Wind Power and Renewables Division
Facts at a glance

<table>
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<th>Siemens Wind Power facts</th>
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<td>One of the world’s leading suppliers of wind power solutions</td>
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<td>Acquired Danish wind turbine manufacturer Bonus Energy A/S in 2004</td>
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<td>Installed Base: &gt; 16,300 turbines with ~ 31,000 MW capacity</td>
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<td>Installed in FY 2015: &gt; 1,970 turbines with &gt; 5,6 GW capacity</td>
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<td>~12,850 employees globally incl. Wind Service</td>
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<td>Revenue in FY 2015: € 5,7 billion</td>
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Wind Power and Renewables Division
Market and locations

**Market**

Market growth for wind energy (installed capacity in MW) is estimated at 2% a year (2012 - 2018)*:

- Onshore (2012 - 2018): 0.7% p.a.

Market position:

- No. 1 in offshore market
- No. 4 in global installations (2013)

**Locations**

- **Headquarters**: Hamburg, Germany
- **Production locations**:
  - **Denmark**
    - Nacelles: Brande
    - Blades: Aalborg
    - Blades: Engesvang
  - **China**
    - Blades and Nacelles: Lingang City, Shanghai
  - **Americas**
    - Nacelles: Hutchinson, Kansas, USA
    - Blades: Fort Madison, Iowa, USA
    - Blades: Tillsonburg, Ontario, Canada

**Sales and service centers worldwide**

* Market Update 2013
Wind Power
Customer focused regional set-up

- Sales
- Engineering
- Execution
- Quality/EHS
- Regional Manufacturing
- Service Training Center
### Siemens Americas Wind Power facts

1. One of the world’s leading suppliers of wind power solutions
2. Installed base in Americas: ~ 7,100 turbines with > 13,900 MW capacity
4. ~1,800 Americas employees (~1,100 in manuf., ~550 in service)
5. Americas headquarters located in Orlando, FL
Strong presence in key markets

- Goldendale, WA
  - Service

- Boulder, Colorado
  - R&D wind & aerodynamics

- Hutchinson, Kansas
  - Nacelles/Hubs

- Wichita, Kansas
  - Distribution Center

- Houston, Texas
  - Americas Service Center

- Mexico City, Mexico
  - Local Sales

- Lima, Peru
  - Business Hub

- Santiago de Chile
  - Local Sales

- Ontario, Canada
  - Business Hub

- Ontario, Canada
  - Blade Facility

- Boston, MA
  - Offshore

- Ft. Madison, Iowa
  - Blade Manufacturing

- Orlando, Florida
  - Americas HQ & Service Training Center

- Woodard, Oklahoma
  - Service

- Sao Paulo, Brazil
  - Business Hub

- Buenos Aires, Argentina
  - Local Sales

- R&D
- Supply chain
- Blades
- Nacelle/Hub
- Sales hubs
- Other sales
- Service
- Training
The Siemens Wind Power product platforms

Platforms

Siemens G2 Platform
Siemens D3 Platform
Siemens G4 Platform
Siemens D6 Platform

Products

SWT-2.3-101
SWT-2.3-108

SWT-3.0-101
SWT-3.0-108
SWT-3.2-108
SWT-3.0-113
SWT-3.2-113
SWT-3.3-130

SWT-3.6-107
SWT-3.6-120
SWT-4.0-120
SWT-4.0-130

SWT-6.0-154
SWT-7.0-154

Feature level
e.g. Net C onverter, Scada, TLM
NetConverter®
Superior electrical capabilities

Active power control
- Available output
- Delta control
- Ramp rate control (MW/minute)
- Set point control

Frequency regulation
- Nominal frequency
- $f_{nom}$, $f_{50}$, $f_{60}$ or 50 or 60 [Hz]

Reactive power capability
- Export
- Import

Low voltage ride through

- Maximum flexibility to comply with different grid codes.
- Low OPEX due to less wear and tear of components
- Potential remuneration from ancillary services
SWT-2.3-120
The new standard

- High Capacity Factor ~10% more AEP
- IEC IIB / IIIA
- Extended standard operating conditions (2000m / 40 deg. C)
- Power Boost capability: 5%
- Low sound power level: 106 dBA
- NetConverter® full power conversion
D3: SWT-3.3-130
Simplicity remains keys success criteria.

- High Capacity Factor ~12% more AEP per turbine
- IEC IIA
- Low sound power level: 106 dBA
- NetConverter® full power conversion
Recent Siemens Blades

ATB technology is featured in Siemens most recent products (gold). Larger ATB blades have replaced smaller traditional straight blades on existing wind turbines.

SWT-2.3-120: Optimized for G2 Platform - North American Market

- Designed in Boulder, CO
- Manufactured in Ft. Madison, IA
- Designed w/ Vortex Generators & DinoTails™ for robust performance in the American Plains
NREL-Siemens CRADA  
(Cooperative Research and Development Agreement)

- DOE/NREL and Siemens Wind Power
- SWT-2.3-101 wind turbine is erected at NWTC, Boulder Colorado
- Initial Budget: DOE/NREL $5M ---- Siemens $9M
- Initial Agreement: Jan 2009- Jan 2013
- Recently extended until Jan 2018
- New 108m rotor installed late 2013

Close cooperation between NREL and Siemens on testing campaigns and data Analysis.
National Wind Technology Center– Siemens 2.3-108 wind turbine

- Have a purchase power agreement with Public Service of Colorado
- Initial Service Date of 2010
- Get paid when and if available
- Interconnection through NREL system to the local utility interface
Concrete tower prototype
Offshore – Leading player in strongest growing market

Cumulated Siemens offshore installations

1990:
- 450 kW (ø35m)

First project:
- 1991: 5 MW Vindeby, DK

1991:
- 6 MW (ø154m)

MW turbines:
- 2000: 40 MW Middelgrunden, DK

2011:
- 630 MW London Array, UK

GW project:
- 2012: 1.8 GW DONG Master Agreement

2017:
- (6 MW (ø154m))
Offshore potential is “unlimited”

~ 70GW European offshore site potential (estimate)
~ only 1.5% of site potential installed

Floating turbines could increase offshore potential

North American / China market have significant potential

Source: Sector Energy
Getting the costs of energy down by innovation
B75 – one of the world’s largest rotor blades

• Increased rotor-swept area harvests more wind and is thus crucial for the annual energy yield of the turbine.
• IntegralBlade-Technology: the world's largest fiberglass component cast in one piece.
• No seams or glued joints and no adhesive, all of which saves weight.
Offshore Fixed Foundation Types

- Most offshore foundations are fixed to the bottom of the ocean.
- Normally located in water no more than 60 meters of depth.
- Most common foundation is Monopile but large turbines are using jacket foundations.
Floating Foundation Types

- Many variations of floating offshore platform
- Siemens experience with Spar Buoy
- Most applications will come in the Pacific Ocean in deep water
- Large challenge with cable systems under the water.
Hywind

- Cooperation on technology with Statoil Hydro to develop World's first floating offshore installation
- In 2009 Siemens installed the first turbine in Norway at a water depth of about 220 meters
- Floating offshore turbines could be installed at sites with greater water depths
- New Project off Scotland with five SWP 6 MW wind turbines
Thank You......