The Future of the Ocean Economy
- Offshore Wind

Workshop on Shipping and the Offshore Industry
Monday 24th November, 2014
OECD, Paris

Key data sources

- EWEA
  - Background
  - Projections
  - Technology
  - Finance
- IEA
  - Global projections
- The Crown Estate
  - LCOE breakdown
  - Cost reduction opportunities
- OffshoreGrid
  - Grid development
Installed capacity

Cumulative and annual offshore wind installations in Europe (MW), 1993-2013

Source: EWEA, 2014

Growth forecasts

Comparison of projections from different sources (GW), 2020-2050

Projections span different spatial scales and cannot necessarily be directly compared

Health warning:

• Many of these growth projections are conditional upon a range of criteria being met
• Others are based upon the scale of development required to achieve pre-determined targets
• Recent events suggest the above may be too optimistic
Becoming cost-effective

- The LCOE for offshore wind remains higher than all other utility-scale energy sources
- Learning curves - the percentage of cost reduction for each doubling of installed capacity – estimates are around the 10% level

![Typical LCOE ranges for renewable technologies, 2012 and 2020](Source: IRENA, 2013)

Larger, more powerful turbines

- Larger turbines offer economies of scale in manufacturing, installation and maintenance.
- Fewer turbines are needed for a given wind farm size
- ...plus reduction in losses from wake effects.
  - Overall impact of the introduction of new generation turbines is expected to reduce LCOE by about 17%

![Larger, more powerful turbines](Source: IEA, 2013b)
Support structures enabling access to deeper waters with greater wind speeds

- Exponential growth only achievable through the deployment of deep offshore designs (>50m).
- Such deep water concepts have huge potential:
  - Winds are stronger further from shore
  - Projects can be invisible from the shoreline lowering the chances of opposition
  - Potentially better accommodation for fishing and shipping lanes
  - More than 70% of the world's offshore wind resource is located in deep water around the world.
- Likely that jackets will overtake mono-piles as the dominant offshore foundation structure before long.
- Floating foundations are likely to represent the long-term future for the offshore wind industry.

Grid connection

- Electricity transmission infrastructure typically accounts for around 15-20% of the capital costs of developing an offshore wind farm (equivalent to 10-15% of the LCOE).
- Lower cost of manufacturing and installing the cable...but requirement for converter stations.
- ‘Point to point’ transmission -> ‘Multi-terminal’ systems
- Ancillary benefits from an interconnected offshore grid include the mitigation of environmental and social impacts, as well as the spatial smoothing of power.
Logistics

- Increased competition across the supply chain.
- Efficiency gains as well as reduced risk through improved FEED.
- Scale and productivity efficiencies.
- Optimising installation methods.
- Minimising O&M costs are essential.

Investment requirements

- Project financing is particularly challenging due to high technological and construction risks.
- Financing costs plays a significant role
  - A one percentage point reduction in the cost of capital reduces LCOE by about 6%
- Considerable investment needed if expansion plans are to be realised.
Access to finance

- Most projects have been funded by developers’ equity through the construction phase
- Utilities will not be able to continue to finance the equity component off balance sheet
- Need to demonstrate to that the financial profile matches what investors are seeking and that risks are either at an acceptable level or can be mitigated.
- Significant range of investors, including both equity investors and debt providers.

Required return on investments from different equity providers (%)

Source: EWEA (2013c)

Policy support / Regulation

- Pricing support mechanisms
- Fiscal incentives
- Facilitating access to finance
- Infrastructure provision
- Access to the grid / Grid development
- Power variability within energy markets
- Building risk into energy portfolios
- Industrial strategy
Marine spatial planning

- Helps to provide the required stability and clarity for investors
- Reduce costs through an optimum integration of the projects in the marine environment
- Cross-border coordination, incl cost savings that could result from shared infrastructure.
- Environmental protection:
  - Fish, birds, cetaceans, landscapes and the marine environment.
- Social impacts
  - Public acceptance vs community acceptance
- Synergies:
  - O&G, marine renewables, aquaculture, tourism

Opportunities for the shipping sector

- At least 17 different types of vessels are needed during the offshore wind life cycle.
- As of 2013, it was estimated that there are 865 vessels globally that can either provide offshore wind services, are under construction or are in the pipeline
- The majority of these vessels either have a European flag or are operated by European vessel operators, and are also operating in European waters
- Map the vessel types by project phase and conduct an assessment of whether their peak demand is in line with expected supply or otherwise (next slide)

| Green shaded cells: supply exceeds peak demand |
| Ambers shaded cells: supply and demand approximately in balance |
| Red shaded cells: peak demand exceeds supply |
| No shading: no information available |

Source: Adapted from Navigant, 2013
### Opportunities for the shipping sector

<table>
<thead>
<tr>
<th>Vessel type</th>
<th>Pre-Construction</th>
<th>Construction &amp; Installation</th>
<th>O&amp;M</th>
<th>Decommissioning</th>
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<tbody>
<tr>
<td>ROV support vessel</td>
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<tr>
<td>Geotechnical survey vessel</td>
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<td>Geophysical survey vessel</td>
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<td>Jack-up barge / vessel</td>
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<td>Heavy lift vessel</td>
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<td>Multi-purpose project vessel</td>
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<tr>
<td>Accommodation vessel</td>
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<tr>
<td>Multi-purpose cargo vessel</td>
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Primarily provide the inbound services for wind turbine and BOP tasks

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