The offshore playing field and Vattenfall’s competitive position

London, 17 January 2017
AGENDA

- Vattenfall’s position
- The offshore wind industry and its development
- Regulatory situation
VATTENFALL WIND POWER

Highlights

- Number two in offshore wind in Northwestern Europe plus strong onshore pipeline
- Strong platform and track record to build on
- Highly experienced team managing all key processes with close supplier collaboration along the value chain

Vattenfall is a leading developer and operator of wind power

5.8 TWh electricity generation in 2015

680 employees FTEs as of Q3 2016

SEK 15bn investment plan 2016-2017

1. Q4 is generally the strongest quarter for wind power due to higher wind speeds
WIND PORTFOLIO OVERVIEW

Installed capacity as of Q3 2016

1,936 MW
Consolidated capacity

2,244 MW
Operating capacity¹

Geographical footprint

- Offshore project in operation
- Offshore project in development
- Number of onshore projects country wide

Solid footprint with operations in all of Vattenfall’s five main markets

1. Operating capacity: total capacity of Vattenfall operated assets. Minority shares included as 100%
2. Including 5 MW solar in onshore capacity

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1,093 MW offshore
843 MW onshore²

1,936 MW
Consolidated capacity

2,244 MW
Operating capacity¹

UK² DK NL SE DE

- Offshore (1,327 MW)
- Onshore (917 MW)

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VATTENFALL
OUR OFFSHORE WIND JOURNEY

A pioneer within offshore wind from the outset

Continued growth ambitions

- Offshore wind will be key to achieve the group’s renewables growth target of **2.3 GW commissioned capacity 2016-2020**
- Combined with onshore wind, Vattenfall will **operate 4 GW by 2020 and plans to operate 7 GW by 2025**
- We aim to be a **leader in Levelized Energy Cost reduction** and have the ambition to deliver renewable power, independent of subsidy schemes

Strong track record in offshore wind and continued ambitious growth plans

1. Operating capacity: total capacity of Vattenfall operated assets. Minority shares included as 100%
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2. Pending closing of transaction

Vattenfall is successfully securing its share of future offshore wind capacity in the European market
OFFSHORE WIND FITS WITH VATTENFALL

Multiple reasons for continued focus on offshore wind

- Portfolio transformation
  - Represents large share of accessible renewable energy
  - Potential to be lowest cost renewable energy source
- Regional fit
  - A dominant part of recent growth worldwide in Vattenfall’s markets (DK, NL, GER, UK, SWE)
- Highly de-risked cash flows
  - All offshore wind farms with fixed levels until ~2030
  - Increased predictability of cash-flows provides a broader base for sector investments
- Profitability
  - Higher IRR outlook than onshore/PV due to CAPEX-needs, complexity, and entry barriers
  - Further consolidation will likely lead to a reduced number of small developers
- Vattenfall business
  - Capacity volumes, CAPEX-levels and project complexity fit Vattenfall’s core competences
  - Competitive advantage due to scale and experience
Key takeaways

- The industrialisation of offshore wind is rapidly changing the competitive environment
- Winning bid levels of 372 DKK/MWh (Vattenfall – Danish Kriegers Flak) and 54.50 EUR/MWh (Shell consortium – Borssele 3/4) considered new industry benchmarks
- Offshore wind is experiencing a learning curve similar to other renewable technologies, from learning to fine-tuning
- The development over the last years ensures offshore wind a long term position in the energy production mix, with benefits for the customers/consumers and the most competitive operators

Vattenfall’s competitive advantage is based on three pillars: fast adaptation to the tender landscape, ability to decrease O&M costs applying latest business standards, lean and agile organisation set-up

1. Figures are only considering revenue streams and are not scope-adjusted, e.g., UK OFTO and grid charges. This might lead to 5-15% correction factor, which does not question the trend as such
AN INDUSTRY IN RAPID CHANGE

**Larger turbines**
- Less locations but bigger capacity
- Less resources (concrete, steel etc.) and cables
- Less charter-times for vessels
- Shorter construction periods

**Park size development**
- Increasing Operational Efficiency
- Economies of scale in procurement and project management

**Clustering of assets**
- Increasing Operational Efficiency
- O&M form shared Offshore Accommodation Platform
- Strategic Spare Parts Management
- Lessons Learned from past construction operations in the area

The offshore industry is maturing, leading to significant cost reductions
### AN INDUSTRY IN RAPID CHANGE – SPECIFIC EXAMPLE

<table>
<thead>
<tr>
<th>Sandbank</th>
<th>Horns Rev 3</th>
<th>Δ</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Project Size</strong></td>
<td>288 MW</td>
<td>407 MW</td>
</tr>
<tr>
<td><strong>Turbine Capacity (Type)</strong></td>
<td>4.0 MW (Siemens SWT 4.0-130)</td>
<td>8.3 MW (Vestas V164-8.3)</td>
</tr>
<tr>
<td><strong># of Locations</strong></td>
<td>72 Locations</td>
<td>49 Locations</td>
</tr>
<tr>
<td><strong>Rotor Diameter</strong></td>
<td>130 m</td>
<td>164 m</td>
</tr>
<tr>
<td><strong>Swept Area per WTG</strong></td>
<td>13,273 m²</td>
<td>21,124 m²</td>
</tr>
<tr>
<td><strong>Hub Height</strong></td>
<td>94 m</td>
<td>102 m</td>
</tr>
<tr>
<td><strong>Wind Speed @ Hub Height</strong></td>
<td>10.2 m/s</td>
<td>9.7 m/s</td>
</tr>
<tr>
<td><strong>Water Depth</strong></td>
<td>25 – 34 m</td>
<td>10 – 20 m</td>
</tr>
<tr>
<td><strong>Distance to Shore</strong></td>
<td>~90 km</td>
<td>~30 km</td>
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</tbody>
</table>

Whilst technology developments lead to cost reductions, each project needs to be viewed in isolation due to different characteristics.
DANISH KRIEGERS FLAK ILLUSTRATES THE DEVELOPMENT OF THE INDUSTRY

**Key facts**

- Attractive site specifics with wind speeds comparable to North Sea projects
- Economies of scale: 600MW site offering a good size for project synergies in terms of procurement, project management and operational optimization
- 372 DKK/MWh for the first 50,000 Full Load Hours instead of a defined timeframe
- Favourable regulation around turbine selection and installation
- Long installation window (3 years)

**Favourable site specifics and market conditions make Kriegers Flak a highly attractive project for Vattenfall**

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**Illustrative development of Levelized Energy Cost**

- Sandbank
- Horns Rev 3
- Danish Kriegers Flak
REGULATORY REGIMES ARE BECOMING MORE MARKET-ORIENTED

Illustrative transition

Difference in tender set ups

a) Central vs decentral
b) Prequalification vs. no prequalification
c) Lead time between bid and commissioning
d) Fixed bidding level vs. marketing responsibility + premium

Competitive tenders with an increasing number of participants have resulted in strong competition and continued cost reductions
KEY SUCCESS FACTORS FOR VATTENFALL IN OFFSHORE WIND

A) Supply chain interaction
- Technical experience sharing on existing construction projects and running assets feeding into future projects
- Supplier market addressed with portfolio approach

B) Portfolio focus
- Strong advantage on the learning curve given our size and findings from past projects
- Optimization of resource and skill allocation to projects in different stages

C) New O&M concepts
- Digitalization of O&M processes
- Reduced unplanned maintenance

Vattenfall is well positioned to lead the offshore industry development
## OVERVIEW OF REGULATORY REGIMES

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<tr>
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<th>Sweden</th>
<th>Denmark</th>
<th>Germany</th>
<th>Netherlands</th>
<th>UK</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Subsidy System</strong></td>
<td>Certificate System: Certificate price paid on top of electricity spot price</td>
<td>Auctioning system 4x700 MW until 2023 – projects awarded to developer with lowest feed-in premium on a full load hour basis</td>
<td>New auction scheme to be introduced; transition (2x1.55 GW) 2016 and 2017 to centralised auction system (0.84 GW annually) starting 2018</td>
<td>Auctioning system 4x700 MW until 2023 – projects awarded to developer with lowest feed-in premium</td>
<td>Post-Brexit: New Department for Business, Energy and Industrial Strategy (DBEIS). Contracts for Difference and Capacity Market auctions</td>
</tr>
<tr>
<td><strong>Duration</strong></td>
<td>Price determined in certificate market, Currently 15-20 EUR/MWh, for 15 years</td>
<td>Current results: Kriegers Flak 372 DKK/MWh and Danish Near Shore 475 DKK/MWh</td>
<td>20 years and 25 years license</td>
<td>20 years, Borselle 1+2: 72.70 EUR/MWh Borselle 3+4: 54.50 EUR/MWh</td>
<td>In March 2016, the government announced further auctions for contract allocation up to GBP 730 million available for offshore wind and other less established technologies. The first of these auctions will be worth GBP 290 million</td>
</tr>
<tr>
<td><strong>Comment</strong></td>
<td>New renewables target: 100% Renewables in 2040 without Nuclear, No offshore-specific subsidy yet</td>
<td>Grid costs covered by the government</td>
<td>Allocation of grid connection by Federal Network Agency, OSS including in project scope</td>
<td>Grid costs covered by the government</td>
<td>Offshore support announced to continue (target 10 GW installed before 2020 + 10 GW after 2020)</td>
</tr>
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1. Hjuleberg, Högabjär, Hoge Väg and Juktan

**VATTENFALL STRATEGIC PARTNERSHIPS**

**DanTysk 288 MW**  
Stadtwerke München 49%  
Vattenfall 51%

**Sandbank 288 MW**  
Stadtwerke München 49%  
Vattenfall 51%

**Horns Rev 1 160 MW**  
DONG 40%  
Vattenfall 60%

**Ormonde 150 MW**  
AMF 49%  
Vattenfall 51%

**Swedish onshore 140 MW**  
Skandia 50%  
Vattenfall 50%

**Egmond aan Zee 108 MW**  
Shell 50%  
Vattenfall 50%