Hva er utsiktene for flytende vindturbinner til havs?
Klimafrokost, Bergen 15/2-2017
Simen Moxnes, Statoil
NES Strategy

Build a profitable renewables business

Develop new lower-carbon business opportunities for Statoil’s core products

OFFSHORE WIND

SOLAR

ENERGY STORAGE

NCS – CO2 STORAGE

CO2 use /IOR

HYDROGEN
Statoil and offshore wind

Offshore wind projects currently in progress delivering >1100 MW
Additional 4800 MW consented / ~5 mill. homes

<table>
<thead>
<tr>
<th>Project</th>
<th>Capacity</th>
<th>Status</th>
<th>Year</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hywind demo</td>
<td>2.3 MW</td>
<td>In operation</td>
<td>2009-</td>
</tr>
<tr>
<td>Sheringham Shoal</td>
<td>317 MW</td>
<td>In operation</td>
<td>2012-</td>
</tr>
<tr>
<td>Dudgeon</td>
<td>402 MW</td>
<td>In development</td>
<td>2017</td>
</tr>
<tr>
<td>Hywind pilot</td>
<td>30 MW</td>
<td>In development</td>
<td>2017</td>
</tr>
<tr>
<td>Arkona</td>
<td>385 MW</td>
<td>Consented</td>
<td>2019</td>
</tr>
<tr>
<td>Dogger Bank</td>
<td>4 x 1200 MW</td>
<td>Consented</td>
<td>2020-</td>
</tr>
</tbody>
</table>

* All capacity figures on 100% basis

Playing to our strengths
- Complex projects
- Marine operations
- O&M & HSE ability
- Leading floating tech.

Attractive market
- Attractive risk/return
- Predictable revenue
- OECD countries
- High entry barriers

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Masdar 25% share
New York Licenses
Vanndyp nær noen av verdens viktige energimarkeder

- North sea – Norway and UK
- US, Atlantic and Pacific coast – and Great Lakes
- Japan and Korea
- Iberian Peninsula and Mediterranean Sea
The Hywind Concept

Proven technology in a new setting

- Simple spar-type substructure
- Standard offshore wind turbine
- Conventional 3-line mooring system
- Blade pitch control system for motion damping
- Suitable for harsh conditions

Demo ➔ Pilot Park ➔ Large parks
• Excellent HSE record - No serious incidents
• Produced 55 GWh since start-up in 2009
• Production as good as or better than other 2.3 MW Siemens wind power turbines
• Experienced storms with wind speed over 44 m/s and maximum wave height of 19 m
• Verification of system integrity in operational mode
Realising the Hywind Scotland pilot park

- Investing around NOK 2 billion
- Partner: Masdar 25%
- 60-70% cost reduction from the Hywind Demo project in Norway
- Powering ~20,000 UK homes

- Installed capacity: 30 MW
- Water depth: 95-120 m
- Avg. wind speed: 10.1 m/s
- Area: ~4 km²

- Average wave height: 1.8 m
- Export cable length: ~30 km
- Operational base: Peterhead
- Start power production: 2017
Oppskalering 2,3 -> 6 MW

Hywind Demo

Hywind Scotland
1st Substructure (HS 3) in full length at Assembly Area
Challenges - Bringing down the cost
Cost reduction of 40-50% by 2030 a realistic target

LCOE (NB: Illustrative)
Piloting Batwind concept for Hywind

Floating Wind + Storage + Grid

1. Capture wind overshoots
   Ability to store excess electricity for sale when capacity is free

2. Reduce balancing cost
   Counter impact of wind forecasting errors

3. Increase power market value
   Capture price peaks through arbitrage

4. Deliver power system services
   Provide frequency reserve response and other ancillary services

- Increase the value of floating wind
- Start developing new business models around storage in Statoil
The future for floating offshore windpower

- Large resource potential
- Hywind is the most mature concept
- Statoil is an experienced developer with a strong financial position
- Target markets for the next step