Offshore Wind Farm Service Vessels
Market update and opportunities
Fosnavåg Konferansen 21 June 2018

Presented by: Frederik Colban-Andersen
Prepared by: Jens Egenberg
Introduction to Clarksons Platou Offshore & market update

• Evolution of SOVs and W2W Vessels
• Trends and Options for Construction and Operation
• Influencing Factors - Rates and Vessel Availability
Clarksons Platou is the Leading Provider of Insight and Execution in the Industry

- 165 years experience of providing seamless end-to-end shipping and offshore services through a global network
- 48 offices spanning five continents
- ~1400 employees
- Listed on the London Stock Exchange (CKN.L) - FTSE 250
- USD 1.2 bill market cap.
- World largest Offshore Service Vessel broker – 90 staff in 10 offices
- World leader in Offshore Wind/Renewables Service Vessel procurement services with 4 offices in the North Sea area + teams in Houston, Shanghai and Singapore

Group service segments

Shipbroking services
Port & Logistics
Investment Banking
Market Intelligence
The Offshore group - Geographic Coverage Clarksons Platou - the world’s leading integrated offshore services group

11 Offshore offices

90 Offshore brokers and support
40 years in O&G....Over 10 years in offshore wind

- Transactions last 10 years:
  - 400 + OSV and Subsea vessel new build orders
  - 400 + OSV and Subsea Vessel sales transactions
  - 50 + MODU/Rig charter contracts
  - 50 + MODU new build Orders
  - 100+ rig sales transactions

- Extensive experience in chartering of all types of offshore units:
  - 1360 charter contracts negotiated in 2015
  - 40-50 Formal tender process successfully concluded annually

A selection of fixtures and milestone contracts concluded by the CPO Renewables team members across the Oslo, London and Aberdeen offices.
With all respect and contrary to popular belief; offshore wind is not about treehuggers......
It started with environmental concerns and politics in Europe, but solar and wind increasingly competitive on a global scale.
Renewable energy is not for idealists only...

Dong Energy breaks subsidy link with new offshore wind farms

The green power industry has hit a milestone after the world’s largest offshore wind farm company said it would build its German schemes without any subsidies.

Sample the FT’s top stories for a week

You select, The Financial Times delivers.

New Record Set for World’s Cheapest Solar, Now Undercutting Coal

Solar power set another record low price as renewable energy developers working in the United Arab Emirates shrugged off financial turmoil in the industry to promise projects that undercut even coal-fired generation.

Developers bid as little as 2.99 cents a kilowatt hour to develop 500 megawatts of solar-power projects for the Dubai Electricity & Water Authority, the utility for the Persian Gulf emirate, announced on Sunday. That’s 18 percent lower than the previous record

In an advance for what has been one of the most heavily subsidized types of renewable power, Denmark’s Dong Energy said it would rely on wholesale market prices instead of extra government support for the projects in the German North Sea.

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What is it all about….lots of steel in the water
....and lots of vessels involved
The Offshore Wind Universe according to Clarksons Platou Renewables

<table>
<thead>
<tr>
<th>Investor base</th>
<th>Electricity producers(1)</th>
<th>Turbine producers(1)</th>
<th>Engineering and/or Foundations(1)</th>
<th>WTG/Foundation installers(2)</th>
<th>SOV /W2W vessels owners(2)</th>
<th>CTV owners(2)</th>
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<tr>
<td>Pension Danmark</td>
<td>Ørsted Vattenfall</td>
<td>Siemens Gamesa</td>
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<td>StatOil wpd</td>
<td>AREVA forward-looking energy</td>
<td>SeaJack</td>
<td>SWIRE BLUE OCEAN</td>
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<td>DNV GL</td>
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<td>Ballast Nedam</td>
<td>A2SEA</td>
<td>ESVAGT</td>
<td>DNV GL</td>
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<td>DNV GL</td>
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<td>Ballast Nedam</td>
<td>A2SEA</td>
<td>ESVAGT</td>
<td>DNV GL</td>
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<td>DNV GL</td>
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<td>Ballast Nedam</td>
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</tbody>
</table>

Source: Clarksons Platou Offshore

GRAY BOXES: Oil and Gas industry sector “peers”
(1) Potential Vessel Charterers
(2) Vessel providers
Source: Clarksons Platou Offshore Research
Offshore Wind Vessels – about 11% of an OWF development

Site survey for geological features and potential obstacles.
Install foundations, typically monopile. Other options include floating, tripods, jackets.
Tower parts, nacelle (generator housing) and three blades installed.
Substation tower topsides dropped into place.
Inter-array and export cables are laid under the seabed by jetting.
Farms monitored constantly from shore. Regular inspections and service visits.
Required at the end of farm life to remove or replace turbines.

Survey Vessels
Crane Barge, Heavy Lift Jack Up
Jack-up Vessel, Wind Turbine Installation
Heavy Lift Vessel
Cable Lay Vessel
DP2 Support, Crew Transfer, Accommodation, O&M Jack Ups
Jack-Up Vessel, Heavy Lift Vessel

Example
“Bavenit” Geophysical Survey Vessel
“Oleg Strashnov” Derrick/Crane Vessel
“Bold Tern” Wind Turbine Installation Vessel
“Jumbo Vision” Heavy Lift Cargo Vessel
“Nexus” Cable Lay vessel
“Island Crown”/ “Wind Server” MSV
“Pacific Orca” Wind Turbine Installation/ Decommissioning Vessel

Source: Clarksons Platou Offshore Research
Market and Segment update

• Evolution of SOVs and W2W Vessels
• Trends and Options for Construction and Operation
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Comparing offshore wind investment in Europe to UK and Norwegian oil and gas markets, they are comparable in size at least during this downturn.

### Sanctioned investment in Offshore Wind Farms

- Investment in offshore wind in Europe rose to a record for the second year in succession during 2016.
- 13GW installed / over 3589 WTG connected. A total of 5 GW reached FID in 2016.
- EURbn 18.2 was invested (FID), up 39%.

### Comparison of investment levels

- Assuming FIDs spent over next three years, offshore wind capex will be around EURbn 12.4 in 2017.
- Looking at the rise in investments from 2014-2016, this is likely to low as new projects will be sanctioned in 2017-2018.
- Below graph shows oil & gas capex for 2016, i.e. not 100% comparable to FID numbers.

**Source:** Wind Europe; Clarkson Research; Clarksons Platou Offshore
### Overview of installed capacity per nation

<table>
<thead>
<tr>
<th>Country</th>
<th>No. of farms</th>
<th>No. of turbines connected</th>
<th>Capacity installed (MV)</th>
<th>Capacity installed / decommissioned in 2017 (MW)</th>
</tr>
</thead>
<tbody>
<tr>
<td>UK</td>
<td>31</td>
<td>1753</td>
<td>6835</td>
<td>1679</td>
</tr>
<tr>
<td>Germany</td>
<td>23</td>
<td>1169</td>
<td>5355</td>
<td>1247</td>
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<tr>
<td>Denmark</td>
<td>12</td>
<td>506</td>
<td>1266</td>
<td>-5</td>
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<tr>
<td>Netherlands</td>
<td>7</td>
<td>365</td>
<td>1118</td>
<td>0</td>
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<tr>
<td>Belgium</td>
<td>6</td>
<td>232</td>
<td>877</td>
<td>165</td>
</tr>
<tr>
<td>Sweden</td>
<td>5</td>
<td>86</td>
<td>202</td>
<td>0</td>
</tr>
<tr>
<td>Finland</td>
<td>3</td>
<td>28</td>
<td>92</td>
<td>60</td>
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<tr>
<td>Ireland</td>
<td>2</td>
<td>7</td>
<td>25</td>
<td>0</td>
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<tr>
<td>Spain</td>
<td>1</td>
<td>1</td>
<td>5</td>
<td>0</td>
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<tr>
<td>Norway</td>
<td>1</td>
<td>1</td>
<td>2</td>
<td>0</td>
</tr>
<tr>
<td>France</td>
<td>1</td>
<td>1</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>92</strong></td>
<td><strong>4149</strong></td>
<td><strong>15779</strong></td>
<td><strong>3148</strong></td>
</tr>
</tbody>
</table>

#### NW Europe MW development

**MW additions per year**

**Cumulative MW development**

- France
- Belgium
- Denmark
- Germany
- Netherlands
- United Kingdom
- Ireland
- Sweden
- Portugal
- Estonia
- Poland
- Total cumulative
Global offshore wind additions to grow steadily and stabilize approaching 2030

- BNEF global offshore wind estimate of 102 GW 2017-2030
- Statoil sees potential of 50-70 GW of European wind by 2030 (vs CP estimate of 78 GWs)

Wind Europe estimates 70-100 GWs in Europe by 2030

- Low estimates post 2027, especially for developing countries

15 GW potential for European wind by 2030, according to various estimates.
The industry has to date been dependent on subsidies, but break even in sight towards 2020-2025.

Cost of offshore wind farm generated energy coming down

Dutch Borssele auctions showing cost coming down

Source: Dong; BNEF; Clarksons Platou Offshore
Offshore Wind mainly established in N.Europe and China, but many regions are starting to see emerging developments.

Source: Clarksons Platou Offshore
Complexity of new farm increase: they are developed further from shore and deeper waters, driving demand for both specialized tonnage/and advanced O&G vessels

All dimensions have increased significantly over the last 20 years

- Average depth ~ 3x last 10 years
- Distance from shore ~ 7x last 10 years
- Area per farm ~ 20x last 10 years
- Nr of turbines per farm ~ 4x last 10 years
- Turbine MW effect ~ 2x last 10 years
- Turbine height ~ 2x last 10 years

Farms being built further from shore and in deeper waters

All dimensions have increased significantly over the last 20 years

-- Key factors development

Note: Numbers including windfarms which are: Consent Application Submitted; Consent Authorised; Fully Commissioned; Partial Generation/Under Construction; Under Construction
Source: 4Coffshore; Clarksons Platou Offshore
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Accommodation and Walk-to-Work Vessels overview

**Vessel of Opportunity (VOO)**

Different kinds of vessels, typically PSVs or CSV, mobilizing from the spot market by adding flexible gangway.

- PSV Havila Fortune
- PSV Rem Star
- PSV Olympic Commander
- CSV Stril Server
- CSV Despina
- CSV Aker Wayfarer
- ...and many more spot vessels

**O&G Walk-to-Work (W2W)**

Vessels originally intended for oil&gas, but now also supporting the offshore wind industry.

- Kroonborg
- Island Crown
- HOS Sandridge
- Edda Fjord
- Island Dilligence
- Vestland Cygnus

**Wind SOV and Commissioning Vessels (W2W)**

Esvagt Froude (Havyard)
- Esvagt Faraday (Havyard)
- Siem Moxie (Ulstein)
- Esvagt Njord (Havyard)
- Acta Orion (CIG)
- Windea vessels (Ulstein)
- VOS Start - KMC design
- Bibby Wavemaster 1
- ...and many more
Long term SOV fleet
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Type and designs

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<th>CTV</th>
<th>W2W</th>
<th>Mini-SOV</th>
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<td><img src="image18.png" alt="Mini-SOV Image" /></td>
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Gangways in action...recent examples

- Uptime gangway on ‘Polar Queen’
- Barge Master gangway with fixed pedestal and internal personnel and cargo lift
- Safeway gangway on ‘Aethra’
- First generation Ampelmann gangway
Crane solutions
Lessons learned

- Mobilization issues/K-y-C
- Industrial Personnel vs SPS
- O&G vs Wind regulations
- Legal implications
- Contract terms (LDs etc)
- Crane operations
- Catering
- Communications
- DP / positioning capability
- Placement of gangway
- Cargo transfer
- Storage & Logistics solutions
- Boat landings/CTVs
- Daughter crafts
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Influencing Factors - Rates and Vessel Availability
SOV and W2W vessel demand model

Assumptions

- Status of wind farms included: Consent application submitted; consent authorized, under construction, pre construction, fully commissioned, partial generation/under construction
- All water depths
- Only wind farms more than 30+ km from shore
- All farms with 50+ turbines included
- Countries: Belgium, Denmark, France, Germany, Netherlands, United Kingdom
- First power used as start-up year, if not construction plus two years assumed as start-up year
- Assumed 0,5 SOV per wind farm with 50-70 MW (shared SOV), 1 SOV per wind farm with 70-150 MW and 2 per wind farm with 150-300 MW
- This model only includes demand for operations and maintenance phase, and commissioning support is not included. But recent tenders from Ørsted and SiemensGamesa indicates similar specifications will be required in the commissioning phase also, significantly increasing demand.

Conclusion: There is a theoretical need for 22 W2W vessels based on this model, based on assumed future need for SOVs, but experience tells us there is a need for approx. 18 x W2W vessels chartered in for yearly construction projects.

Low case implying 15% reduced sanctioning of projects.
Source: 4COffshore; Clarksons Platou Offshore
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Renewables@clarksons.com
Industry participants – cumulative MW to show largest players historically

Developers share of 2017 annual installations (MW)

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<th>Cumulative MW capacity by owner</th>
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<td>Copenhagen...</td>
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<tr>
<td>Others</td>
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</table>

Different developers have different capabilities

- Some developers, like Ørsted, Statoil and other companies coming from the Oil and Gas industries, have plenty of marine expertise and do/take responsibility for much of the work themselves

- Other utilities coming from onshore, are more reliant support from external service companies, and often let the foundations/turbine producers do more of the marine work

<table>
<thead>
<tr>
<th></th>
<th>Develop</th>
<th>Build</th>
<th>Operate</th>
<th>Own</th>
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<tr>
<td>Others</td>
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Source: WindEurope