targets.</td>
</tr>
</tbody>
</table>
### 3 Agenda Point Discussion

#### 3.1 The significance of a meshed offshore grid in the North Sea from an energy economic perspective

- A short overview on the German offshore wind farms (OWF) was presented regarding their connection and construction status.
- Moreover, the new regulatory regime for offshore grid connection in Germany was explained.
- A future perspective for a meshed offshore grid was presented.
- Conclusions/Questions to be investigated
  - How can TSOs ensure a sustainable financing of grid investments? (Financial barrier)
There is a need for a strong and capable organizational structure – ensure system stability and proper management of the “Energiewende”, e.g. creation of a national O-TSO/ European (North Sea) OFTO?

Barriers evolve due to different technical standards and grid codes, different support schemes are not the main problem. The question of paying of feed-in rates can be solved by implementing a clearing system between the states participating in an interconnected offshore grid – this way every wind farm gets the national feed-in rate of the country it belongs to independent from its current supply point.

Systematic (step-by-step) approach to accelerate implementation, e.g. long-term grid planning incl. meshed grid, standardization and implementation schedules contribute to:

- Substantial reduction of risk exposure in case of grid failures/damages
- Creation of a flexible and stable (offshore) grid by common technical standards and regulatory provisions
- Substantial reduction of downtime/repair times by spare parts management (studies by MARSH and Deutsche WindGuard, 2012)

  Helps creating improved conditions for financing/insurance for (offshore) grid connection systems (DC) and OWFs.

Demonstration projects on a bilateral/trilateral basis needed (with EU support) to prove technical feasibility, identify and deal with regulatory barriers

  take into account long lead times of offshore projects and resolve regulatory/financial barriers separately and more long-term

### 3.2 Introduction to the project and latest results

- The cornerstones of the NorthSeaGrid project were discussed:
  - The question in focus is why interconnection lines are not built even so they are evaluated as cost efficient in studies before. The question of costs and benefits shall be further analyzed within the project to develop recommendations to overcome current barriers.
  - It is important to understand that this project always looks at the step from the system of a direct interconnectors and radial connections of wind farms to the system of interconnectors that directly integrate a wind farm (integrated solution). The basic idea is to study what is needed to do this step as several studies have shown that these integrated solutions are highly beneficial in terms of costs but also regarding several technical aspects. In this sense the project does not compare an integrated solution with a green field, but an adequate alternative standard solution of direct interconnectors and radial connections.

- The latest results from their model were presented:
  - Feedback regarding the scenarios used by ICON was that in 2030 nuclear power was still an input factor, even so nuclear power is supposed to be phased out by then.

### 3.3 Financial and regulatory barriers

#### 3.3.1 Financial barriers

- Main Question: Are there additional barriers for an integrated solution, as long as there is a solid business case?
  - One important point is where the revenue will come from and that a high level of certainty is needed. Otherwise no investment will be made.
It also needs to be considered that in an integrated solution the investor has to deal with different markets. Especially for the financing bank it is very important that it is clear where the revenue comes from. It has been stated that technical risks can be handled and that suitable financial products exist for financing such solutions. The only risk, which is hard to calculate, is the regulatory/political risk, which gets even more complex if more countries are involved. It has been underlined that one stakeholder cannot use public finance of the Netherlands to build projects in Germany. It has been pointed out that KfW and EIB can support investments in the German grid and that a European Offshore-Grid regulation could have a positive impact on the finance ability of an interconnected offshore grid. The observation that EU support is hard to get for private investments was voiced. The question whether the congestion rent could be used for financing the regulated asset base was raised:

- the operator of a grid which is financed by congestion rent has no incentive to reduce the congestion
- It has been stated that funding is not the main problem and that investors would be available if interest rates would be attractive enough (e.g. 7-8% for 20 years guaranteed). But today, revenues fully lie in hand of the regulator and are valid just for one governmental period, no private investor would invest under this conditions.

The question of who could guarantee the revenue stream independent from the regulatory and political risks was analysed.

- In the case of Germany nobody knows the amount of revenues after 2017. Due to the missing security no investments will take place. But one stakeholder has to take the full OPEX risk for 20 years. The regulatory risk is the largest risk for one stakeholder due to the fact that the revenue stream can be different in the next legislature period.
- This is also important because the financing banks mainly look at the revenue stream
- The risk premium for TSOs could be reduced via a higher reliability on regulatory aspects
- One stakeholder is obliged to conduct projects (according to the German law EnWG). If they do not invest they would lose their TSO license

Could non-regulators be an option?

- All Projects of Common Interest (PCIs) are planned as regulated assets.

### 3.3.2 Regulatory barriers

- Regulatory risk is the largest risk for one stakeholder, due to the possibility that the revenue stream will look different in the next legislature period
- Other comments:
  - OWFs which are connected to more than one country will most likely be realized via specific solutions for every individual case
  - A regional or even European approach is not likely
  - Therefore specific solutions are also needed for the three specific cases
  - The point of cost allocation was raised as well, because the cost benefit calculations will be very important for EWEA. How will the welfare increase/decrease in the concerned countries?
  - Here, not only social welfare should be analyzed but the concrete welfare of each participating country or stakeholder, because social welfare in general does not initiate investments.
  - If the benefits of an interconnected grid don’t go to the parties which cover the costs, what are the recommendations?
The potential for a common remuneration in Europe was discussed.
   - However, an aligned remuneration is not the most important thing for an offshore grid. Different levels of remuneration are only an accounting problem. More important is to start with demonstration projects and go forward step-by-step from there.
   - France is not considered in the regulatory framework assessment but could benefit from offshore connections. There should be a way for participating in terms of costs, too.
   - An offshore grid will also be used for onshore production.

3.4 Technical and risk-related barriers

3.4.1 Technical barriers

- Short introduction of the technical barriers
  - There are no additional technical barriers for an interconnected offshore grid compared to today’s technology (radial connections for each offshore wind farm or cluster).
  - Main question: Are there additional challenges in comparison to business as usual and is the DC-Breaker the only issue?
    - The required technology already exists
    - Offshore grid connection is more expensive than onshore
    - Also radial connections are not stable at the moment, there are issues with AC-DC converters
    - One stakeholder would prefer to gain more years of experience before multi-terminal solutions are applied, because even the radial connections are not working without problems
    - From his point of view 4 – 5 years of experience are needed before concrete efforts are made on an interconnected offshore grid.
    - Maintenance cost are of higher importance in terms of project performance, here the calculation risk is high due to lacking experience.
      - 90% of the OPEX goes into maintaining the platform and only 10% into the electrical system
      - Lots of unexpected costs arise
      - To support the learning curve demo projects are needed
      - Investment cost per MW have doubled in the last 4 – 5 years for offshore AC-DC connection – it would be important to calculate with the right prices within the modelling. Further communication on this issue between the project partners and Stakeholders will be possible.

3.4.2 Risk-related barriers

- The costs will be higher than the ones used for the model
- Pilot project and demonstration projects would be useful and important

4 Annex

Agenda

<table>
<thead>
<tr>
<th>Time</th>
<th>Topic</th>
<th>Speaker(s)</th>
</tr>
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<tbody>
<tr>
<td>09:00</td>
<td>Registration &amp; welcome</td>
<td>Fabio Genoese, CEPS</td>
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<tr>
<td>09:10</td>
<td>The significance of a meshed offshore grid in the North Sea from an energy-economic perspective</td>
<td>Andreas Wagner, Managing Director at Stiftung Offshore Windenergie</td>
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<tr>
<td>Time</td>
<td>Session</td>
<td>Presenter(s)</td>
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<tr>
<td>09:30</td>
<td>Introduction to the project and latest results</td>
<td>Paul Kreutzkamp, 3E Ioannis Konstantelos, ICON</td>
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<td>09:50</td>
<td>Financial and regulatory barriers</td>
<td>Jaap Jansen, ECN Gerhard Gerdes, Deutsche WindGuard</td>
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<tr>
<td></td>
<td>Q&amp;A</td>
<td>All participants</td>
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<tr>
<td>10:50</td>
<td>Coffee break</td>
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<tr>
<td>11:00</td>
<td>Technical and risk-related barriers</td>
<td>Paul Kreutzkamp, 3E Muhammad Jafar, DNV GL</td>
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<tr>
<td></td>
<td>Q&amp;A</td>
<td>all participants</td>
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<tr>
<td>12:00</td>
<td>Panel discussion</td>
<td>Andreas Wagner, Managing Director at Stiftung Offshore Windenergie</td>
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<td>Wilfried Breuer, Managing Director at TenneT Offshore GmbH</td>
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<td>Wilfried Hube, Managing Director OWF Riffgat at EWE</td>
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<td>Markus Rieck, Country Sales Director Germany at Alstom</td>
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<tr>
<td>12:45</td>
<td>Summary &amp; conclusions</td>
<td>Fabio Genoese, CEPS</td>
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<tr>
<td>13:00</td>
<td>End of the workshop</td>
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