The future of offshore renewables

Matthew Knight, Director Business Development UK Offshore Wind
Siemens covers the complete energy value chain

We provide reliable & proven

▶ Wind turbine generators
▶ Offshore grid connections
▶ On and Offshore asset services
▶ HVDC interconnectors
▶ Finance for offshore wind and also
▶ Conventional generation, tidal, biomass, CHP, etc.
A summer of offshore wind openings

David Cameron, PM
London Array 4th July 2013

Michael Fallon,
Energy Minister
Greater Gabbard 7th August

Nick Clegg, Deputy PM
Lincoln 1st August

Greg Barker,
Climate Change Minister
Gunfleet Sands 3, 12th September

Ed Davey,
Energy and Climate Change Secretary, Walney 9th February 2012

Me
London Array 19th April
The global potential >200,000 MW
Opportunity

1,075 Wind turbines in UK waters
Capacity 3,653MW
2,500MW in other European countries
A further 100,000MW under development
Euro 300Bn
100,000 jobs by 2025*
UK GDP benefit 0.8% by 2030*
“The Energy equivalent of North Sea Oil”**
76% public support**

* The Economics of Gas and Offshore Wind, Cambridge Econometrics, Nov 2012
** The offshore valuation
*** DECC Public Attitudes Tracker

Europe’s offshore wind plans

<table>
<thead>
<tr>
<th>Country</th>
<th>Capacity (GW)</th>
</tr>
</thead>
<tbody>
<tr>
<td>UK</td>
<td>51</td>
</tr>
<tr>
<td>DE</td>
<td>37</td>
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<tr>
<td>F</td>
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<tr>
<td>NL</td>
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<td>DK</td>
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<td>ES</td>
<td>6.8</td>
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<tr>
<td>ROI</td>
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<td>POL</td>
<td>8.3</td>
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<tr>
<td>GR</td>
<td>4.4</td>
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</tbody>
</table>

*DECC Public Attitudes Tracker* 

EWEA figures from Feb 2013
Elements of offshore wind farms

- Wind Turbine: c45% of Capex
- HVDC Converter Stations
- Collector Substation: 5%
- Marine export cable: 5%
- Onshore export cable: 5%
- AC Substation & Reactive Compensation: 5%
- Foundation: 20%
- Array cables: 7%
- Array switch: 1%
- High Voltage: 1%

Capex % is typical and for guidance only.
National drivers result in different models for grid

**Denmark 4GW**
Onshore TSO builds grid
Grid concept part of site selection
Simple radial connections and relatively small projects – single AC cable
Reactive compensation at grid level
TSO designs and builds

**Great Britain >45GW**
Developer builds grid then transfers to OFTO
In future OFTO build also possible
50% of R3 will be HVDC "lumpy" - requires big investment decisions
Coordinated design key to large scale
Offshore grid code relaxed vs. onshore
Developer splits into a few turnkey contracts

**Belgium & Netherlands 3-6GW**
Developer builds grid
Grid code applies at point of connection
BOP single EPC contract

**France 6GW**
Developer builds offshore substation, RTE (TSO) lays cable. Grid code applies onshore
Not yet clear

**Germany 25GW**
Onshore TSO builds grid
Zonal connections mostly HVDC
Build triggered by developers reaching financial milestone
Stranding risk (both ways)
Consent and design verification by BSH
Full grid code applies offshore
TSO turnkey contract (HVDC)
Developer procures AC collector

**Rest of Europe >10GW**
Regulation of grid still under discussion, will learn from other countries and follow working model
Most likely developer builds grid
Grid code usually applies at point of connection
BOP single EPC contract?

**UK 51 GW**
**ROI 4.2 GW**
**DE 37 GW**
**FIN 4.5 GW**
**F 6 GW**
**BE 2.3 GW**
**NL 5.9 GW**
**IT 2.8 GW**
**DK 5.4 GW**
**POL 8.3 GW**
**ES 6.8 GW**
**GR 4.4 GW**

EWEA figures from Feb 2013
The French approach
The UK must spend c£110Bn on replacement electricity generation in the next decade.*

Energy Market Review aims to reduce investor risk so this can be borrowed at the lowest cost.

Government doesn’t want to pick winners.

The 45-55% low carbon by 2030 will be a mix of:

- Carbon capture and storage
- Nuclear
- Offshore wind

“The market will decide”

*The energy challenge – New Infrastructure DECC You Tube
Making the UK market a success

By the year end the government will have set the challenge

"Reduce costs faster than this and you can build all you want" (subject to LCF limit)

We know industry can reduce cost
But it depends on a flow of projects to demonstrate savings so they can be “banked” on the next project

If the early projects are delayed the curves cross and we miss out
Cost reduction

Wind costs have fallen 45% each decade

We need to go faster

As well as separate manufacturers’ initiatives there is a UK Government – industry wide approach

June 2012 Crown Estate Offshore Wind Pathways

June 2012 DECC Offshore Wind Taskforce

Cost of energy can reduce 1/3 by 2020
Subject to rate of deployment

Oct 2012 DECC Offshore wind Programme Board – treat this like a business project

2013 BIS & DECC Industry Strategy
• Lead role in co-ordinating technology innovation with newly created Offshore Renewable Energy Catapult
UK Draft Delivery plan August 2013 - Scenarios

<table>
<thead>
<tr>
<th>Scenario Description</th>
<th>Installed capacity In 2030 (GW)</th>
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<tbody>
<tr>
<td></td>
<td>Offshore wind</td>
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<tr>
<td>100g CO₂/kWh scenario</td>
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<td>50g CO₂/kWh scenario</td>
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<td>200g CO₂/kWh scenario</td>
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<td>High CCS deployment scenario</td>
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<td>High nuclear deployment scenario</td>
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</tr>
<tr>
<td>High offshore wind deployment scenario</td>
<td>39</td>
</tr>
</tbody>
</table>

These are NOT targets – just potential different market development scenarios

Message is unclear – central scenario at odds with the Industrial Strategy

Cost reduction is key to offshore wind market size
Bringing down the cost of energy

CAPEX + OPEX + Finance + FUEL = LCOE

Reduce Capital Expenditures (CAPEX)
(e.g. lower weight, fewer components, foundations, substations, cables)

Reduce Operating Costs (OPEX)
(e.g. lower maintenance though higher reliability, better access strategy)

Finance
(e.g. Improving project and risk management)

Increase lifecycle energy output
(e.g. higher efficiency, longer life time, higher availability)
Innovation – Turbines and Construction

**SWT 6.0 154**
- Twice the power
- Half the component count
- 1/3 lower weight per MW
- Direct drive technology

**Jack up vessels**
- Early projects borrowed from oil and gas
- 3 turbine kits per sailing
- Now 6-10
- Deeper water is still an issue

MV Resolution installing a 3.6MW wind turbine at London Array
Innovation – Balance of Plant

Foundations
- Carbon trust winners
- And many more

Array cables
- Catapult project

Grid
- Reference design substations
- New HVDC solutions

Service
- Service Operations Vessel
- Access systems
- Tablets for technicians
- Customer Support Centre
Tidal is at the demonstration stage

http://www.marineturbines.com
Conclusions

Offshore Wind is a new industry with huge potential
Success in Europe will be driven by UK and Germany
Grid connections add cost and complexity however regulated
Government signals affect the way the wind farm can be financed
The industry has plans to reduce cost
But they depend on scale
The UK government will finalise EMR by the end of the year
Then it’s up to the industry to find a way to deliver
Other marine renewables will follow
Matthew Knight, Director Business Development UK Offshore Wind

Thank you

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