UNDERWATER ASPECTS OF OFFSHORE WIND FARM INSTALLATION AND OPERATION

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Overview

- Offshore Wind Industry
- Typical Wind Farm
- Submarine Cable Installation & Protection
- Subsea Platform Inspections
Offshore Wind Industry

- **EU**
  - Status in 2010: 3,000 MW
  - Target for 2020: 40,000 MW

- **North America**
  - Status in 2010: 0 MW
  - Target for 2020: 3,000 MW

- **China**
  - Status in 2010: 100 MW
  - Target for 2020: 6,000 MW

- **South Korea**
  - Status in 2010: 0 MW
  - Target for 2020: 2,500 MW

*E.ON Offshore Wind Energy Factbook (www.eon.com)*
Typical Wind Farm
Submarine Cable Installation

American Wind Energy Association (AWEA)
Offshore Compliance Recommended Practices, 16 Sep 2012

7.3.4.1: Overview: “there are no agreed-upon international or national standards for installation of either submarine medium-voltage array cables or submarine high-voltage export cables.”

7.3.4.6: Cable Installation: “An inspection-class underwater remotely operated vehicle (ROV) may be required of both inter-array and export cables to monitor the cable touchdown point on the seabed through the installation process.”

“70% of insurance claims for offshore wind farms come from the submarine cables”
Offshore Electrical Cable Burial for Wind Farms, BOEM Project # 671, Nov 2011
### 7.3.4.6.3. Cable Protection

- **15 ft (4.5 m) below seabed** “In an anchorage area or in a channel with sizeable ship traffic where considerable maneuvering is required which may result in a ship deploying an anchor.”

- **3-6 ft (1-2 m) below seabed** “In all other areas, depending on cable design requirements for burial, installation needs, and site-specification circumstances.”

<table>
<thead>
<tr>
<th>Equipment</th>
<th>Burial Method</th>
<th>Seabed Type</th>
<th>Operational Water Depth</th>
<th>Burial Depth</th>
</tr>
</thead>
<tbody>
<tr>
<td>ROV trencher</td>
<td>Hydro jetting</td>
<td>Sand and clay up to 75kPa</td>
<td>5m to 2,000m</td>
<td>Up to 3.0m</td>
</tr>
<tr>
<td>ROV tractor</td>
<td>Mechanical cutting</td>
<td>Up to 40MPa</td>
<td>Up to 500m</td>
<td>Up to 3.0m</td>
</tr>
<tr>
<td>ROV tractor</td>
<td>Hydro jetting</td>
<td>Up to 75kPa</td>
<td>Up to 500m</td>
<td>Up to 3.0m</td>
</tr>
<tr>
<td>Jetting sled—surface mounted power pack</td>
<td>Hydro jetting</td>
<td>Up to 75kPa</td>
<td>0 to 50m **</td>
<td>Up to 5.0m</td>
</tr>
<tr>
<td>Jetting sled—vehicle mounted power pack</td>
<td>Hydro jetting</td>
<td>Up to 75kPa</td>
<td>5m to 50m **</td>
<td>Up to 5.0m</td>
</tr>
<tr>
<td>Plow</td>
<td>Passive</td>
<td>Up to 75kPa</td>
<td>Up to 500m</td>
<td>Up to 3.0m</td>
</tr>
<tr>
<td>Plow</td>
<td>Hydro jetting</td>
<td>Up to 75kPa</td>
<td>Up to 500m</td>
<td>Up to 3.25m</td>
</tr>
</tbody>
</table>
10.3.1: General:

“An in-service inspection plan (ISIP) should be developed for the offshore wind facility that addresses individual wind turbine facilities, the entire offshore wind facility, its infrastructure, and any electric service platform.”

10.3.2: Frequency of Inspections:

![Underwater Routine Inspections Table]

ASCE Manual 101, Underwater Investigations, Table 2-2
10.3.4 & 5: Subsea Platform Inspections:

• Circumferential Welds
• Splash Zones
• Corrosion Protection Areas
• Risers/J-tubes
• Electrical Cables
• Seabed Scour Areas
Questions?