

Norwegian Research Centre for Offshore Wind Technology

www.nowitech.no

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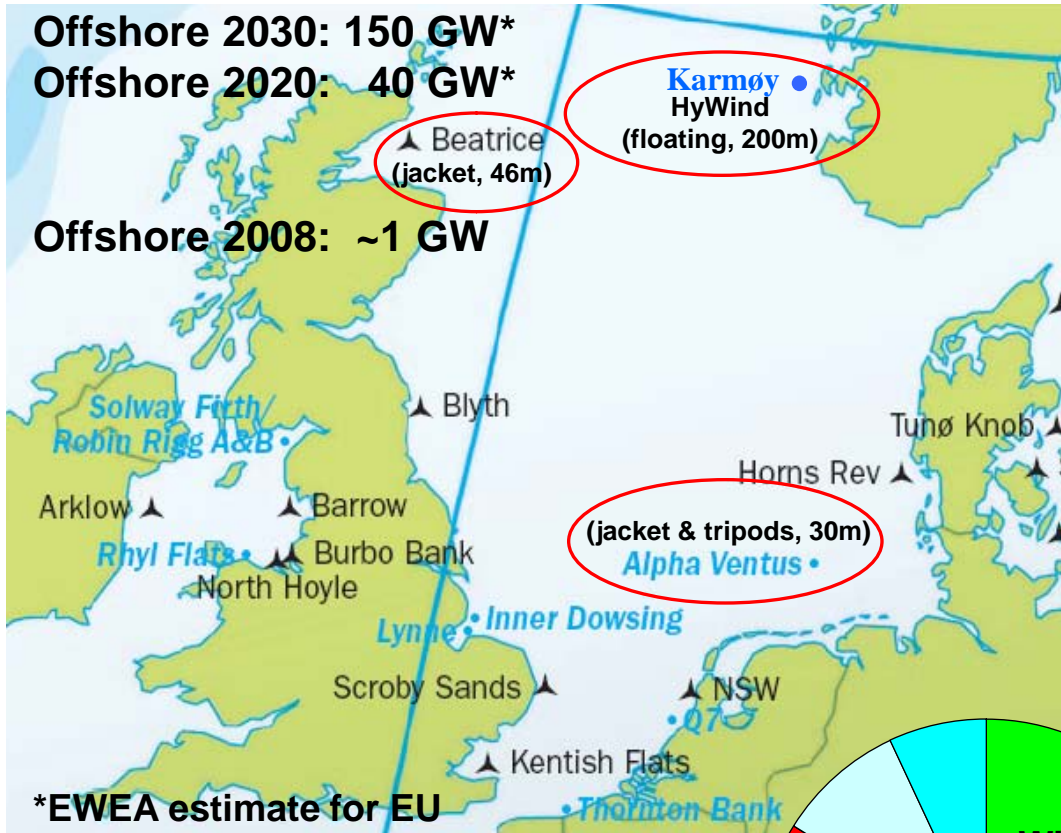
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Strong motivation for offshore wind R&D

Offshore 2030: 150 GW*

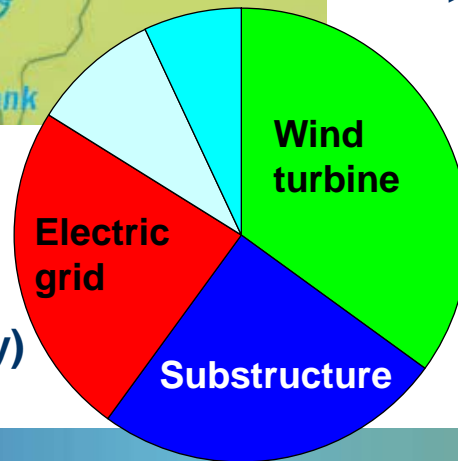
Offshore 2020: 40 GW*

Offshore 2008: ~1 GW



- ▶ Huge potential: 150 GW expected by 2030 in EU
- ▶ Offshore wind is vital for battling climate change, development of industry and contributing to security of supply
- ▶ Development at an early stage – only 3 full scale tests on +30 m water depth realized by 2009
- ▶ Technology needs to be developed to reduce costs per kWh

CAPEX distribution offshore wind farm (DTI study)



NOWITECH in brief

► Objective:

Pre-competitive research laying a foundation for industrial value creation and cost-effective offshore wind farms. Emphasis on deep sea (+30 m).

► Work packages:

1. Numerical design tools (including wind and hydrodynamics)
2. Energy conversion system
(new materials for lightweight blades & generators)
3. Novel substructures (bottom-fixed and floaters)
4. Grid connection and system integration
5. Operation and maintenance
6. Concept validation, experiments and demonstration

► Total budget (2009-2017):

+NOK 320 millions including 25 PhD/post docs

R&D partners



Associate R&D partners



Industry partners



Associate industry partners



Vision

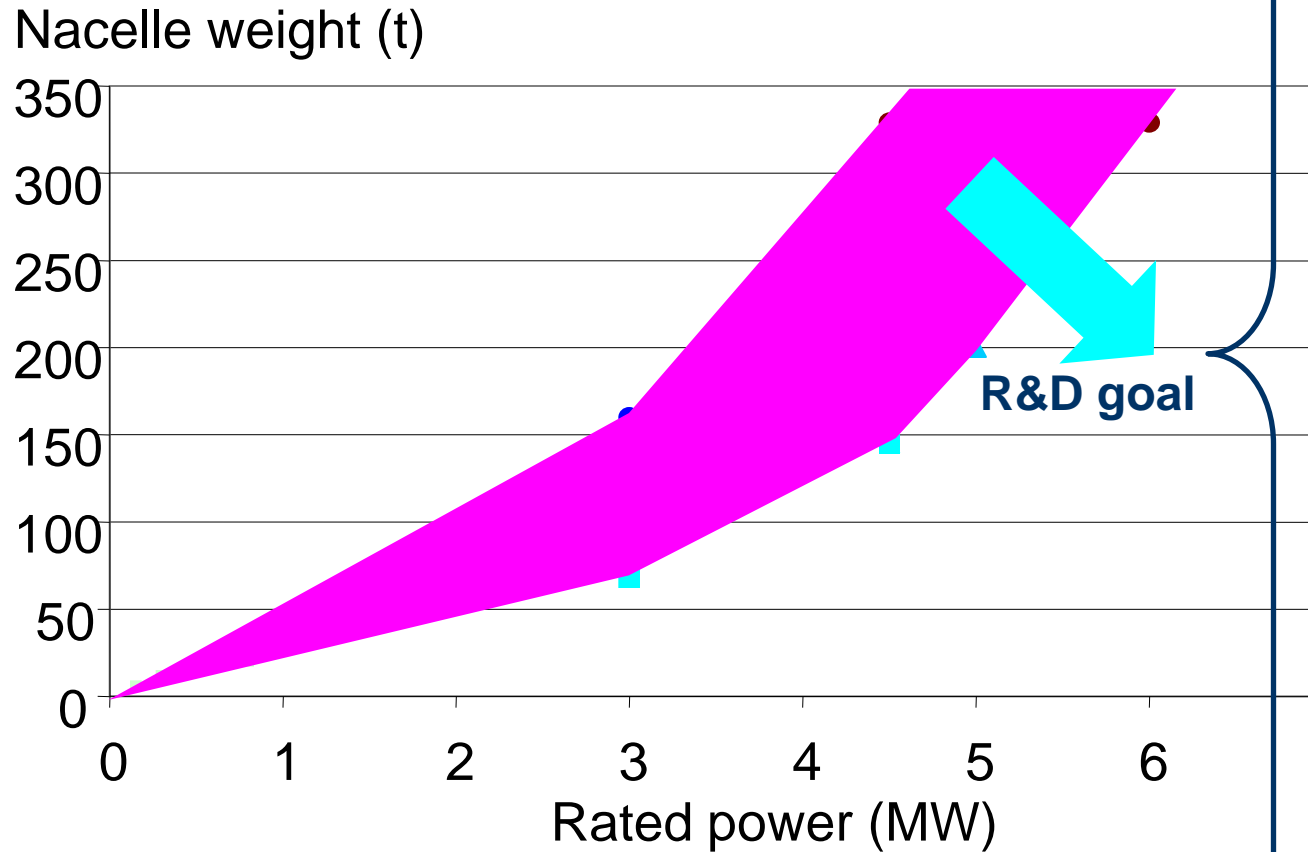
- ▶ **large scale deployment of deep sea offshore wind turbines**
- ▶ **an internationally leading research community** on offshore wind technology enabling industry partners to be in the forefront.

Means and main ambitions

- ▶ **Combine wind technology know-how with offshore and energy industry experience to enhance development of offshore wind.**
- ▶ **Establish a recruitment and educational programme that provides for highly qualified staff at Master and PhD level for serving the industry.**
- ▶ **Build strong relations with selected top international research partners.**
- ▶ **Facilitate active involvement by industry partners to ensure relevance and efficient communication and utilization of results.**
- ▶ **Support to industry is through pre-competitive research – commercial development will come as a result and be run in separate projects.**
- ▶ **Actively pursue opportunities to increase R&D activity on critical issues.**

R&D example:

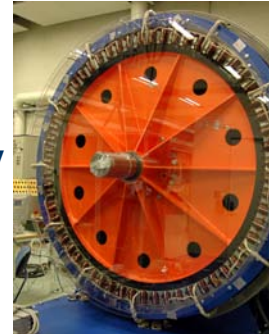
Tower top weight is critical for keeping the cost down



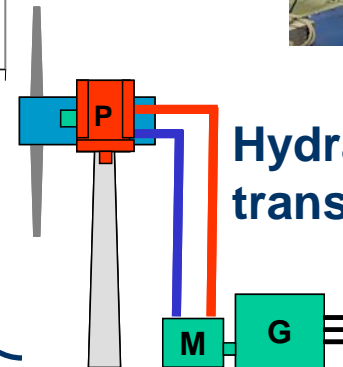
Down-wind rotor



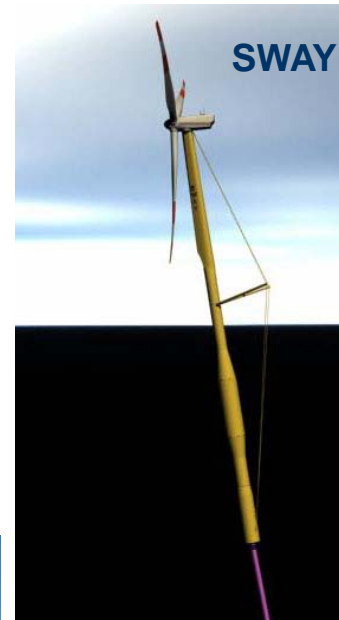
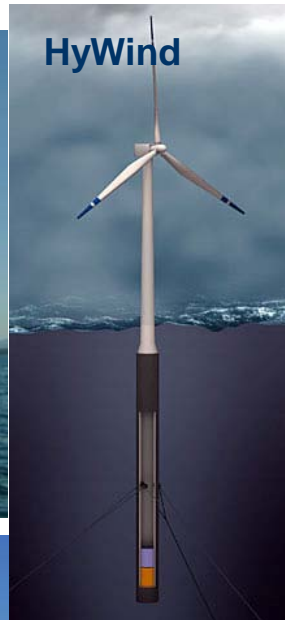
New generator technology



Hydraulic transmission



R&D example: Floating wind turbines - a solution for the future!

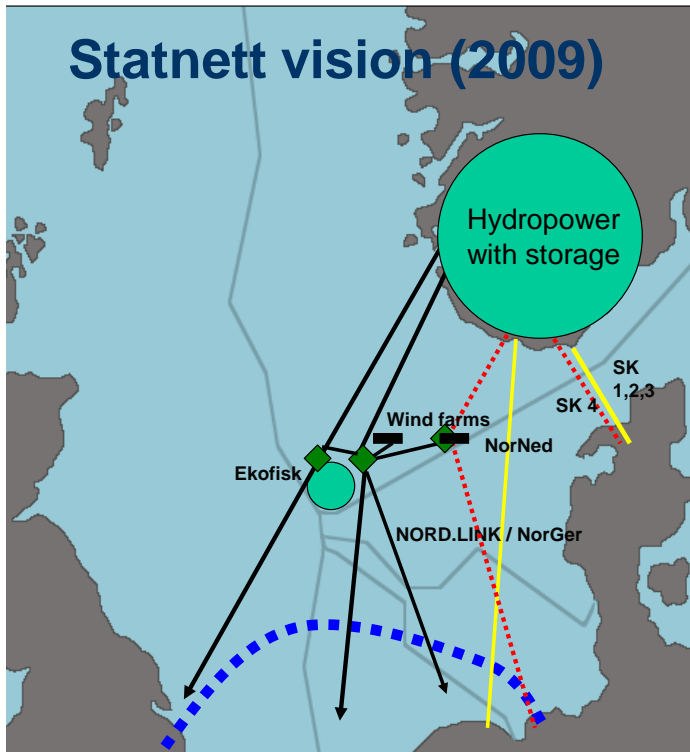


- ▶ HyWind 2,3 MW test in operation Sept. 2009
- ▶ Still a long way to go before large scale commercial deployment of floating wind turbines

R&D example:

An optimized grid is a key for efficient integration

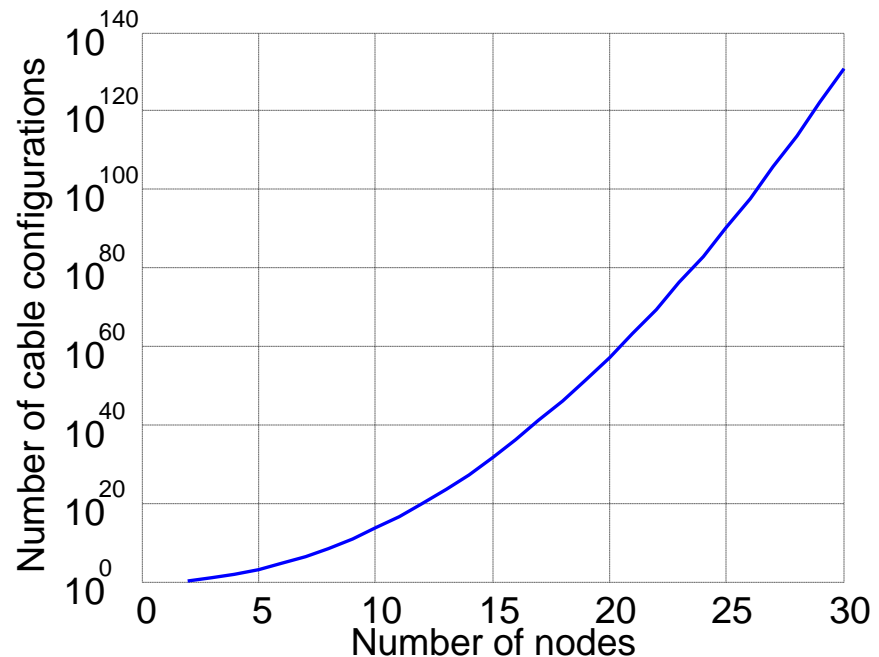
Statnett vision (2009)



**Wind and hydro:
a win-win combination**

Main challenges

- ▶ Many possible grid configurations
- ▶ New market solutions are required
- ▶ New technology (HVDC VSC, multi-terminal, hybrid HVDC/HVAC, ..)
- ▶ Cost, Reliability and Security of Supply



Achievement:

Research gives basis for industrial development

- ▶ Competence achieved through RCN projects have been critical for industrial development, e.g. ChapDrive, HyWind, SWAY
- ▶ Education is a key; NOWITECH has started 14 Phd/post doc studies, and 12 new grants are announced (April 2010)
- ▶ Research School in progress with offshore wind lectures etc
- ▶ Lab facilities are being developed for enhancing the quality of research, e.g. SmartGrids lab, EFOWI and NOWERI
- ▶ New projects with industry are being developed
- ▶ Promote test & demo programme together with industry: DEMO2020
- ▶ Results are disseminated effectively – wind energy R&D seminar held every January in Trondheim since 2004

How to bridge the gap between R&D and large scale deployment of deep sea offshore wind?

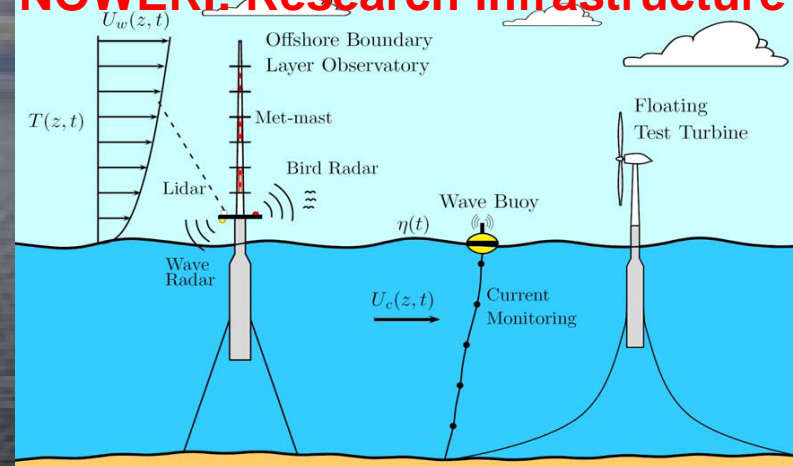
- ▶ Suggestion: Test & demonstration programme necessary steps between R&D and large scale deployment

DEMO 2020: single turbines / wind farms

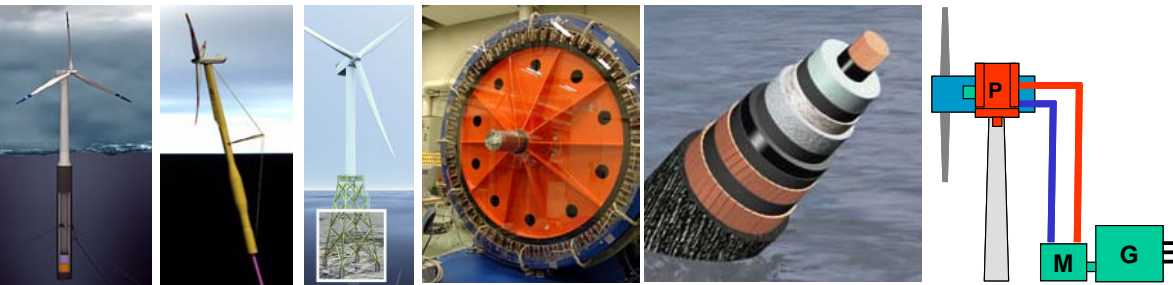
- ▶ Phase 1: 2011-2014
- ▶ 8 turbines w sub-structures, cables, grid connection, test-programme, ..
- ▶ Total budget (phase 1) 2 - 4,5 GNOK
- ▶ Qualify suppliers for UK round 3, and other early starting markets

Picture from Alpha Ventus (DE)

NOWERI: Research infrastructure



- ▶ Test and Demonstrate deep sea technology (bottom fixed & floaters)
- ▶ Utilize R&D results & gain new knowledge
- ▶ Create new industry and employment



Rounding up

- ▶ Remarkable results are already achieved by industry and R&D institutes on offshore wind
- ▶ Technology still in an early phase – Big potential provided technical development and bringing cost down to a competitive level
- ▶ Offshore wind is a key for large scale energy supply, developing new industry and battling climate change!
- ▶ NOWITECH plays a significant role in providing new knowledge as basis for industrial development of cost-effective offshore wind farms
- ▶ Cooperation between research and industry is essential for ensuring relevance, quality and value creation