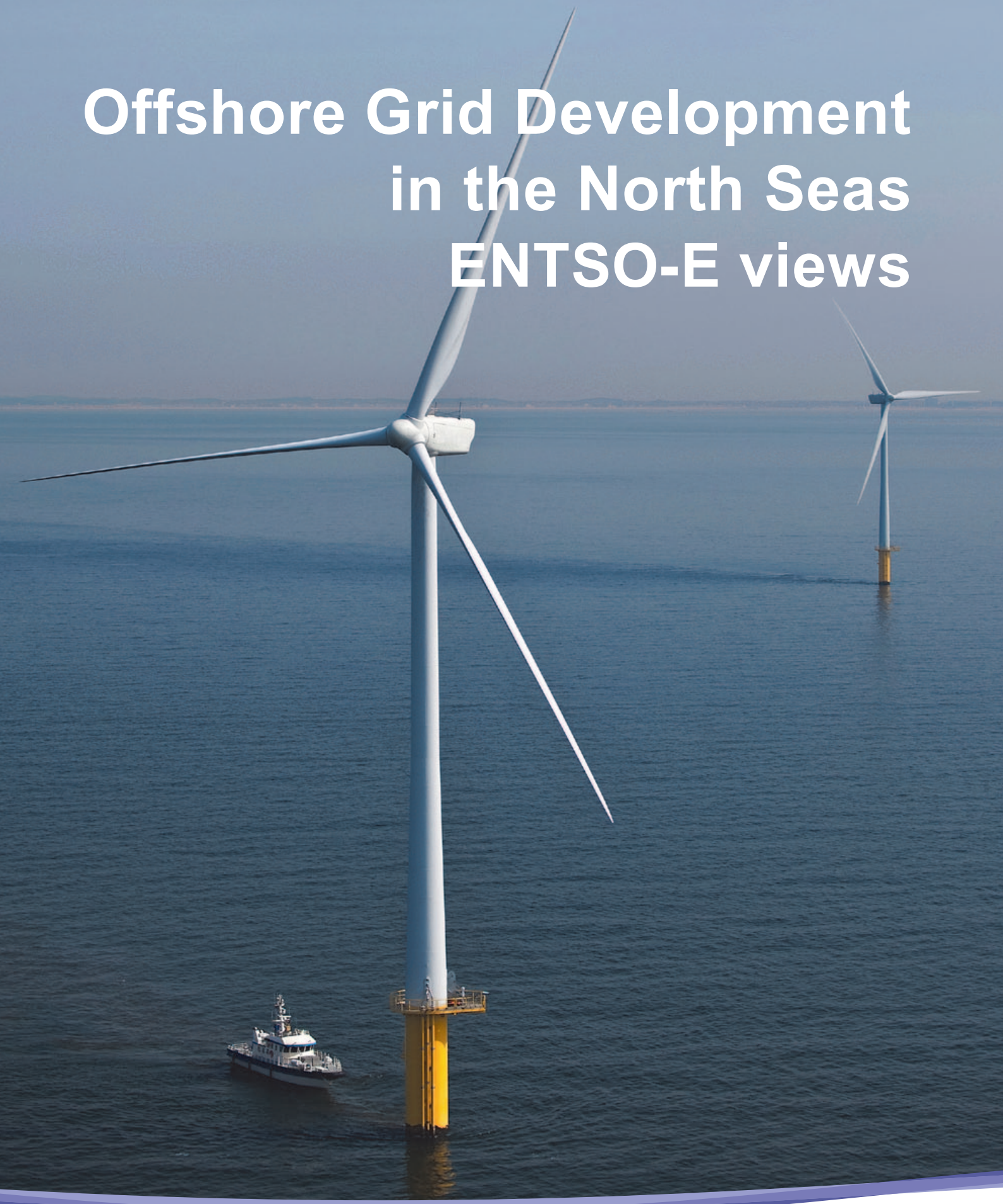
Offshore Grid Development in the North Seas ENTSO-E views



European Network of
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Offshore Grid Development in the North Seas

The connection and integration of offshore wind energy in the North Seas is widely recognised as being critical to the deliverability of EU environmental targets. The current national regimes for connection will, in time, become a barrier to achieving these targets with issues of security, market integration, inflexibility and standardisation alongside rising costs to consumers becoming increasingly prevalent.

A coordinated, integrated offshore grid will deliver significant benefits to European citizens:

- Improved energy security and network resilience for wind evacuation;
- Increased capacity for cross border trade;
- Fewer, larger assets reducing overall capital cost and environmental impact;
- Increased drive towards standardisation and deliverability, helping a stressed supply chain;
- Future proof for network evolution and further European integration

Country	**Starting position (2020)** in GW	**Potential volumes that could be expected by 2030** in GW
Belgium	2	4
Denmark	1	3,4
Germany	10	24
The Netherlands	2	12
Norway	0	1
Great Britain	11,5	38,5
Total	**25,5**	**82,9**

Table 1:
Offshore wind volumes expected in the North Sea (including Skagerrak and Kattegat, excluding Irish Sea and English Channel)

With deadlines for meeting renewable targets fast approaching, the lack of a framework to deliver an integrated design means that substantial benefits are likely to remain unclaimed if action is not taken soon.

Background

Despite its volatility, successful connection and integration of offshore wind, and in particular wind in the North Seas, is essential to achieving binding climate targets set by the EU. Large volumes of wind generation are expected to commission in the next 20 years, although the exact timing and location of such developments are difficult to predict. It is therefore essential that future plans take account of the evolution of developers' needs and technological advances to ensure stranded costs are minimised.

The EC Communication on the Energy Infrastructure Package identifies the creation of an offshore grid as a priority initiative and looks to the North Seas Countries' Offshore Grid Initiative (NSOCGI) work structure to enable all parties to address together grid configuration and integration, market and regulatory issues, and planning and authorisation procedures.

ENTSO-E has developed some initial concept designs to consider the relative benefits of an integrated grid development over the continuation of national, radial schemes.

This initial analysis covers only the North Sea perimeter (including Skagerrack and Kattegat but excluding the Irish Sea and English Channel). It has been assumed that on top of existing or "in-flight" interconnector projects, some additional subsea interconnectors will be needed by 2030. These additional links have been designed according to the two different concepts: current radial verses integrated.

Current National Approaches

The current national approaches (Figure 1) to connecting offshore wind generation encourage the installation of single user point to point (radial) sub sea connections to each individual wind farm. Equipment is designed and installed sufficient to evacuate 100 % of the potential output from the windfarm, but obviously remains unused when

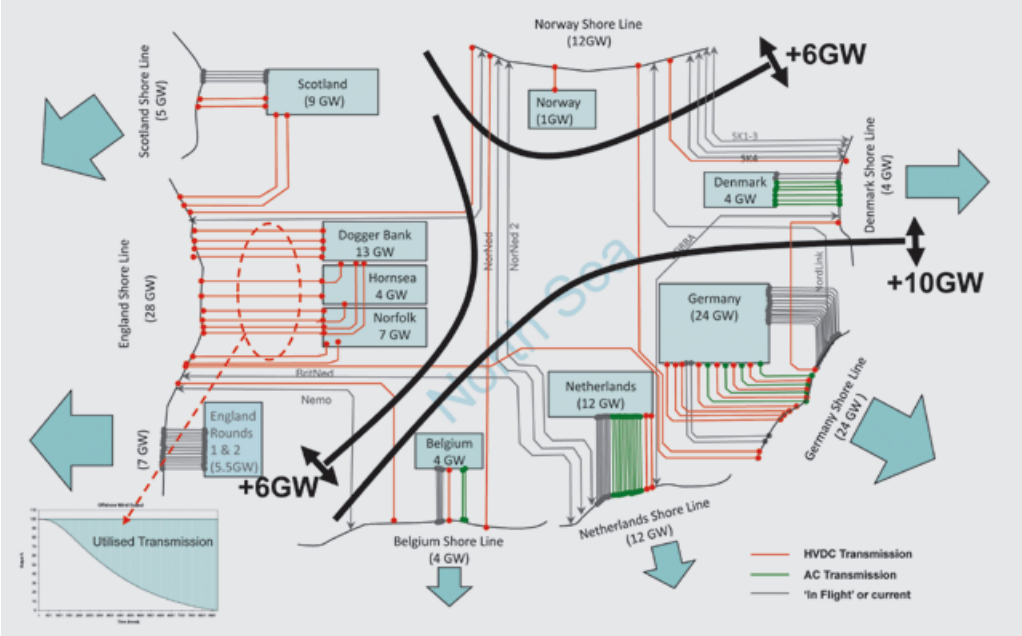

Figure 1:
Continuation of national solutions, with additional (shore-to-shore) interconnectors for cross border trade

there is no wind farm (or partially unused when the park is not operating at full output). Given the typical load factor of an offshore wind generator is less than 40 % this underutilisation is significant.

Further development and evolution of the radial connections will not be possible due to lack of anticipatory investments and standardisation drivers. Cross-border trade across the North Seas is limited to the routes of shore-to-shore interconnectors.

The current approach has worked acceptably for the smaller, near shore installations seen to date, but larger, more distant-from-shore volumes of connection can and should be planned differently.

Coordinated Plan

An alternative approach (Figure 2) is to plan, size, construct and operate an offshore grid by sharing assets between wind connections and cross border capability (by developing connections between wind parks in different countries), and also sharing costs and benefits on a wider European scale.

As is the case with onshore grids, an integrated offshore grid increases flexibility of power flows therefore enhancing security of energy supply and network resilience, while capacity for cross-border trade is improved through connections between wind farms. In addition, such an approach could be delivered at lower investment cost as it would result in the installation of fewer assets, and therefore deliver capital savings in the order of 10 % (or € 7 billion), based on the initial views of the TSOs within the North Sea Region.

Fewer assets require fewer subsea cable routes, and significantly fewer landing points on shore making consenting and authorisations more manageable from a societal point of view.

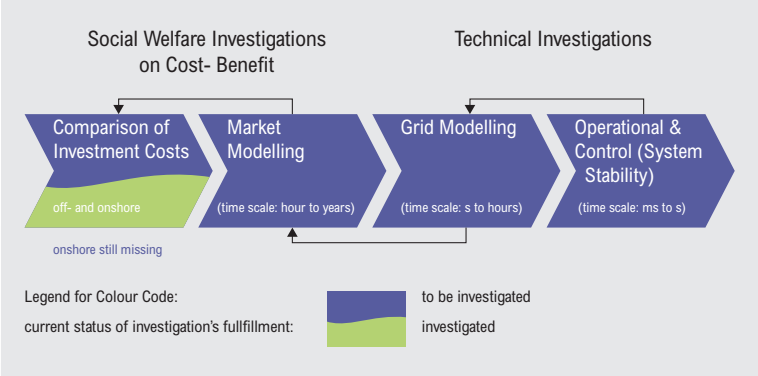

Figure 3:
Framework for full investigation into Offshore Designs

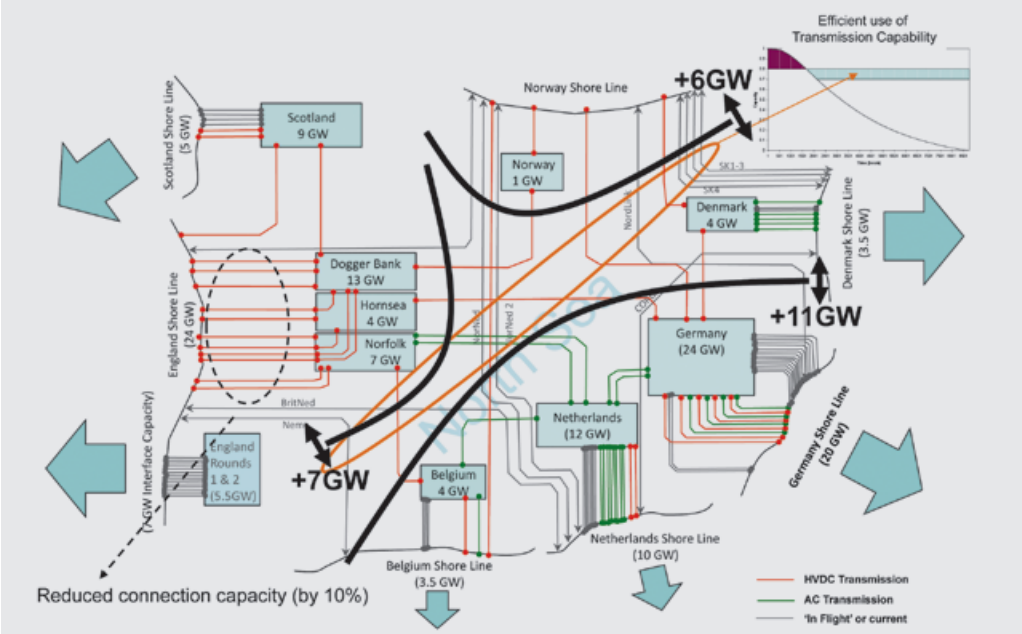

Figure 2:
Creation of an integrated grid showing fewer, larger routes to shore and interconnection between platforms

While a coordinated grid would demand technological standardisation, this should future proof designs for network evolution and greater European integration.

This analysis shows that while it is necessary to install sufficient connection capacity to transport all of the wind to shore from the wind farms, it is not necessary to install an equivalent capacity between wind farms for international trade. The optimal size of these wind farm to wind farm interconnectors depends on many factors including the results of detailed market studies and commercial rules and more work needs to be done to develop these detailed designs.

Limits to this Consideration

The analysis undertaken forms only a first step of the infrastructure investigations that TSOs and ENTSO-E routinely go through in the transmission planning process which is described in in Figure 3. ENTSO-E will take this detailed analysis forward using the planning tools described in the TYNDP and the 2050 Roadmap.

The analysis assumes expected technological developments, but early agreement is required to ensure the necessary coordination can be delivered. This coordination is complex – regulatory frameworks and development of appropriate market models are critical early enablers.

Conclusions

- Pilot TYNDP projects are essential (and in the main sufficient) to achieving 2020 targets although there may be some benefits in additional interconnection in specific areas like the island of Ireland within these timescales
- Benefits of international integration look to be significant for larger volumes of offshore wind generation – mostly post 2020
- A longer term coordinated plan is the only way to deliver these benefits
- ENTSO-E is committed to working closely with the NSCOGI and all stakeholders, but action has to be taken now to overcome the barriers to the development of an optimum integrated grid in the North Seas.

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Contact

ENTSO-E AISBL

Avenue de Cortenbergh 100
1000 Brussels – Belgium

Tel +32 2 741 09 50
Fax +32 2 741 09 51

info@entsoe.eu
www.entsoe.eu

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