



Hywind Scotland, status and further plans

Science meets industry 14 May 2014

Statoil

Statoil is an international energy company with operations in 36 countries. Building on 40 years of experience from oil and gas production on the Norwegian continental shelf, we are committed to accommodating the world's energy needs in a responsible manner, applying technology and creating innovative business solutions.



Building the Portfolio: Material positions in fixed offshore wind

Project execution to operations: Sheringham Shoal, UK

317 MW In operation, 2012



Working to bring technology costs down: Dudgeon Offshore, UK

> Up to 560 MW Under development



Larger projects, deeper waters, further from shore: Doggerbank, UK

> Up to 9 GW Under consent





Floating wind - Potential markets



North sea - Norway and UK



US, Atlantic and Pacific coast - and Great Lakes



Japan and Korea



Iberian Peninsula and Mediterranean Sea



Water depths

Hywind Demo – the world's first full scale prototype

WTG 2.3 MW

- Conventional technology used in a new way
 - slender floating cylinder (simple sub-structure)
 - conventional 3-line mooring system
 - use of standard offshore wind turbine
- In operation from September 2009
 - produced 36 GWh since start-up
 - capacity factor 50% in 2011 (overall 40%)
 - experienced wind speed of 40 m/s and maximum wave height of 19 m
- Blade pitch control to dampen out motions
- Floater motions have no negative impact on turbine performance
- Concept verified







Hywind Demo Assembly and Installation - 2009

• Simple and safe assembly and installation





Key characteristics of Hywind concept:

- Floating substructure enabling mass production
- Assembled inshore reducing time and risk
- Traditional anchoring
 low installation cost
- Flexibility installation, maintenance and removal
- Resistant to environmental effects



From Idea to Commercial Concept

- The technical concept is considered proven
- Next step: Pilot parks to demonstrate improvements and cost reductions
- Large parks is the end game objective





Pilot Park objectives

- Test multiple units in park-configuration
- Optimise assembly and installation
- Verify scaled up, lighter design
 - Fabrication
 - Forces from WTG onto tower and sub-structure
- Verify reliability and availability of optimised multiturbine concept
- Reduce construction risk for future full scale park
- Mobilise supply chain

Demonstrate cost efficient and low risk solutions for commercial scale parks



Hywind Pilot Park configuration



Hywind Scotland Pilot Park Project introduction

	Hywind Scotland
Installed capacity (5 WTGs)	30 MW
Area (sea level)	~4 km ²
Water depth	95-120 m
Average wind speed (@100 m)	10.1 m/s
Mean waves, Hs	1.8 m
Offshore export cable length	Ca.30 km
Onshore cable length	Ca.2-3 km
Transmission voltage	33 kV
Mooring	Pre-laid chains
Anchor	Suction





Hywind Scotland Pilot Park

100% Statoil project

3.5 ROC and grace period of 18 months

Agreement for Lease signed Nov. 2013

Grid application submitted Dec. 2013

Concept selection (DG2) Sep. 2014

Consent application ready for submission Jan. 2015

FID (DG3) anticipated Q3 2015 Final commissioning (DG4) Q3 2017 Energy production 0,13 TWh/yr No OFTO Lifetime 20 years



Scottish Government positive to floating wind



Scottish First Minister Alex Salmond visits Statoil, August 2010





- Scottish consultation regarding introduction of a separate band for «experimental offshore wind»
- The European Commission has granted state aid approval for the introduction of an enhanced ROC (i.e. 3,5 ROC/MWh) for floating wind in Scotland
- Draft legislation published by the Scottish Government in February 2014 containing the details about the enhanced ROCs for floating wind
- Approved by the Scottish Parliament this year



Pilot park area and export cable corridor



• Base case pilot park location – final location has not yet been decided.



Assembly, Tow to site and Hook-up

- Upending/ballasting of substructure and assembly of WTG in deep sheltered, inshore waters
 - Lifting heigth increased significantly(63,5 m to 97 m), available vessels very limited
 - West coast most promising
 - Two assembly methods considered
 - Crawler crane on barge lifting WTG components from barge
 - Large crane barge lifting the fully erected turbine from shore
- Tow-out of floating WTGs to field
 - 2-4 tugs (8-12 days) per unit
 - North of Orkney
- Moorings
 - 3x pre-installed chains
 - Suction anchors







Heavy Maintenance

- Heavy maintenance philosophy for Hywind Demo not critical because the design lifetime of the demonstration unit is short compared to what is required for a commercial wind farm.
- Heavy maintenance will have an effect on the overall regularity of the Hywind Scotland pilot park, and on all other commercial offshore wind farms.
- Smart (cheap and safe) solutions for replacement of large components are needed.



THANK YOU FOR YOUR ATTENTION.

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