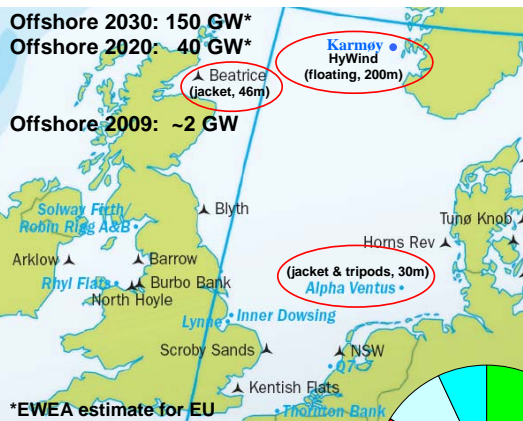


Demo 2020. A test- and demonstration programme for Norway

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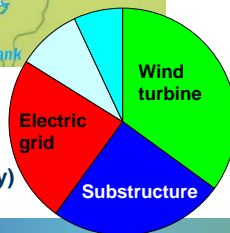
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A huge international market



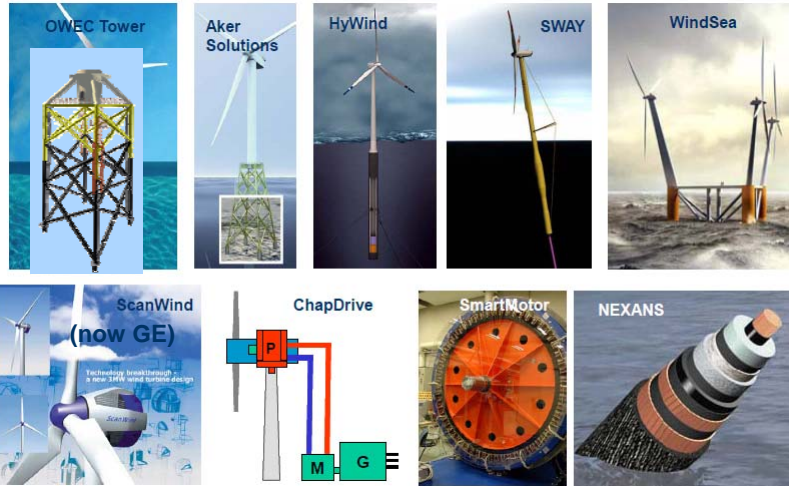
- ▶ Norwegian industry are taking part as wind farm developers and suppliers of goods and services
- ▶ This demonstrates ability to compete, BUT the question is how to secure future large supplies!

CAPEX distribution offshore wind farm (DTI study)



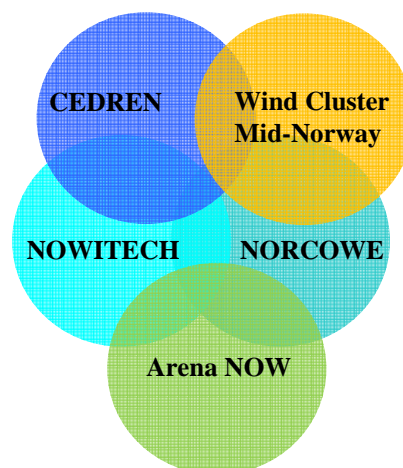
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Norway is developing offshore wind technology



3

A strong cluster on offshore wind



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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).
- ▶ **R&D partners:** SINTEF, IFE, NTNU + associates: Risø DTU (DK), NREL & MIT (US), Fraunhofer IWES (DE), University of Strathclyde (UK)
- ▶ **Industry partners:** Statkraft, Statoil, Vestavind Kraft, Dong Energy, GE Energy, EDF, Lyse, Statnett, Aker Solutions, SmartMotor, NTE, DNV, Vestas, Fugro Oceanor, Devold AMT, TrønderEnergi
+ associates: Innovation Norway, Enova, NORWEA, NVE, EBL, Navitas
- ▶ **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

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NORCOWE - in brief

- ▶ **Vision:**
Combine Norwegian offshore technology and Danish wind energy competence + Create innovative and cost effective solutions for deep waters and demanding offshore conditions
- ▶ **R&D partners:** CMR, UNI Research, University of Bergen, University of Agder, University of Stavanger, Aalborg University (DK)
- ▶ **Industry partners:** Statkraft, Vestavind Offshore AS, Agder Energi, Statoil, Lyse, Aker MH, National Oilwell Norway, Origo Engineering, Norwind
- ▶ **Work packages:**
 1. Wind and ocean
 2. Offshore wind technology and innovative concepts
 3. Marine operations and maintenance
 4. Optimisation of wind farms
 5. Common topics: Education, Security, Environment, Test facilities and infrastructure
- ▶ **Total budget (2009-2017):** NOK 240 millions including ~20 PhD/PostDocs

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Arena - Wind Cluster Mid-Norway "Building Norway's Bremerhaven"



Måløy



Aker Midsund As planlegger for vertskapsrolle for utviklingsprosjekter i forbindelse med demolegg på Havsul 1



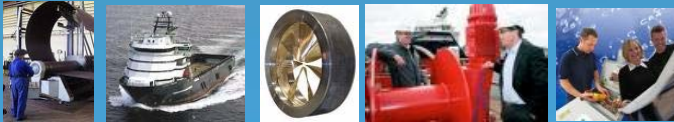
VINDi.MØRE



Et miljø med sterke aktører, som:

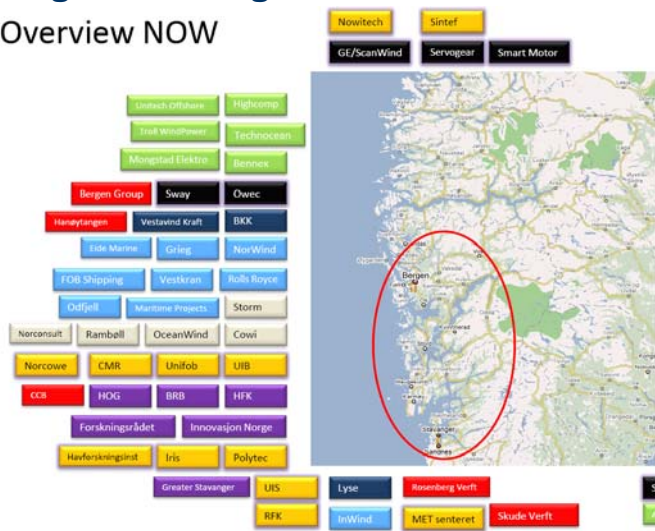


Møre og Romsdal har på mange områder et verdensledende sterkt cluster innen maritim sektor; og offshore, skipsverft, skipsutstyr og et sterkt ingeniøermiljø – som nå vurderer mulighetene innen offshore vindkraft.



Arena NOW – Bergen/Stavanger

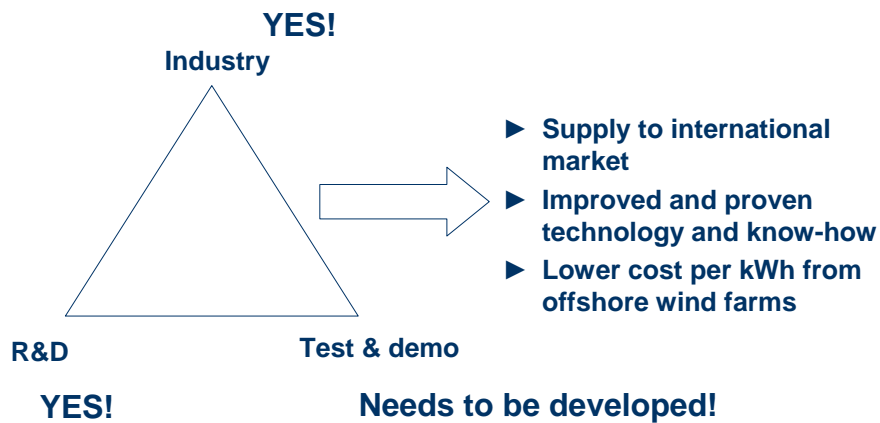
Overview NOW



- Foundations / WTG components
- Marine Operations / shipping
- Utility / Operator
- Yard / base facilities
- Equipment / technical services
- Consulting / Other services
- R&D and education
- Public services



The golden triangle for success



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Rationale for test & demo programme

- ▶ One of the main goals for the Norwegian offshore wind industry is to establish a programme for:
 1. Demonstrating new and existing technologies and products in order to acquire references for Norwegian suppliers
 2. Prepare maritime and oilrelated industri for restructuring after peak oil
 3. Testing new technologies for R&D purpose and commercialize R&D
 4. Building competency and track record
- ▶ with the ultimate aim to strengthen Norwegian offshore wind competitive capabilities.
- ▶ Arena NOW, Arena Vindenergi, Norcowe, and Nowitech have agreed to take a common approach as to define a national plan for an offshore wind demonstration programme.

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Business case

There is a need for the Norwegian offshore wind industry to:

1. Have domestic facilities for testing of new Norwegian offshore wind related technologies and products
 2. Build Norwegian competency and clusters in order to strengthen competitive capabilities towards foreign competitors in commercial markets
 3. Create Norwegian reference projects that can be used to win projects and contracts externally/commercially
- ▶ The above will be achieved through the realisation of a coordinated national offshore wind test and demonstration programme.

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Example elements of a test & demo programme

- ▶ Small scale (200 kW) test turbine for open experimental research (infrastructure application due 30/1-2010 by NORCOWE, NOWITECH and CEDREN)
- ▶ Prototypes, possibly in scale, of various new turbine concepts and technologies (bottom-fixed and floaters)
- ▶ Demonstration wind farms of semi-commercial nature, showcasing planning, installation, new technology, operation, access, grid connection, ..
- ▶ Open programme; significant state funding; locations and applications for test and demo are decided by developers; funding based on rational criteria

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Test and demonstration program for offshore wind and ocean energy in Norway "Demo2020"

arena Arena NOW (Norwegian Offshore Wind)
Arena Windcluster Mid-Norway

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norcowe

Norwegian Centre for Offshore Wind Energy

- ▶ The two offshore wind industry clusters Arena NOW and Arena Windcluster Mid-Norway together with the two research centres in offshore wind, NORCOWE and NOWITECH represents more than 100 industry companies, 5 universities and 4 research centres from Verdal in the Mid-Norway to Kristiansand in the South.
- ▶ The two industry clusters and the two offshore wind research centres have jointly proposed the establishing of a Norwegian test and demonstration program for offshore wind and ocean energy, "Demo2020".

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Goal – first phase of Demo2020

- ▶ Qualify Norwegian industry and suppliers to deliver to the offshore wind markets in Europe, especially to round 3 in UK and Germany.
 - Ensure that Norwegian suppliers can get track record and deliver to international offshore wind markets
 - Ensure testing of components before integrating in to a complete wind power system.
 - Qualifying of competitive and cost effective technology and services based on Norwegian offshore competence from oil and gas industry
 - Creating new products and services for a global market will establish new jobs in Norway.
 - Enable research centres to test components under real conditions as well as giving them access to real data for verifying models and theories.
 - Transfer research results to industrial activity.

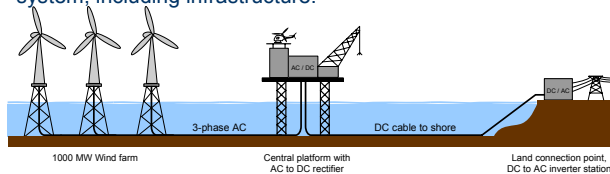
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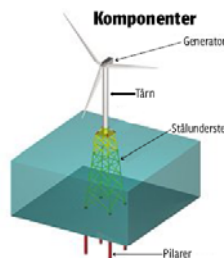


What is a demonstration program?

- ▶ An offshore wind demonstration program should support:
 - a system part, i.e. full scale demonstration of the complete wind power system, including infrastructure:

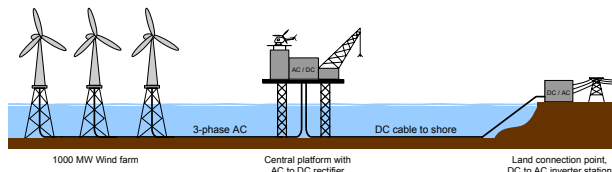


- a component part, i.e. component test installation methods, processes, fabrication methods etc.



Cost and timeframe for the first phase of Demo2020

- ▶ The offshore wind development in Europe has already started. Procurement processes will start and contracts will be given to qualified suppliers from 2013.
- ▶ It is therefore important to start a test and demonstration program in 2011 in order for the suppliers to be qualified to deliver to the German and UK market.
- ▶ Demo2020 recommends a minimum program of 8 turbines/foundation (complete systems) within **2014**, of which the first one or two to be installed in 2012.
- ▶ A demonstration program with 8 complete wind turbine systems, infrastructure and a component part will have a total cost of 2,5-4 billion NOK.
- ▶ The governmental contribution should be large enough to reduce financial risk for the suppliers to contribute.



Demo Rogaland part of Demo 2020

- ▶ Statoil, GE and Lyse have signed a cooperation agreement to investigate the feasibility of a demonstration facility for offshore wind in Rogaland, Norway.
- ▶ The intention is to built two to four demonstration turbines and to test and qualify GEs 4 MW direct drive offshore turbine.
- ▶ The project will also give opportunities for other suppliers, such as foundation and cable supply and transport and installation services. These and other deliveries will be evaluated as part of the project development.
- ▶ As part of this cooperation agreement, Lyse has applied to NVE for concession to install wind turbines at three alternative locations near the coast of Rogaland. Concession for 2 off 4 MW turbines is applied both at Rennesøy, Kvitsøy and Karmøy.
- ▶ The companies will apply for funding from Enova as this project will depend on governmental funding to be realised.
- ▶ Investment decision is expected spring 2011.

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