



The history of Hywind / R&D role in development of offshore wind,

Novitech final seminar, Trondheim 22-23 August 2017

Arne Eik, Leading business developer Hywind

CLIMATE ROADMAP

Creating a low carbon advantage

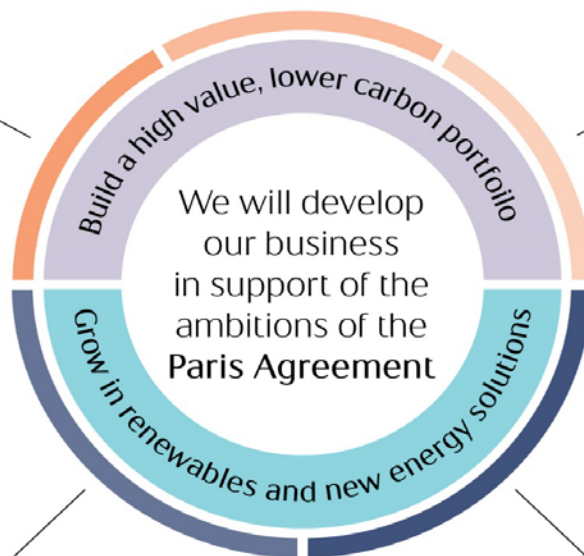
Methane emissions in the gas value chain is below **0.3% of gas delivered** to the market for Norwegian gas to Europe

We aim to reduce our carbon intensity to **8kg CO₂/boe** by 2030

We aim to reduce emissions with **3 million tonnes/year** accumulated from 2017 to 2030

We expect **15-20% of our investments** to be in new energy solutions by 2030

We expect low carbon R&D to account for **25% of research funds** in 2020



All investment decisions are evaluated against our **climate ambition**

Strong growth in new energy solutions

Build a **profitable renewables business**

OFFSHORE WIND



SOLAR

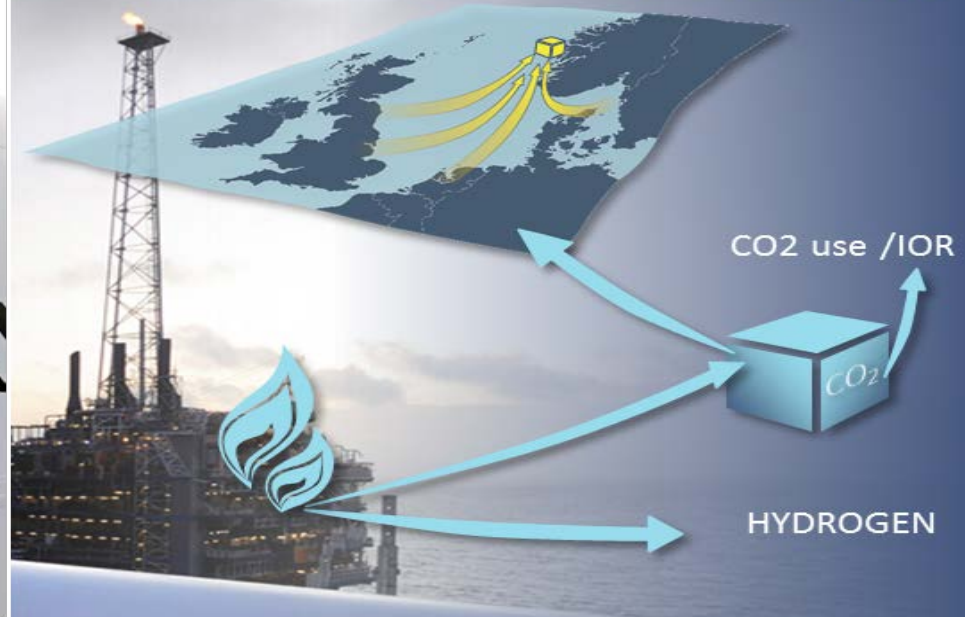


ENERGY STORAGE



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

NCS – CO₂ STORAGE

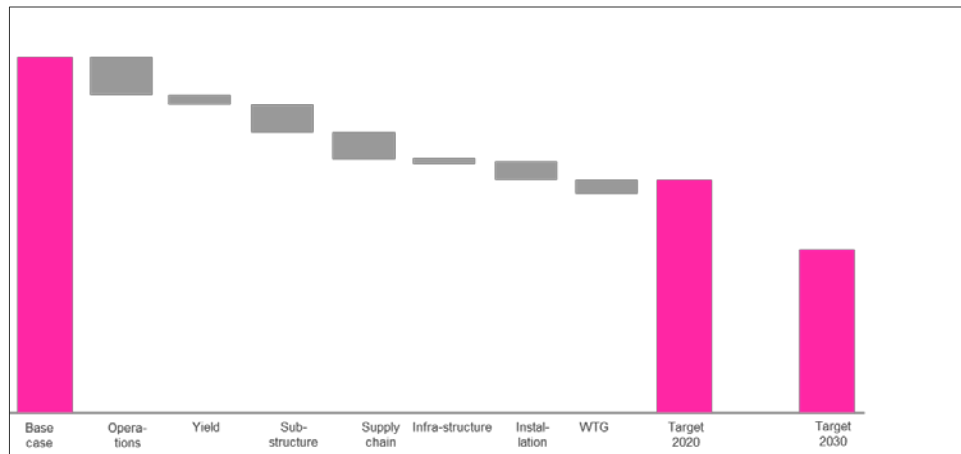


Why is Nowitech important to Statoil?

- Excellent **collaboration** venue for academia and industry
- Development of several **technologies**.
 - SIMA has become our main internal analysis program for load and response on wind turbines
 - 3D-float has been used in an early stage of Hywind Scotland development.

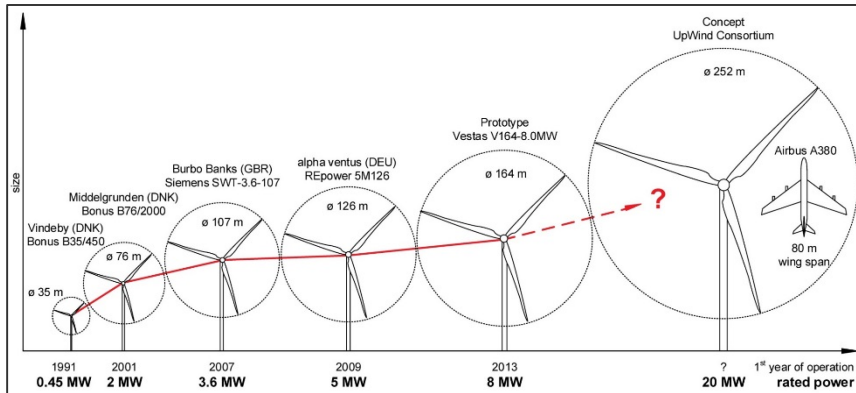
Taking the next step – cost reductions

- Cost reductions of at least 50% by 2025-2030 is considered a realistic target
- Technology development and optimization / industrialization and standardization
 - Potential for further standardization and better wind sites compared with bottom-fixed
- Large investments required to set up streamlined fabrication lines
- Need predictable project pipeline and frame conditions



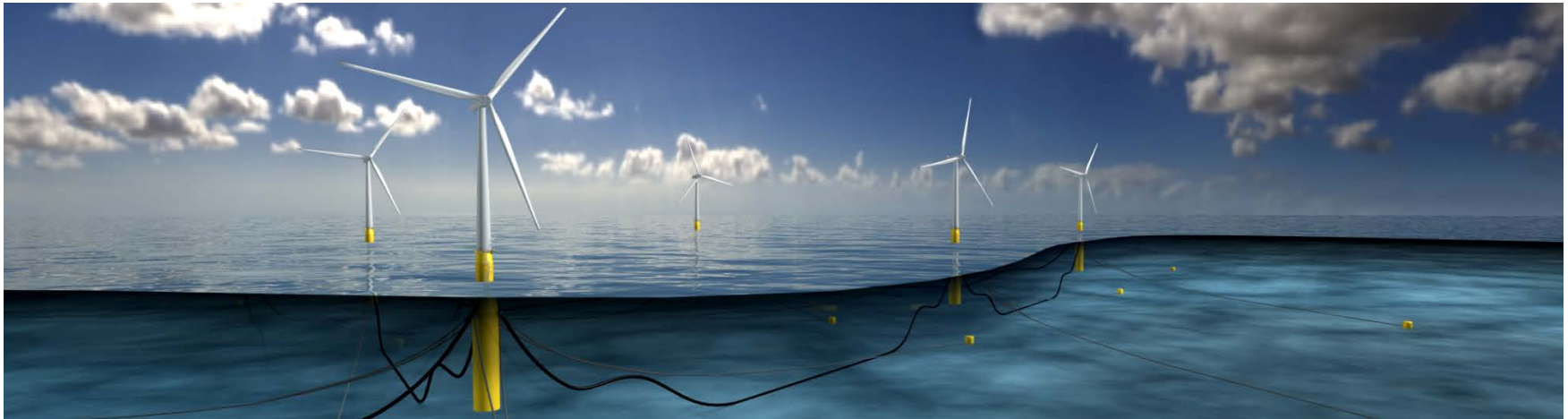
Taking the next step – technology development

- Technology needs to be sufficiently demonstrated and de-risked to be bankable
- Testing and data collection & analysis on multiple units for a longer duration
- Concept need to be scalable to 10-20MW turbines
- Further design optimization and more efficient installation and O&M methods



Summary

- Floating wind has a large potential, and development of new project opportunities is ongoing
- The Hywind concept is proven, and will be further demonstrated on Hywind Scotland
- Cost and technology challenges can be overcome by close cooperation with research institutions and industry



Statoil. The Power of Possible

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Strategic beliefs...

COST

- The main challenge for FOW is to get perceived (long time) costs down towards BFOW levels
- FOW has a significant, but not forbidding fundamental cost disadvantage in relation to BFOW
- The cost saving potential of FOW lies mainly in industrialization (mass production, specialized installation vessels), but also in technology development
- FOW is now at the same maturity level as BFOW was ~10 years ago

MARKETS

- Large markets (US, Japan, China, UK) can be willing to pay a substantial premium (relative to «market price») if they see a need for FOW in the long run, and believe that costs can come down
- Smaller markets can be willing to pay up to the cost of the replaced energy, plus a limited «green» premium
- Except in markets where depth prohibits bottom-fixed (BFOW), markets for FOW will first emerge when BFOW potential is exhausted, and at gradually growing depths

TECHNOLOGY

- There is a large cost saving potential in learning from the shipbuilding industry
- Statoil can leverage our R&T and project resources to develop cost-saving technologies
- In the short to medium term, FOW may piggy-back on BFOW technologies (turbines, installation vessels) to save costs
- FOW will in time mature into one single industry-wide concept, but with several varieties
- Partnerships withare needed in order to.....

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