Learning from the Experts Webinar Series

Vessel Types

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DNV

May 11, 2022
Meeting Procedures

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>
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Learning from the Experts

This webinar series is hosted by NYSERDA’s offshore wind team and features experts in offshore wind technologies, development practices, and related research.

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Vessels for Offshore Wind

Noe Rouxel, Offshore Wind Advisory – North America
11 May 2022
Content

1. Who is DNV
2a. Maritime activity on an offshore wind farm
   2b. Details on the most impactful vessels
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5. Industry trends
Who is DNV
Offshore Wind Advisory Services

- Lease area evaluations
- Feasibility studies
- CAPEX & OPEX estimation
- Energy assessment & remote sensing technology selection
- LiDAR validation
- Survey design & oversight
- Survey data management

- Avian risk assessment
- Environmental studies
- SAP/COP preparation
- Navigation risk assessment
- Third party EIS preparation
- State RFP bid preparation
- Interconnection studies
- Decommissioning studies
- Stakeholder Engagement

- Technical due diligence
- Lenders Technical Advisor
- Supply contract review
- Manufacturing observation

- Marine Warranty Surveyor
- Construction monitoring
- Power performance testing
Maritime activity on an Offshore Wind Farm
Life cycle of a wind farm

Different activities in the different phases of the project:

Development
- Bathymetry Surveys
- Geotechnical Surveys
- UXO Surveys
- Floating Lidar installation

Construction
- Component transport
- Seabed Preparation
- Foundation installation
- Cable Laying
- Wind Turbine Installation
- OSS installation
- Scour protection installation
- Crew Transfer

Operation & Maintenance
- Inspections
- Preventive and light maintenance
- Subsea inspections
- Replacement of major components
- Crew Transfer

Decommissioning
- Foundation removal
- Cable removal
- Wind Turbine removal
- Dredging
- Component transport
- Crew Transfer

4-7 years 1.5 - 3 years 25 – 30 years 1 – 2 years
Development and permitting phase

Medium-sized vessels, collecting site data

### Development

- Bathymetry Surveys
- Geotechnical Surveys
- UXO surveys
- Floating Lidar installation

<table>
<thead>
<tr>
<th>Vessels</th>
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<tr>
<td><img src="image" alt="Bathymetry Survey Vessel" /></td>
<td>Bathymetry Survey Vessel</td>
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<td><img src="image" alt="Geophysical Survey" /></td>
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<tr>
<td><img src="image" alt="Geotechnical Survey Vessel" /></td>
<td>Geotechnical Survey/Jack Up/Floating Drill Vessel</td>
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<td><img src="image" alt="Meteocean Buoy deployment" /></td>
<td>Meteocean Buoy deployment</td>
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Construction Phase (1/6)

Component transport

- Component transport
- Seabed Preparation
- Foundation installation
- Cable Laying
- Wind Turbine Installation
- OSS installation
- Scour protection installation
- Crew Transfer

- Transport of large components (Offshore Substation Foundation and Topside, Jackets,…)
- Long distance transport of wind turbine components
Construction Phase (2/6)

Seabed preparation and rock dumping

**Construction**
- Component transport
- Seabed Preparation
- Foundation installation
- Cable Laying
- Wind Turbine Installation
- OSS installation
- Scour protection installation
- Crew Transfer

- Deepening of port accesses
- Flattening of sand waves on seabed
- Levelling of seabed before the installation of gravity based foundations (GBS)
- Installation of scour protection around monopiles
- Protection of subsea cables
- Installation of rock matt for the GBS
Construction Phase (3/6)

Installation of the foundations

**Construction**
- Component transport
- Seabed Preparation
- Foundation installation
- Cable Laying
- Wind Turbine Installation
- OSS installation
- Scour protection installation
- Crew Transfer

- Installation of components requiring heavy liftings (monopiles, Jackets, OSS, ...)
- Lifting and Installation of foundations
- Generation of bubble curtains to mitigate the noise generated by the pile driving
Construction Phase (4/6)

Cable Laying

- Component transport
- Seabed Preparation
- Foundation installation
- Cable Laying
- Wind Turbine Installation
- OSS installation
- Scour protection installation
- Crew Transfer

Cable Laying Vessel (CLV)

- Export cable Laying between the windfarm and the shore
- Inter-array cable laying between the wind turbines
- Cable burial (may be simultaneous to cable laying)
- Installation of cable protections
Construction Phase (5/6)

Wind turbine installation

Construction

- Component transport
- Seabed Preparation
- Foundation installation
- Cable Laying
- Wind Turbine Installation
- OSS installation
- Scour protection installation
- Crew Transfer

- Transportation of components form marshalling harbour to offshore site
- Installation of wind turbine components:
  1. Mast
  2. Nacelle
  3. Blades (x3)
Construction Phase (5/6)

Wind turbine installation

Construction

- Component transport
- Seabed Preparation
- Foundation installation
- Cable Laying
- Wind Turbine Installation
- OSS installation
- Scour protection installation
- Crew Transfer
Construction Phase (5/6)

OSS installation

- Crane capacity up to 24,000 t (2x12,000t)
- Good seakeeping
- Slow transit speed
- Small global fleet, based in northern Europe
- High cost

**Construction**
- Component transport
- Seabed Preparation
- Foundation installation
- Cable Laying
- Wind Turbine Installation
- OSS installation
- Scour protection installation
- Crew Transfer

**Semi Submersible crane vessel (SSCV)**
- Installation of heavy structures (>5,000t) such as HVDC OSS topside and foundations.

- Crane capacity up to 24,000 t (2x12,000t)
- Good seakeeping
- Slow transit speed
- Small global fleet, based in northern Europe
- High cost
Construction Phase (6/6)

Personnel transfer and accommodation

- Component transport
- Seabed Preparation
- Foundation installation
- Cable Laying
- Wind Turbine Installation
- Scour protection installation
- Crew Transfer and accommodation
- Crew changes of installation vessels
- Bring technicians and light equipment to the offshore structures
- Conducts wind turbine commissioning
- Transfer crew and equipment to offshore structures
- House crew offshore
- Accommodate a high number of technicians offshore for the duration of the commissioning work
Operation & Maintenance Phase (1/2)

“Light” Maintenance and inspections

Operation & Maintenance

- Inspections
- Preventive and light maintenance
- Subsea inspections
- Crew Transfer
- Replacement of major components

- Transfer of Maintenance technicians from shore to the offshore structures
- Conducts wind turbine commissioning
- House crew offshore
- Accommodate a high number of technicians offshore for the duration of the commissioning work
Operation & Maintenance Phase (1/2)

Exceptional heavy maintenance (replacement of a major component)

- Inspections
- Preventive and light maintenance
- Subsea inspections
- Crew Transfer
- Replacement of major components

Jack-up crane vessel (WTIV)

- Lifting and replacement of heavy components (blade, gearbox, generator, main transformer)
Floating Offshore Wind

Component transport

FOW Construction

• Anchors and mooring lines installation
• Wind turbine towing
• Wind turbine hook-up

Tow the floating wind turbines (Turbine + Floating foundation) from the construction port to the installation site.
• Install certain types of anchors

Install suction pile anchors
• May install inter-array cables and/or cable accessories
• Perform other subsea operations requiring lifting, ROV, etc...
Vessel details – most impactful
Wind Turbine Installation Vessel (WTIV)

- 4 or 6 legged
- Self-propelled: 8-12 knots typical transit speed
- Jack-up by hydraulic jacks typically
- Dynamically Positioned (DP)
- In transit Hs limit typically 2.5-3m
- Jacking up Hs limit typically 1.5-2.5m
- Lift capacity typically 500-3,000t

+ Very good stability during lifts

- Long Jacking time (up & down process)
- Geotech. survey to be performed before installation
- May not be suitable for all seabed
Heavy Lift Vessel (HLV)

- Floating crane
- Self-propelled: 12-14 knots typical transit speed
- 8-point moored or Dynamically Positioned (DP)
- Working Hs limit typically 1-2 m (vessel and task dependent)
- Lift capacity typically 3,000-5,000 t
- Working stability from ballasting

+ suitable for any seabed
+ quick positioning
+ Fast transit speed
+ Higher crane capacity

- Less stable for precise lifts
- Reduced weather window
- Risk of “loosing” the position during operations
Heavy Lift Vessel (HLV)
Crew Transport Vessel (CTV)

Main Features:

- Fast transit speed (18 to 35 knots)
- POB: 12 or 24
- Length: 20 to 35m
- Bow Fender adapted to boat landings
- Boat Landing transfer up to 1.5m significant waves

May also include:

- Deck space to carry 10 feet containers
- Capability to perform offshore bunkering
- Boat landing gripper systems
- Deck crane
The Jones Act
The Jones Act

• Jones Act prevents non-U.S. ships engaging in coastwise trade from one U.S. point to another

Source: GAO
The Jones Act

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Source: GAO
The Jones Act

- The most impacted categories of vessels

- Feeder Vessels and Barges
- Dredge
- Heavy Lift Vessel (HLV)
- Support and noise mitigation vessels
- Cable Laying Vessel (CLV)
- Scour protection installation vessel
- Anchor Handling Tugs
- Wind Turbine installation vessel
- Service Operation Vessel (SOV)
- Accommodation platform or flotel
- Crew Transfer Vessel (CTV)
- Diving Support Vessel

Impacted

Potentially impacted
Expected demand
US demand forecast

• In 2021 DNV, in collaboration with the National Renewable Energy Laboratory (NREL) and the Business Network for Offshore Wind evaluated how the U.S. supply chain can evolve to achieve the national offshore wind energy target and create local economic benefits.

• 30 GW by 2030… and more to come:
  • 2,100 Wind turbines and foundations
  • 6,800 Miles of cables
US demand forecast

Vessels Required (2023 - 2035)

- CTV
- Feeder Barge
- WTIV
- CLV
- SOV

40 – 50 CTV by 2030
US demand forecast

Vessels Required (2023 - 2035)

- Feeder Barge
- WTIV
- CLV
- SOV

- 10 feeder vessels
- 5 WTIV
US Jones Act fleet

- The Existing and future US fleet:

1. Jones Act compliant WTIV in construction: **Charybdis (2,200t, 56m, 144m)**

2. 2-3 SOVs under construction:

3. CTV: 4 in operation + several under construction

- Significant Tugs and transport barge fleet

- 1 Scour protection installation vessel ordered

- Several US AHTS, mostly in the Gulf coast
Industry trends
Larger Installation vessels

- Wind turbines are expected to reach more than 22 MW in the next decade
- The newbuilt fleet needs to anticipate the increase of future structure sizes and project scale
  - Maximum hub height: up to 160 m
  - Nacelle weight up to 1000 tonnes
  - Blades up to 140 m
- More deck space to carry more and larger components
Development of integrated feeder vessels concepts

- DP feeder vessels
- WTIV/barges interfaces
- Jack-up feeder barges
Unmanned and Autonomous Vessels

• Surveys
• Guard/Safety vessels
Thank you

Any Questions?

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www.dnv.com
Coming Next:

May 25, 1:00 p.m. ET
Workforce Development
Phil Jordan, BW Research Partnership & Harvard University

Visit wind.ny.gov to register

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