New energy solutions

Marte Godvik, Statoil, R&T, Renewables | The Future of Energy at UiB

Statoil

Shaping the future of energy

Competitive at all times

Transforming the oil and gas industry

Providing energy for a low carbon future





Business areas

Exploration

•Exploit prolific basins
•Test impact opportunities
•Access at scale

Development & Production

•Safe and secure operations
•Drive cost and capital efficiency
•Capitalise on technology and operating experience

Midstream & marketing

•Leverage European gas position
•Onshore access to premium markets
•Exploit global trading competence

Portfolio management

•Realise value
•Sharpen our upstream profile
•Strengthen execution and financial resilience

New Energy Solutions

•Build a distinct growth portfolio of profitable new, non- oil and gas options
•Identify and develop business models to drive demand for our core products

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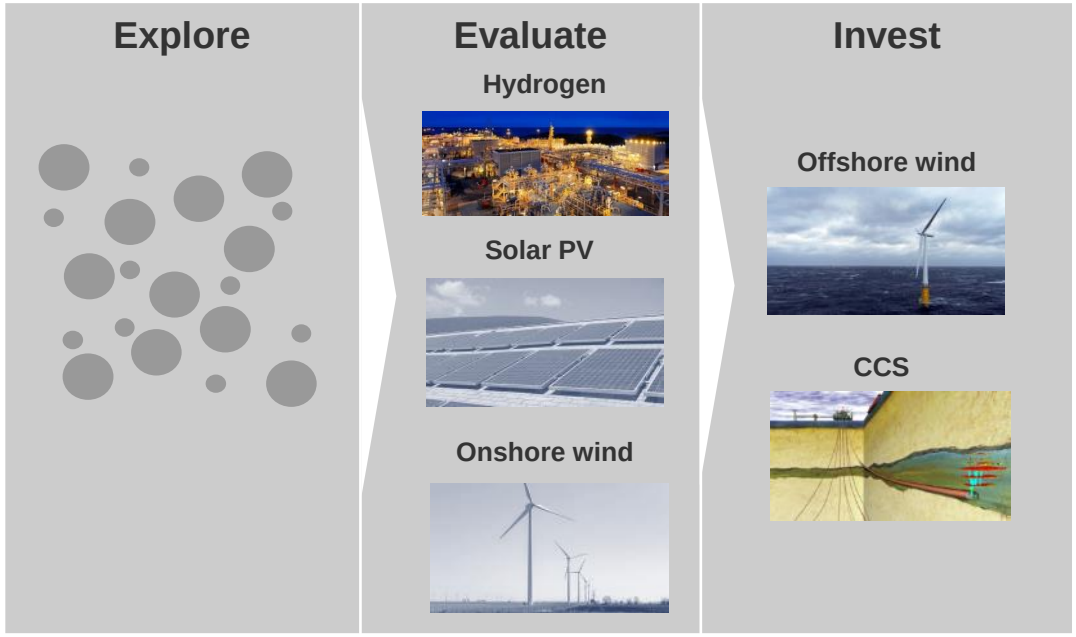
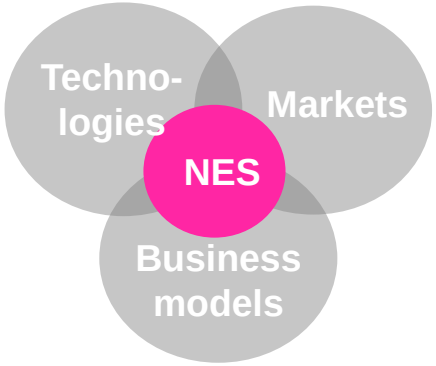
Where to focus?

Taking a wide perspective



Seeking *solutions*, not technologies



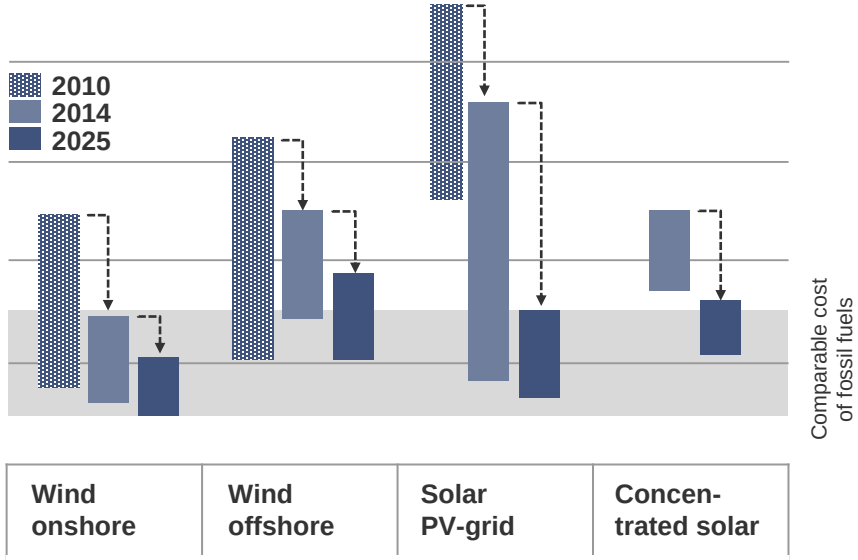
Investing with firm capital discipline

- **Competitiveness**: Attractive risk/returns
- **Materiality**: Potential to build scale in Statoil
- **Relevance**: Building on core competence

Lower costs drive strong growth

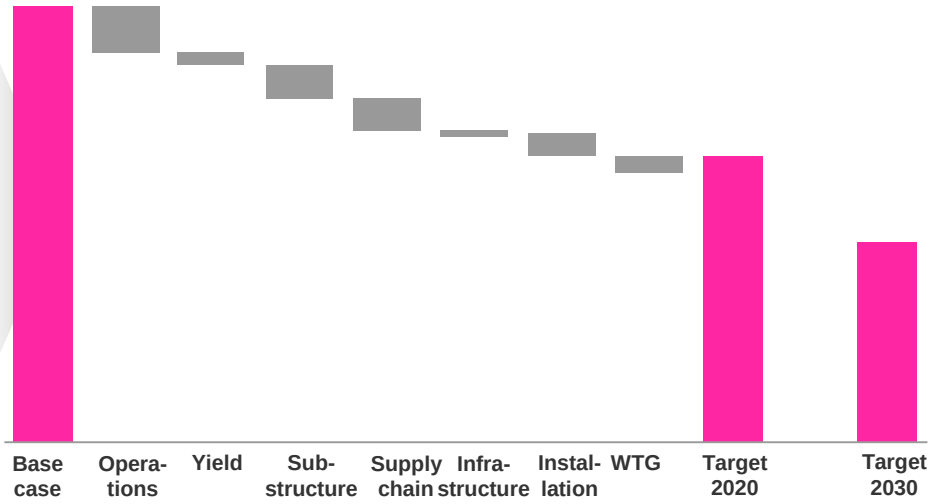
Costs rapidly coming down

Power, global LCOE ranges



Cost reduction of 40-50% by 2030 realistic

- floating offshore wind competitive without support regimes



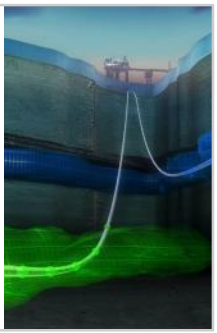
Source: IRENA; Statoil analysis

Portfolio

CO_2 management:
Proven technology, developing commerciality

Playing to Statoil's strengths

- Leveraging our oil & gas competence and experience



Potential market

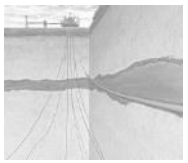
- CCS to deliver 13% of CO2 emission cuts by 2050 in IEA 2DS
- Commercial models needed

COP21 · CMP11
PARIS 2015
UN CLIMATE CHANGE CONFERENCE

Operating some of world's largest CCS projects

Capturing up to 1.8 MT CO2/yr / ~850,000 cars/yr

COP21 drives momentum on climate action

Sleipner	In Salah	Snøhvit LNG	TCM	New NCS CO2 storage	Tenders for concept studies (New)
					
In operation	Injection stopped*	In operation	CO2 capture	Feasibility studies	
1 MT/yr.	**~1 MT/yr.**	**0.7 MT/yr.**	**0.1 MT/yr.**		
1996-	2004-11	2008-	2012-	2016-	

** Due to preliminary conclusions regarding reservoir properties – mainly related to capacity*

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Offshore wind projects to power >1M homes

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

Offshore wind projects currently in progress delivering >1100 MW

Additional 4800 MW consented / ~5 mill. homes

North West Europe | Japan | United States

Hywind demo	Sheringham Shoal	Dudgeon	Hywind pilot	Arkona (New)	Dogger Bank	Hywind large scale
						
In operation	In operation	In development	In development		Consented	
2.3 MW	317 MW	402 MW	30 MW	385 MW	4 x 1200 MW	
2009-	2012-	2017	2017	2019	2020-	

** All capacity figures on 100% basis*

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Piloting Batwind @ Hywind Scotland

- Battery and converter as integrated part of Hywind project
- 1 MWh storage capacity in pilot

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

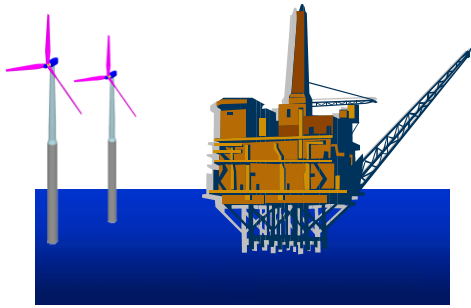
2 Reduce balancing cost
Can introduce own regulation of power supply

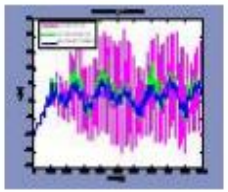
3 Increase power market value
Opportunity to capture price peaks through arbitrage

Hywind

What is Hywind?

- Floating wind turbine
- A standard offshore wind turbine placed on a ballasted vertical steel cylinder, anchored to seabed
- Active motion controller
- Statoil-owned technology

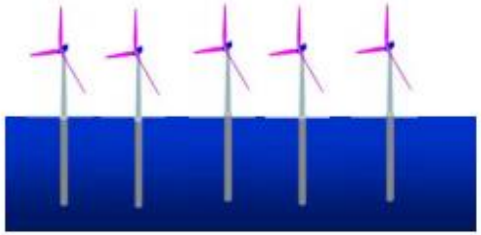




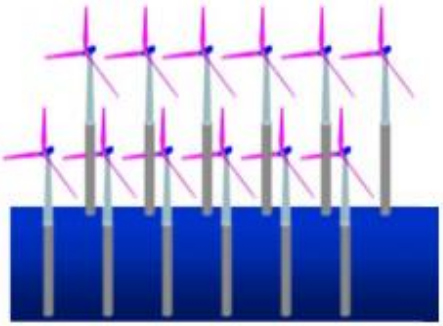
Concept
2001

Model test
2005

Full-scale prototype
2009



Hywind Scotland pilot park 2017



Large Parks, 500-1000MW

Hywind Demo Project
- the world's first full scale floating turbine

- Overall capacity factor of 40%
- Wind speed of 44 m/s and maximum wave height of 19 m
- Floater motions have no negative impact on turbine performance
- Observed behaviour and collected data confirm initial model assumptions

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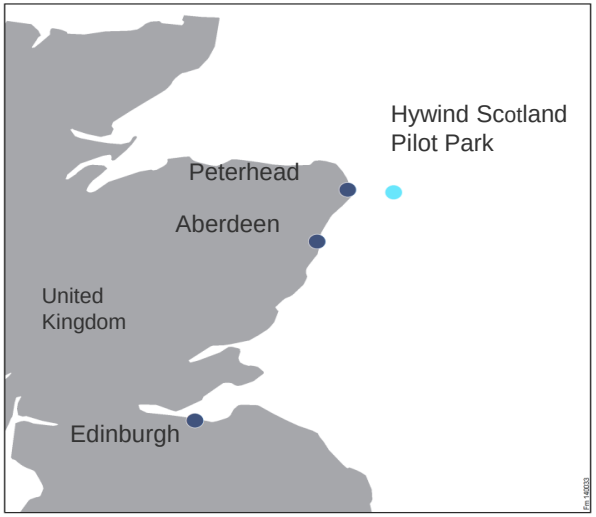
Hywind Scotland Project
- A pilot park

- 5 x 6MW turbines in a park
- Location at Buchan Deep outside Peterhead
- Investing around NOK 2 billion
- 60-70% cost reduction from Hywind Demo project
- Powering ~20,000 UK homes
- First deliveries to grid 2017



Primary objective:
Demonstrate feasibility, cost efficient and low risk solutions for commercial scale parks

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Hywind Scotland - project objectives

Demonstrate cost-efficient and low risk solutions for commercial scale parks

- Test multiple units in park-configuration
- Verify up-scaled design
- Verify reliability and availability of optimized multi-turbine concept
- Mobilize supply chain

Hywind Demo Hywind Scotland

Upscaling from Demo 2009 to Hywind Scotland 2014

Dimension	Hywind Demo	Hywind Scotland
Mass	5300 tons	~11500 tons
Hub height	~65 m	~100 m
Draught	100 m	~75 - 80 m
Diameter of sub-structure	8.3 m	~14 - 15 m
Water depth	220 m	~95 - 120 m
Rotor diameter	~85 m	154 m
Capacity	2.3 MW	6.0 MW

Where are the next floating wind opportunities?

Utilities

Why floating wind?
- Security of supply
- Limited space
- Sustainability

Big cities

Why floating wind?
- Transmission
- Electrification
- Limited space

Islands

Why floating wind?
- Cost of alternatives
- Security of supply
- Limited space

Oil and gas

Why floating wind?
- Emission taxes
- Cost of fuels
- License to operate

Illustration photos from Flickr.com: Moyan Brenn, Darshan Simha and Nosha. Oil and gas photo by Statoil.

Expanding the potential floating wind market

Thank you

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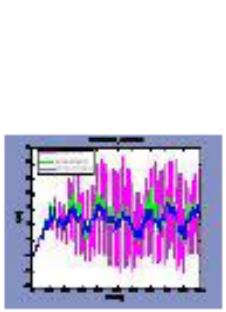
Commercialisation of Hywind

Status:	Next step:	End goal:
• The technical concept is considered proven	• Pilot park to demonstrate improvements and cost reductions	• Commercial scale parks of 500-1000 MW • Cost competitive with bottom fixed



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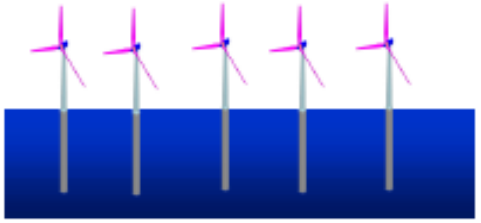

Hywind Scotland pilot park 2017