How to decrease cost and increase the investment security of renewables

Michael Hannibal | CEO Offshore, Siemens Wind Power and Renewables Division | October 07, 2016
Onshore wind power becomes market competitive by cost decrease

Onshore wind levelized cost ($/MWh)

Cost in $

Wind costs have fallen 50% since 2009

Learning rate 19.0%

Continuous market growth and technology innovation world wide

Accumulated installations onshore and offshore wind

Wind energy with rapid growth in the past decade

Source: Bloomberg New Energy Finance (BNEF)
Onshore wind – what we do to lower cost further and improve on capacity factor

Examples for measures to optimize turbine for sites and further reduce cost

- Optimal turbine fit for every site
- Longer blades
- Higher towers
- Optimization of project execution
Continuous costs out offshore wind – Ambition to reach LCoE of below 8 ct €/kWh by 2025

5 levers for cost reduction

- Turbine
- Foundations
- OPEX
- AEP (Annual energy production)
- Grid connection

Cost out path until 2030

- 2014: 14.5 ct/kWh
- 2020: <10 ct/kWh
- 2025: <8 ct/kWh
- 2030

5 levers for cost reduction:

- Turbine
- Foundations
- OPEX
- AEP (Annual energy production)
- Grid connection
Siemens as offshore leader drives innovations to further reduce costs

**Innovation on turbine**

Innovative turbine: SWT-8.0-154
- Built on proven 6.0/7.0-154
- 10% more AEP vs. 7 MW
- Leverage existing supply chain

Innovative diagnostics
- 200 Gigabyte of data per day
- Detecting damage before it occurs
- Remotely fixing the problems

**... and beyond**

Industrialized jacket foundation
~40% cost reduction compared to traditional concepts

Innovative grid access
- E.g. new HVAC solution requires no separated platform
- 40% cost reduction

**Turbine Size development**

<table>
<thead>
<tr>
<th>Year</th>
<th>Diameter (m)</th>
<th>Power (kW)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1980</td>
<td>11</td>
<td>30</td>
</tr>
<tr>
<td>1991</td>
<td>35</td>
<td>450</td>
</tr>
<tr>
<td>2016</td>
<td>154</td>
<td>8,000</td>
</tr>
<tr>
<td>2016</td>
<td>79.8</td>
<td>7,980</td>
</tr>
<tr>
<td>A380</td>
<td>79.8</td>
<td>8,000</td>
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Cost reductions through industrialization – New factories in the UK and in Germany

### Nacelle production site (SWT-7.0-154)
- Investment of €200 million
- Up to 1,000 jobs
- Allows loading via a Ro/Ro ramp directly on a transport vessel
- Start of production in 2017

- **Cuxhaven**

### Blade production (B75) assembly plan and installation facility
- Up to 1,000 direct jobs
- Allows loading via a Ro/Ro ramp directly on a transport vessel
- Start of production in late 2016

- **Greenport Hull**
Cost improvement of wind energy enables further market growth

World Energy mix development

- Electrification will play a major role in decarbonization
- Wind power contribution of total energy consumption is still at nascent phase

1) IEA Word Energy Outlook 2015, New Policies scenario

Non-electricity energy consumption e.g. Oil & Gas

Electricity

<table>
<thead>
<tr>
<th>Year</th>
<th>Total final energy consumption</th>
<th>Thereof electricity</th>
</tr>
</thead>
<tbody>
<tr>
<td>2013</td>
<td>82%</td>
<td>18% Wind Power</td>
</tr>
<tr>
<td>2030</td>
<td>78%</td>
<td>22% Wind Power</td>
</tr>
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x4 in TWh
New installations and reduced growth – Europe risks falling behind

Europe wind installations, 2000 – 2015 (GW)

Global wind installations, 2000 – 2015 (%)

Source: Bloomberg New Energy Finance (BNEF)
Our industry needs a predictable policy framework and sufficient market volume

Currently planned EU legislation

New Renewables Directive
- **Targets:** Member States should publish their individual targets for post-2020 period as soon as possible, strong governance legislation
- **Reporting mechanism:** European Commission to design scheme including planning and reporting obligations by Member States as well as European Commission oversight

Electricity market design
- **Electricity market design fit for renewables:** Includes priority dispatch for renewable generation, clear curtailment and congestion management rules for TSOs/DSOs
- **Flexibility needs to be properly remunerated**

European Energy Union
- Interconnectors, cross-border trading, regional balancing and capability markets

Market scale and concrete volume commitments are key to ensure investments and continued cost reduction

Prerequisite for successful integration of renewables in the electricity market
THANK YOU FOR YOUR ATTENTION!