Virtual Wind Conference
EU’s offshore strategy

Giles Dickson, CEO WindEurope
About WindEurope

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<tr>
<th>Category</th>
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<tr>
<td>Wind turbine manufacturers</td>
<td>GE Renewable Energy, Siemens Gamesa, Vestas</td>
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<td>Wind farm developers</td>
<td>ACCIONA, Equinor, RES, Shell</td>
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<td>Power utilities</td>
<td>RWE, EDF Renewables, Iberdrola Renovables, Vattenfall</td>
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<td>Component manufacturers</td>
<td>LM Wind Power, BASF, ZF, Hitachi, ABB</td>
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<td>Installation / logistics</td>
<td>Jan De Nul Group, Port of Amsterdam, Van Oord</td>
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<td>Financial &amp; legal services</td>
<td>Allianz, Baker McKenzie</td>
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<td>Research institutes</td>
<td>CATAPULT Offshore Renewable Energy, Fraunhofer, TU Delft</td>
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+ NATIONAL WIND ASSOCIATIONS
15% of EU power is provided by wind

205 GW

15% of Europe’s electricity demand

GW installed
Wind share of electricity demand
Offshore wind in Europe today

23 GW

3% of Europe’s electricity demand

GW installed
Wind share of electricity demand
1 new offshore wind turbine = €15m to the economy

€7.5bn EU GDP contribution
77,000 jobs in Europe today

200,000 jobs in Europe in 2030
Onshore & offshore wind will be the main sources of electricity generation by 2040
Onshore wind to remain the bulk of Europe’s wind capacity

EU27+UK. Source: 2030 WindEurope NECP scenario, 2050 EC long-term strategy
Europe’s offshore capacity to grow 5x by 2030

Offshore Wind annual installations based on existing projects and announces auctions, complemented by Government ambitions under the NECPs*

Source: WindEurope
Where to do 450 GW

Source: BVG Associates for WindEurope
Where to do 450 GW

Source: BVG Associates for WindEurope
North Sea Wind: The Poster Child

Area taken up by offshore wind in 2050:
- <5%
- 5-10%
- 10-15%
- 15-20%
- 20-35%

Population density:
- Low
- Mid
- High
How to deliver 450 GW
How to deliver 450 GW

Offshore wind installed capacity

- 23 GW in 2020

2020 2030 2050
How to deliver 450 GW
How to deliver 450 GW

- 2020: 23 GW
- 2030: 111 GW
- 2050: 450 GW
How to deliver 450 GW
How to deliver 450 GW

- Maritime Spatial Planning
- Align processes
- First cross border projects

Offshore wind installed capacity

2020: 23 GW
2030: 111 GW
2050: 450 GW
How to deliver 450 GW

- Maritime Spatial Planning
- Align processes
- First cross border projects

It won’t be enough!
How to deliver 450 GW

- Happy Coexistence
- Gear up supply chain
- Offshore hybrids

Offshore wind installed capacity

- 23 GW (2020)
- 111 GW (2030)
- 450 GW (2050)
Cost of offshore wind is decreasing

Auction results

<table>
<thead>
<tr>
<th>Year</th>
<th>Price (€/MWh)</th>
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<tbody>
<tr>
<td>2014</td>
<td>1.32 USD/EUR</td>
</tr>
<tr>
<td>2015</td>
<td>1.11 USD/EUR</td>
</tr>
<tr>
<td>2016</td>
<td>1.11 USD/EUR</td>
</tr>
<tr>
<td>2017</td>
<td>1.13 USD/EUR</td>
</tr>
<tr>
<td>2018</td>
<td>1.18 USD/EUR</td>
</tr>
<tr>
<td>2019</td>
<td>1.12 USD/EUR</td>
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</table>
Europe needs both floating and fixed-bottom offshore wind
7 GW of floating wind by 2030

- 30 MW (UK)
- 25 MW (Portugal)
- 25 MW (Portugal, Other)
- 10 MW (Other)
- 120 MW (France, 2030)
- 95 MW (Norway, 2030)
- 80 MW (UK, 2030)
- 25 MW (Portugal, 2030)

Energy cost: €40-60/MWh

Wind Europe
Floating costs will fall
Offshore hybrid projects

Combined grid solution

Modular grid

Interconnector tie-in

Offshore hub

Neighbour OWF
Kriegers Flak combined grid solution

400 MW

Source: 50hertz
Kriegers Flak combined grid solution

The new offshore wind farm Kriegers Flak, together with the existing wind farms Baltic 1 and Baltic 2,
Hybrids on their way
Electricity interconnectors

ENTSO-E Ten Year Development Plan forecast:

• €27bn to 2030 for 21 individual projects (out of €114bn)

• Projects would develop into a “Northern Seas Grid Infrastructure” based on **40-59 GW offshore wind by 2030** and a **maximum of 127 GW by 2040**

Source: ENTSO-E, TYNDP 2018 Regional Insight Report
The modular Hub-and-Spoke concept is a technically feasible solution that can adapt to specific design requirements. The consortium is well placed to develop, build and operate Hub-and-Spoke projects.

Source: TenneT
Renewable hydrogen competitive by 2030

LCOH: Renewable H₂ cost-out – Europe

- Fossil captive H₂ 2020: 1.2-1.7 EUR/kg
- Renewable H₂ 2020: 0.9 EUR/kg
- Impact of ETS free allowances: 0.3 EUR/kg
- Technology development: 0.6 EUR/kg
- Power cost charge: 0.8 EUR/kg
- Renewable H₂ 2030: 2.0 EUR/kg
- Fossil captive H₂ 2030: 1.5-2.0 EUR/kg

Avg. cost gap to fossil H₂: 4-8.3 EUR/kg
Hydrogen pipelines
National Governments need to deliver ambitious Plans
How to deliver the NECP volumes

1. Simplify permitting procedures
2. Clear auction schedules
3. Well-designed auctions
4. Climate proof infrastructure investments
Maritime Spatial Planning
Wind employs 300,000 people in Europe
Hull, UK
Bremerhaven, Germany
Thank you!