Rising to the Offshore Challenge

Offshore – Siemens Wind Power A/S, Brande, Denmark
Siemens Wind Power nr. 1 position is based on 20 years of offshore experience

<table>
<thead>
<tr>
<th>Year</th>
<th>Event</th>
<th>Turbine Size</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>1991</td>
<td>World's 1st offshore wind farm</td>
<td>5 MW</td>
<td>Vindeby</td>
</tr>
<tr>
<td>2000</td>
<td>World's 1st offshore wind farm w/ large turbines</td>
<td>40 MW</td>
<td>Middelgrunden</td>
</tr>
<tr>
<td>2003</td>
<td>World's largest offshore wind farm in operation</td>
<td>166 MW</td>
<td>Nysted</td>
</tr>
<tr>
<td>2009-10</td>
<td>World's largest offshore wind farm in installation</td>
<td>504 MW</td>
<td>Greater Gabbard</td>
</tr>
<tr>
<td>2009</td>
<td>World's largest offshore wind farm ever contracted</td>
<td>630 MW</td>
<td>London Array</td>
</tr>
</tbody>
</table>

- #1 in offshore orders 2007, 2008, 2009 \((2 \text{ GW signed!})\) and in 2010
- **Leading market share** in 2007, 2008, 2009 and 2010
- Succeeded in industrializing the industry (from 5MW to 630MW wind farms)
Worldwide market leader in offshore projects

- Largest offshore agreement → 500 turbines to be installed
- Baltic I, DE → 21 turbines (offshore) ¹)
- Sheringham Shoal, UK → 88 turbines (offshore)
- Lillgrund, SE → 48 turbines (offshore)
- Burbo Banks, UK → 25 turbines (offshore)
- Rødsand II, DK → 90 turbines (offshore) ¹)
- Rhyl Flats, UK → 25 turbines (offshore) ¹)
- Horns Rev II, DK → 91 turbines (offshore) ¹)
- Lynn / Inner Dowsing, UK → 54 turbines (offshore)
- Middelgrunden, DK → 20 turbines (offshore)
- Greater Gabbard, UK → 140 turbines (offshore) ¹)
- Samsø, DK → 10 turbines (offshore)
- Gunfleet Sands, UK → 30 turbines (offshore) ¹)
- Nysted/Rødsand, DK → 72 turbines (offshore)
- Gunfleet Sands II, UK → 18 turbines (offshore) ¹)
- Vindeby, DK → 11 turbines (offshore)

¹) in installation
Competent solutions in all phases of a wind power plant project

**Planning**
- Siting guidance
- Financing packages
- Insurance packages
- Network evaluation

**Construction**
- Product delivery
- Project management
- Installation
- Commissioning
- Local presence around the globe

**Service and Expansion**
- Inspections
- Maintenance programs
- Modernizations
- Extensions
- Repairs
- Spare parts
- Training
- Global service network

**Operation**
- Operation & maintenance agreements
- Monitoring
- Diagnostics
Siemens Offshore Wind
- One Supplier for Generation and Transmission

Now selling Siemens Offshore Package – Buy your Turbines with a Grid!
**Our answer for advanced turbine technology:**
**SWT-2.3: Well fit for sites close to the shore**

<table>
<thead>
<tr>
<th>Main data:</th>
</tr>
</thead>
<tbody>
<tr>
<td>IEC Class IEC:</td>
</tr>
<tr>
<td>Rotor diameter:</td>
</tr>
<tr>
<td>Blade length:</td>
</tr>
<tr>
<td>Swept area:</td>
</tr>
<tr>
<td>Hub height:</td>
</tr>
<tr>
<td>Annual output at 9 m/s</td>
</tr>
<tr>
<td>Rotor weight:</td>
</tr>
<tr>
<td>Nacelle weight:</td>
</tr>
<tr>
<td>Tower weight:</td>
</tr>
<tr>
<td>Installed offshore:</td>
</tr>
<tr>
<td>Ordered for offshore:</td>
</tr>
</tbody>
</table>
Our answer for advanced turbine technology: SWT-3.6-107/120: The No. 1 offshore machine

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<th>Main data:</th>
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<tbody>
<tr>
<td>IEC Class IEC: IA / IA/B</td>
</tr>
<tr>
<td>Rotor diameter: 107 / 120 m</td>
</tr>
<tr>
<td>Blade length: 52 / 58.5 m</td>
</tr>
<tr>
<td>Swept area: 9,000 / 11,300 m²</td>
</tr>
<tr>
<td>Hub height: Site specific</td>
</tr>
<tr>
<td>Annual output at 9 m/s 15,437 / 16,793 MWh</td>
</tr>
<tr>
<td>Rotor weight: 95 / 100 t</td>
</tr>
<tr>
<td>Nacelle weight: 125 t</td>
</tr>
<tr>
<td>Tower weight: Site specific</td>
</tr>
<tr>
<td>Prototype installed: 2004 / 2009</td>
</tr>
<tr>
<td>Serial production: 2006 / 2010</td>
</tr>
<tr>
<td>First installed offshore: 2007 / 2011</td>
</tr>
<tr>
<td>Installed offshore: 143 units</td>
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<tr>
<td>Ordered for offshore: 800+ units</td>
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Prototype installed: 2004 / 2009
Serial production: 2006 / 2010
First installed offshore: 2007 / 2011
Installed offshore: 143 units
Ordered for offshore: 800+ units
Siemens wind turbines were specially designed for offshore application and act as a role model for the overall industry.

**General layout of SWT-3.6 nacelle**

**Offshore modifications**
- Offshore modifications implemented as part of basic design.
- **Easy maintenance** – transformer and HV switchgear in tower bottom (SWT-3.6)
- **Corrosion protection, outside** – surface protection to C5M in splash and spray zone
- **Corrosion protection, inside** – "closed room system", with climate control (dehumidifiers, salt filters) and cooling via heat exchangers.
- **Harsh environment protection** - Opening reduced to a minimum
Our answer for advanced turbine technology: Integral Blade without glue joints

Siemens Integral® Blade

- The blade is manufactured in a single operation, using a closed process invented by Siemens
- No glue joints between spars and shells, no weak points, no easy access for water or lightning
- Combining superior strength with excellent power and noise performance
Lightning strikes - only surface damage due to the Integral Blades®

Since the Integral Blade has been introduced in 2001…

• Thousands of lightning strikes
• No blade destroyed by lightning
Our answer for advanced turbine technology: Continuous monitoring to prevent failures

Turbine Condition Monitoring

- Designed to continuously monitor the external and internal state of the wind turbine
- 24 / 7 precise online vibration measurement on the gearbox, the generator and the main shaft bearings
- Detect significant deviations from its normal operating condition
- Prevention of costly breakdowns
- Reduced service costs
- Optimized availability and energy generation
Build up a strong presence in key markets around the globe
Global Offshore Hubs

- Head Office in Brande, Denmark
- Regional Office in Frimley, UK
- Regional Office in Hamburg, Germany
- Regional Office in Beijing, China for APAC (2010)
- Regional Office in Boston, USA for Americas (2010)
Siemens Wind Power in Korea

Siemens - as world market leader in wind offshore – is in continuous contact with developers in Korea.

Siemens is already boosting the Korean wind Industry by sourcing components from Korean suppliers.

Siemens foresees the emergence of a Korean wind turbine manufacturing capability, even without foreign presence but is willing to support if requested.

Siemens is prepared to set up local production in Korea when the market takes off.
Contact us for more information

**Gustl-Bernhard Friedl**
CEO Offshore Region
E R WP OF
gustl-bernhard.friedl@siemens.com
+45 9942 8970

**Theresa Cooke**
Director of Offshore Business Development
E R WP OF BD
theresa.cooke@siemens.com
+45 9942 2142

Siemens Wind Power A/S
Borupvej 16, 7330 Brande, Denmark

Source: Vendors, developers, Emerging Energy Research

YTD 2010

Siemens: 359 MW
Repower: 0 (240MW out of frame contract ‘09)
Vestas: 0
CAPEX - The offshore turbine makes up 45 - 48% of the total investment for water depths up till 30m and 50km offshore.

### Project specifications of the offshore wind farms in Horns Reef and Nysted

<table>
<thead>
<tr>
<th>Project name</th>
<th>Installation year</th>
<th>Capacity [MW]</th>
<th>Turbine size [MW]</th>
<th>Investment Costs [€ million]</th>
</tr>
</thead>
<tbody>
<tr>
<td>Horns Reef</td>
<td>2002</td>
<td>160</td>
<td>2</td>
<td>272</td>
</tr>
<tr>
<td>Nysted</td>
<td>2004</td>
<td>165</td>
<td>2.3</td>
<td>248</td>
</tr>
</tbody>
</table>

Source: EWEA

### Offshore

- **Turbine (incl. Transport and installation)**: 48%
- **Foundations**: 21%
- **Transformer stations and main cable to coast**: 6%
- **Design and project mgmt.**: 3%
- **Environmental analysis**: 1%
- **Misc.**: 11%

### Onshore

- **Turbine (incl. installation)**: 78%
- **Transformer station (incl. grid connection)**: 11%
- **Foundation**: 6%
- **Design/project mgmt.**: 2%
- **Environmental analysis**: 1%
- **Misc.**: 2%

Source: EWEA