Equipment for Offshore Wind Turbine Installation

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www.GustoMSC.com
Goal of Presentation

Brief introduction of GustoMSC
Introduction to Offshore Wind
Create a feeling for the scale and sizes
Position of GustoMSC in this market
Contents of Presentation

- Introduction
- Offshore Wind
- Installation of Wind Turbine
- GustoMSC Design & Construction
- Developments in WTI Equipment
History GustoMSC

- 1862  Start of Gusto shipyard (The Netherlands)
- 1977  Start of Marine Structure Consultants B.V. (Sliedrecht)
- 1978  Start of Gusto Engineering (Schiedam)
- 2003  Start of GustoMSC alliance
Total number of employees: over 5100 representing 38 nationalities
SBM Offshore Group

Business approach

Exploration  Construction  Production

Jack-up

Semi-submersible

Vessel
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Offshore Wind

Power & size development

RePower 5 MW blade
61.5 m
Offshore Wind

GE 3.6 MW
North Sea Wind Farms
Projected Development

Annual wind power installations EU (2000-2030)

Data collected in February 2010 Source: EWEA, European Wind Energy Association, Pure Power, p.47
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Present Installation Methods

This is the result of serious work
Present Installation Methods
Present Installation Methods

Hammering Monopiles
Present Installation Methods

Transition piece

Jack-up Wind

Photo’s courtesy Mammoet
Present Installation Methods

Transition piece (grouted)
Present Installation Methods

Steel tower ( bumpers & guides?)

Photo courtesy Mammoet
Present Installation Methods

Nacelle

- Converter
- Gearbox
- Onboard-Crane
- Rotor Bearings
- Hub
- Transformer
- Generator
- Yaw System
Present Installation Methods

Nacelle
Present Installation Methods

Nacelle installation

Vagant
Present Installation Methods
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GustoMSC WTI vessel

Film

GustoMSC's Wind Turbine Installation Jack Up Vessel
Basic Design Class Approved package:

A. Arrangements of all relevant spaces
B. Hull Basic Construction Plans
C. Jacking System Basic Construction Plans
D. Marine Principle Diagrams
E. Key one line and short circuit calculations
F. Specifications and supporting calculations
Design process

Possible Tank tests if required
GustoMSC Jack Up Technology

**Jacking System**
‘High speed double acting system’

- Leg square: 4 x 4 m
- Cylinder: 700 mm
- Rod: 300 mm

**Performance**

<table>
<thead>
<tr>
<th></th>
<th>Speed</th>
<th>Leg Load</th>
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<tbody>
<tr>
<td>Leg handling</td>
<td>2 m/min</td>
<td>-</td>
</tr>
<tr>
<td>Jacking</td>
<td>1 m/min</td>
<td>3750 ton</td>
</tr>
<tr>
<td>Holding</td>
<td>-</td>
<td>7500 ton</td>
</tr>
</tbody>
</table>
GustoMSC Jack Up Technology

Hydraulic Cylinders

Hydraulics by Bosch Rexroth
GustoMSC Jack Up Technology

Leg construction
GustoMSC Cranes (for WTI)

Column Crane on pedestal

- GCC-500-HD
- GCC-550-ED
- GCC-850-HD
- GCC-1000-HD
GustoMSC Cranes (for WTI)

Boom assembly
GustoMSC Cranes (for WTI)

Crane tub section
GustoMSC Cranes (for WTI)

Winches & Slewing gear
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Future development

- Monopiles
- Gravity Foundations
- Floating Structures
- Tripods, Jackets, Trusses

Substructure Cost vs. Water Depth (meters)

Courtesy: NREL
North Sea Wind Farms

UK Round 3 (planned 2020)

Bars show the minimum and maximum numbers of installations required within each water depth range.

The low figure assumes all 6MW turbines, the high figure assumes all 3.6MW turbines.
New GLC design
(5 are being built at present)
Lift capacity 800 ton
Water depth 40 - 45 m
Future development

CHALLENGES for installations:

- cost reduction (€/kWh)
- handling larger turbines
- faster and safer installation
- deeper water / future foundations
Equipment for Offshore Wind Turbine Installation

Questions?