

NOWITECH

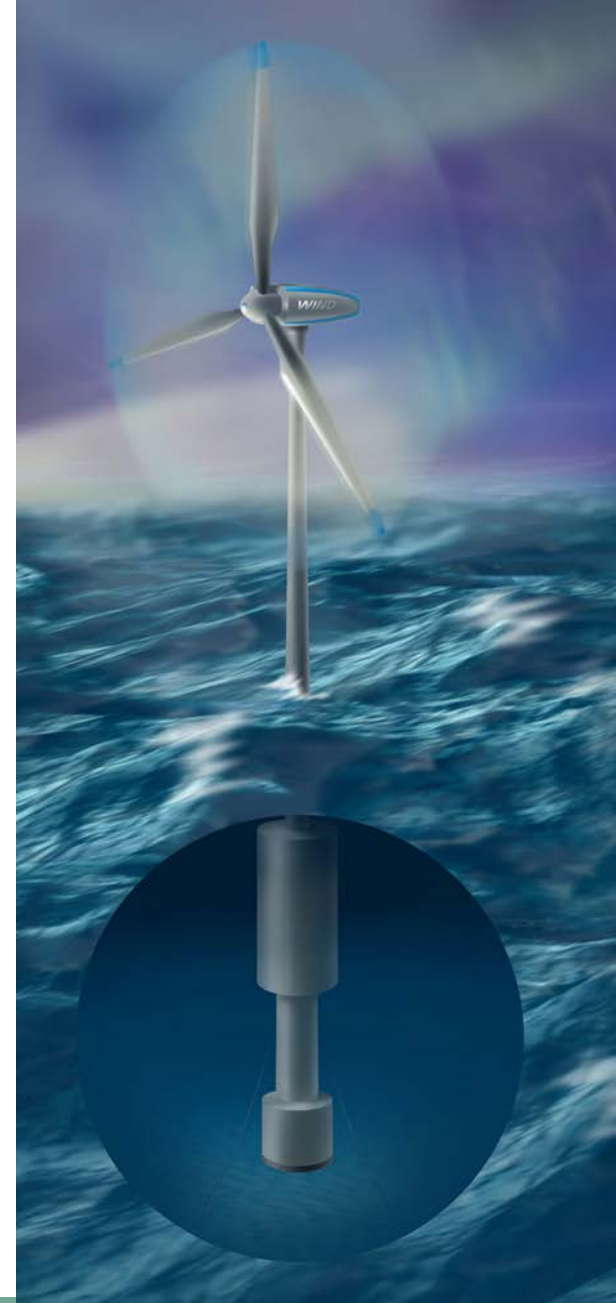
Innspill til Energimeldingen

Desember 2015

www.nowitech.no

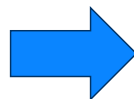
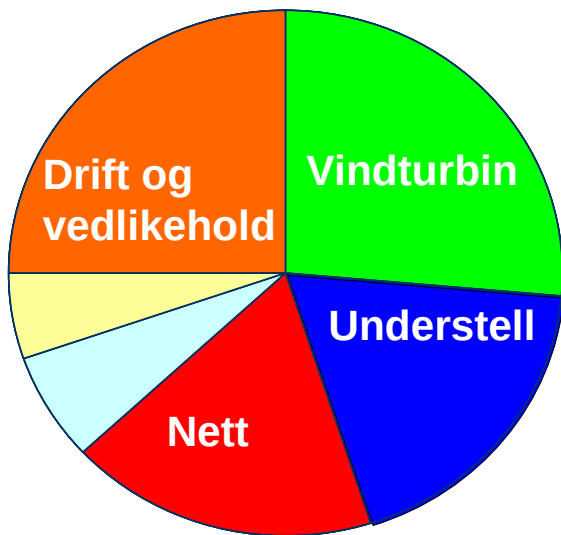
Trond Kvamsdal

Chair NOWITECH Scientific Committee

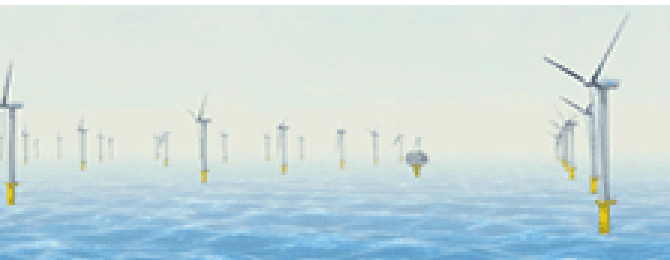


Havvind er en global klimaløsning

- ✓ Global fornybar klimaløsning
- ✓ Potensial for å dekke 7 x EUs energibehov
- ✓ Små negative miljøkonsekvenser
- ✓ Utviklingen er i tidligfase, men i kraftig vekst
- ✓ Havvind er prioritert i Energi21 og EU SET-plan
- ✓ Mål om 50 % kostnadsreduksjon innen 2030



Havvind en gylden mulighet for Norge



- ✓ Norge har ledende FoU-kompetanse
- ✓ Norge har sterk leverandørindustri
- ✓ Norge har store vindressurser
- ✓ Havvind er en gylden mulighet for nye arbeidsplasser i Norge
- ✓ Norsk industri er klar for grønt skifte



Havvind i Energimeldingen



Foto: John Olav Tande

For at Norge kan bli ledende eksportør av FoU, teknologi og tjenester trengs:

- ✓ **Styrket FoU innsats**
- ✓ **Støtte til demopark**

Framtida er maritim og fornybar = HAVVIND!



Les mer på

<http://blog.sintefenergy.com/fornybar-energi/demopark-for-havvind-er-et-viktig-klimabidrag/>

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EXTRA



Konkurranseskraft i lavutslippssamfunnet

Styrket satsing på teknologutvikling og markedsstimulering



Et hav av muligheter

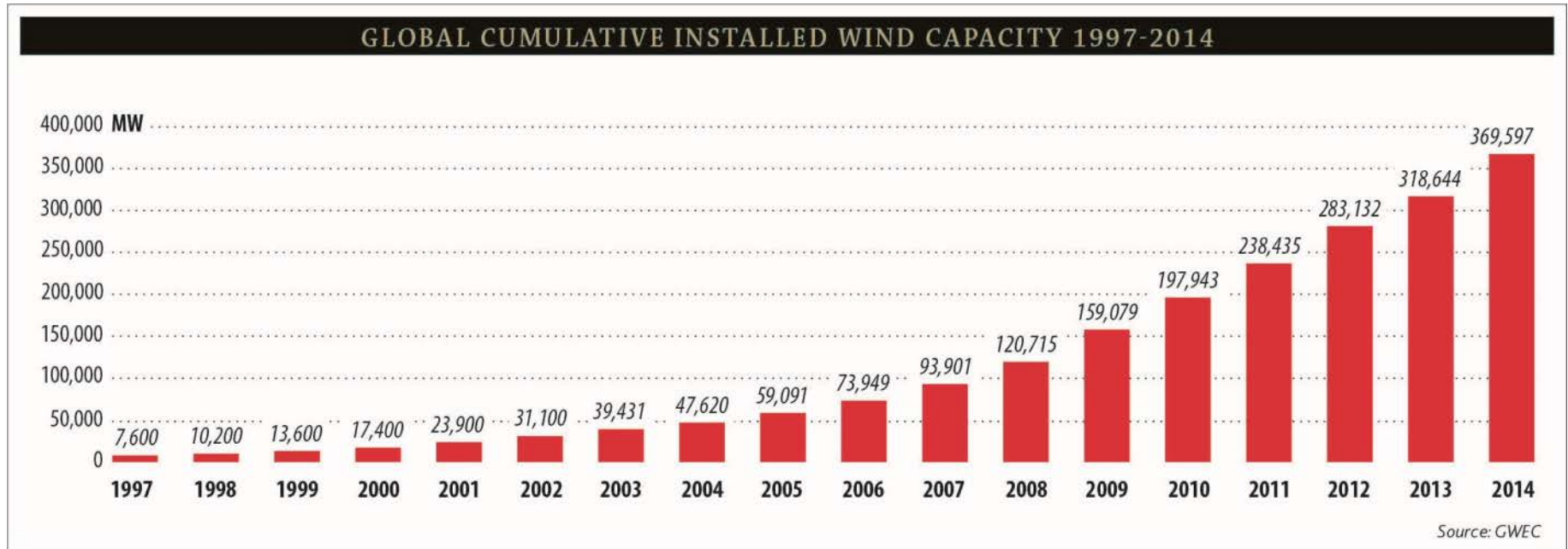
Norsk satsing på offshore vindkraft – et bidrag til økt verdiskaping,
renere energiforsyning og et bedre klima



Centre for renewable energy
SFFE – Sentret for smarte energi

NTNU SINTOF IIP 110 1

Vindenergi i medvind

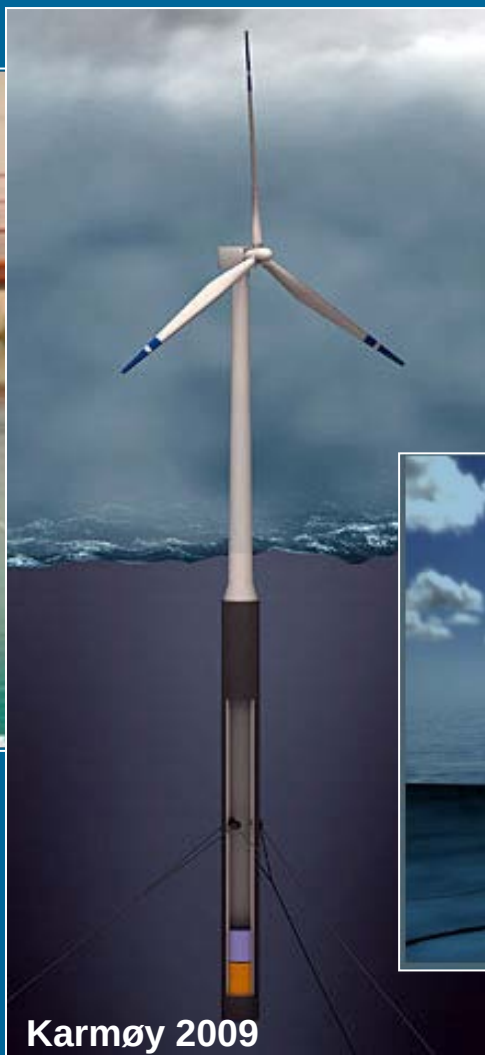


- ✓ På land: 8 GW i 1997; 361 GW i 2014
- ✓ Offshore: 8 GW i 2014; 361 GW i 2031 (?)
- ✓ Offshore vind er prioritert i Energi21 og EU SET-plan

Hywind – fra Norge til Skottland



SINTEF/
MARINTEK
2005



Karmøy 2009



Skottland 2017

Norsk industri er klare for grønt skifte



- ✓ Statoil og Statkraft er tungt inne som utbyggere av offshore vindparker i britisk sektor.
- ✓ Aibel har levert understellet til verdens største HVDC plattform i Tyskland.
- ✓ Nexans, Draka og ABB har store leveranser av elkraftutstyr til vindparker i Nordsjøen.
- ✓ Fred Olsen er ledende innenfor frakt og installasjon av offshore vindkraftverk, og DNV GL innenfor konsulent og sertifiseringstjenester.
- ✓ SINTEF leder EERAs aktivitet innen offshore vindkraft og er med i de store FoU prosjektene i EU på offshore vindkraft.
- ✓ Flere bedrifter er på vei inn, for eksempel Kongsberg Maritime (wind farm management) og Fugro Oceanor (Seawatch)
- ✓ Det norske engasjementet er likevel beskjedent i forhold til potensialet. Nettverksorganisasjonen innen fornybar energi, INTPOW, har identifisert 150 norske selskap med kompetanse og interesse innen offshore vindkraft.

Norge har sterk kompetanse på kritiske områder ★

Offshore wind LCOE

Offshore wind has cost reduction opportunities in multiple areas including scale effects

Turbines & plant



- Larger turbines and wind farms
- Increased reliability
- Scale effects and industrialisation

Substructures



- Standardised and optimised offshore foundation design and design criteria
- Industrialised manufacturing

Transmission



- eBoP optimisation of substation and transmission capex
- Innovative transmission solutions
- Improved grid access

O&M



- Low OPEX drivetrains
- Turbine and component quality
- Condition monitoring, diagnostics, preventive maintenance

Source: Siemens, MHI-Vestas, MAKE



MAKE

Delivering renewable
energy insight™

OWIB
4 September 2014

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A huge long-term global market for green technologies

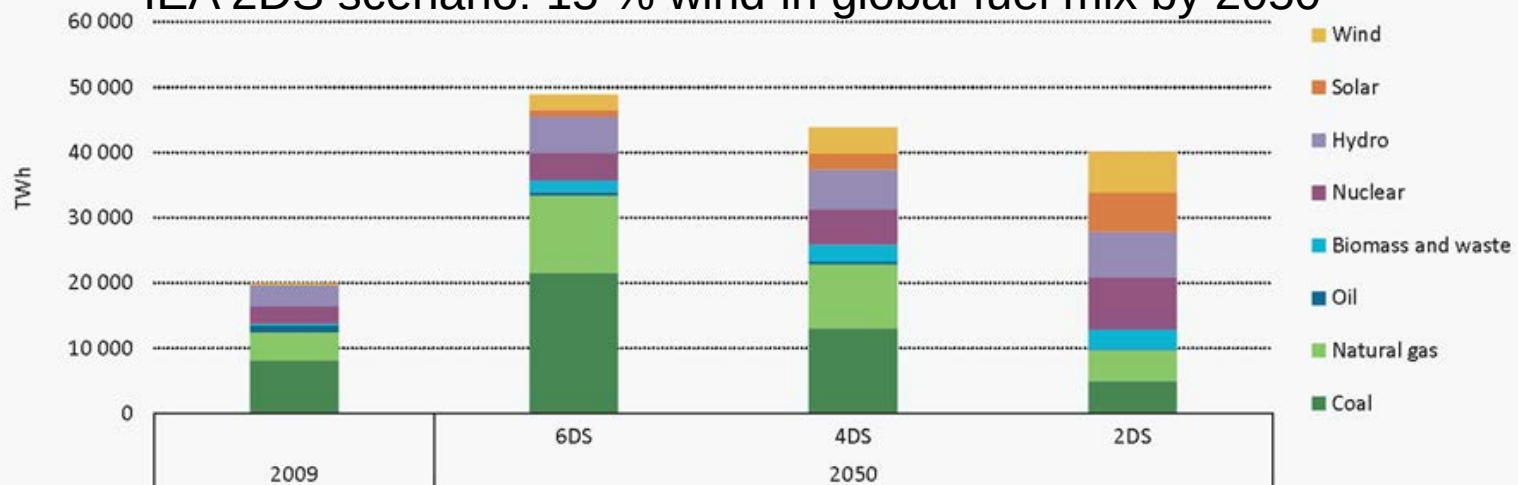
- ▶ Battle climate change
- ▶ Security of supply
- ▶ Industry value creation

Stern Review (2006):
..strong, early action on climate change far outweigh the costs of not acting.



Figure 1.10 Fuel mix in electricity generation, by scenario

IEA 2DS scenario: 15 % wind in global fuel mix by 2050



Key point

Diversification of fuels and increased use of low-carbon sources in the 2DS achieves a high degree of decarbonisation in electricity generation by 2050.

Copy from IEA Energy Technology Perspectives 2012

2013 installed wind:

Total 318 GW incl 7 GW offshore

2050 2DS wind:

6000 TWh/3000 h = 2000 GW

Required annual installations to reach 2DS goal for wind:

2000 GW / 40 y = 50 GW/y

+ end of lifetime replacements



SET-plan initiative: Global Leadership in Offshore Wind



- ✓ **Offshore wind costs must be reduced** and performance and reliability increased to meet its full contribution to the European energy mix.
- ✓ There is a need to **develop (floating) substructures or integrated floating wind energy systems for deeper waters** and for use in other climate conditions, to increase the deployment possibilities and to improve the European position in the global market.

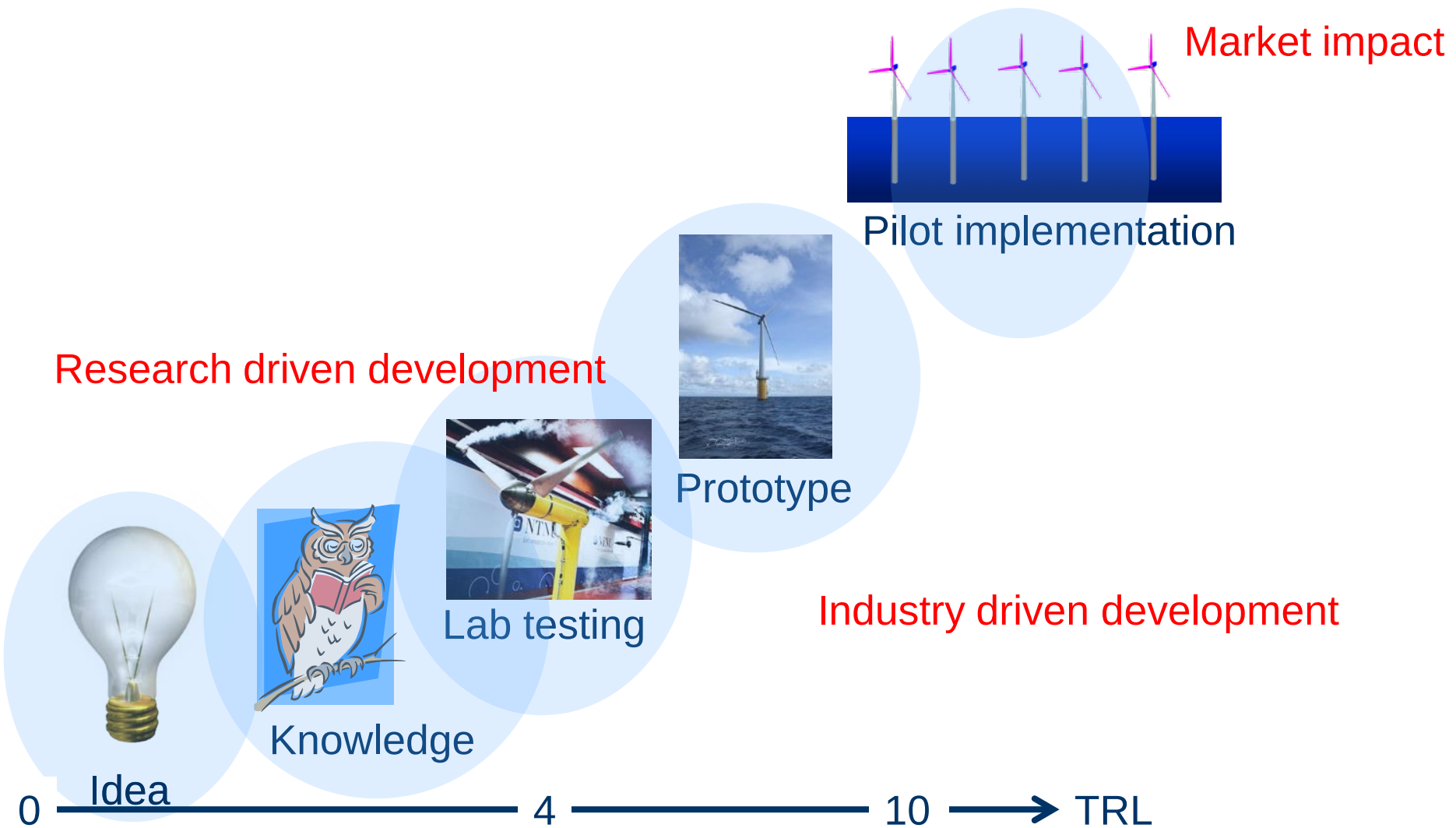
Working document of the EC for consultation (SET Plan Secretariat – 09 October 2015):

Proposed targets in offshore wind energy

1. **Reduce the levelised cost of energy (LCoE) for fixed offshore wind*** by improvement of the performances of the entire value chain to
 - less than 10 ct€/kWh by 2020 and to
 - less than 7ct€/kWh by 2030;
2. **Increase the reliability of offshore wind turbines to 99% and the capacity factor to 55% by 2020;**
3. **Develop cost competitive integrated wind energy systems** including substructures which can be used in **deeper waters (>50m)** at any distance from shore and for use in different climate conditions with LCoE of:
 - less than 14 ct€/KWh by 2020 and to
 - less than 9 ct€/KWh by 2030

*within the LCoE, the costs for delivering the electricity to onshore substations are taken into account

From R&D to innovations to cost reductions



NOWITECH in brief

- ▶ A joint pre-competitive research effort
- ▶ Focus on deep offshore wind technology (+30 m)
- ▶ Budget (2009-2017) EUR 40 millions
- ▶ Co-financed by the Research Council of Norway, industry and research partners
- ▶ 25 PhD/post doc grants
- ▶ **Key target: innovations reducing cost of energy from offshore wind**
- ▶ Vision:
 - large scale deployment
 - internationally leading

Research partners:

- ▶ SINTEF ER (host)
- ▶ IFE
- ▶ NTNU
- ▶ MARINTEK
- ▶ SINTEF ICT
- ▶ SINTEF MC

Industry partners:

- ▶ CD-adapco
- ▶ DNV GL
- ▶ DONG Energy
- ▶ Fedem Technology
- ▶ Fugro OCEANOR
- ▶ Kongsberg Maritime
- ▶ Norsk Automatisering
- ▶ Rolls Royce SmartMotor
- ▶ Statkraft
- ▶ Statnett
- ▶ Statoil

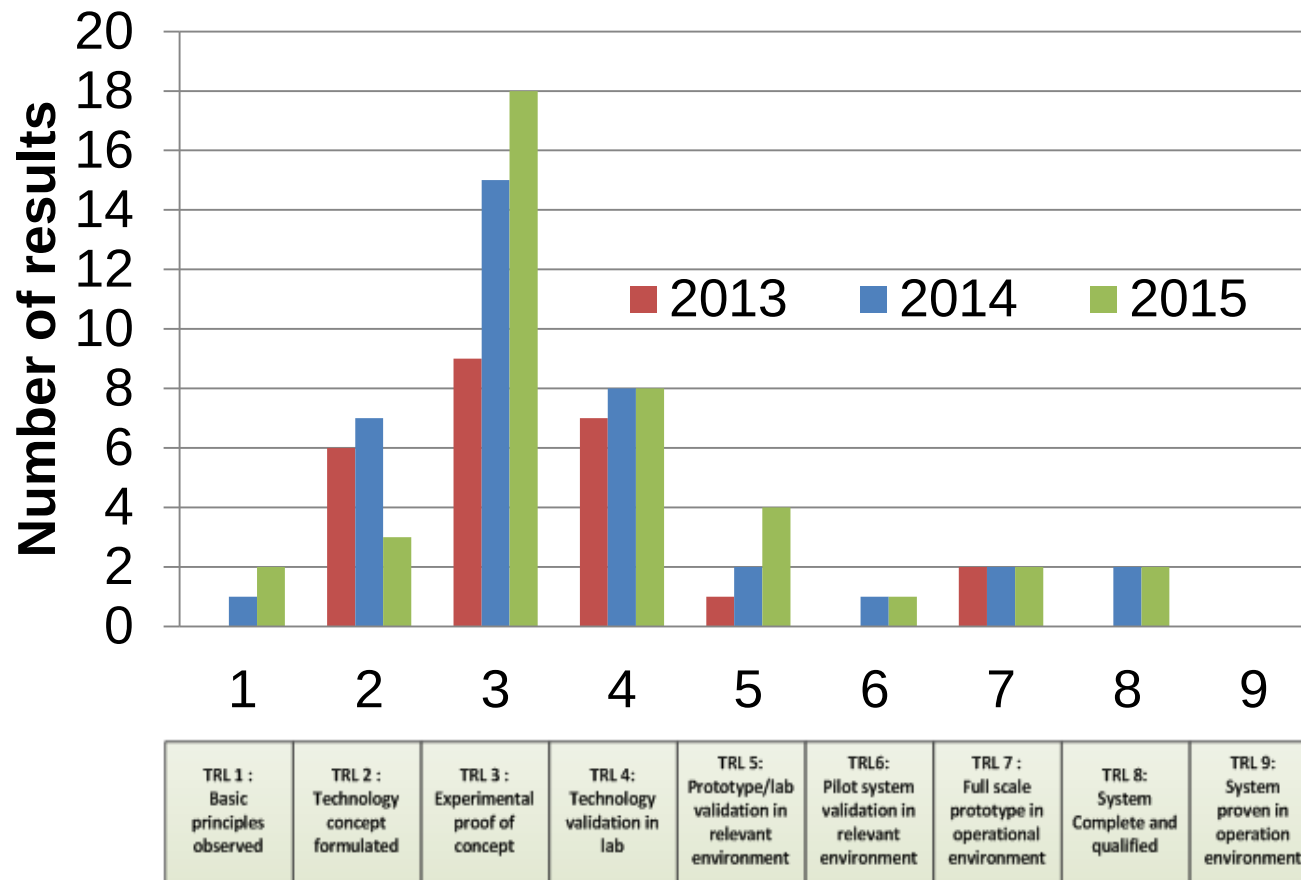
Associated research partners:

- ▶ DTU Wind Energy
- ▶ Michigan Tech Uni.
- ▶ MIT
- ▶ NREL
- ▶ Fraunhofer IWES
- ▶ Uni. Strathclyde
- ▶ TU Delft
- ▶ Nanyang TU

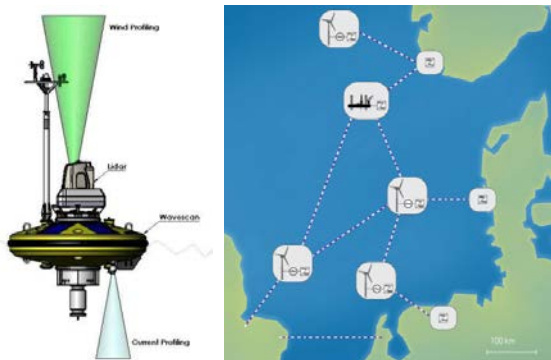
Associated industry partners:

- ▶ Devold AMT AS
- ▶ Energy Norway
- ▶ Enova
- ▶ Innovation Norway
- ▶ NCEI
- ▶ NORWEA
- ▶ NVE
- ▶ Wind Cluster Norway

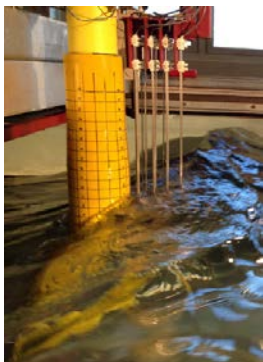
NOWITECH har gitt sterke resultat!



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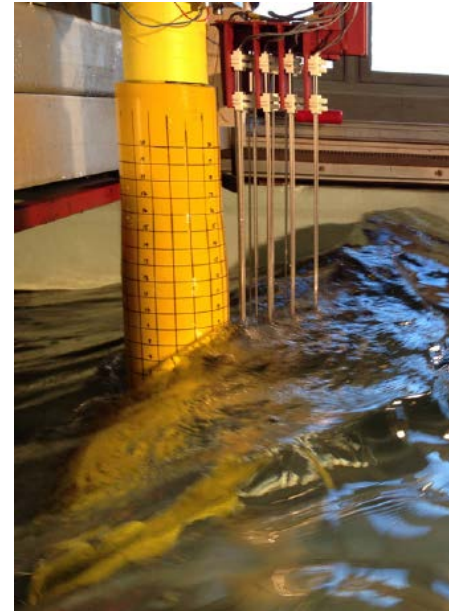
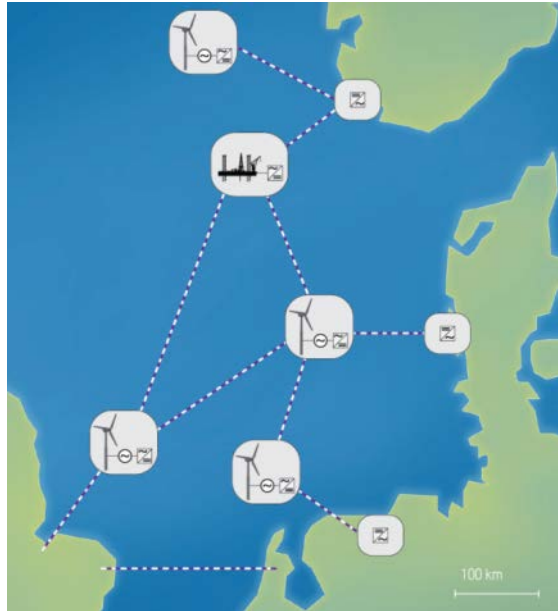
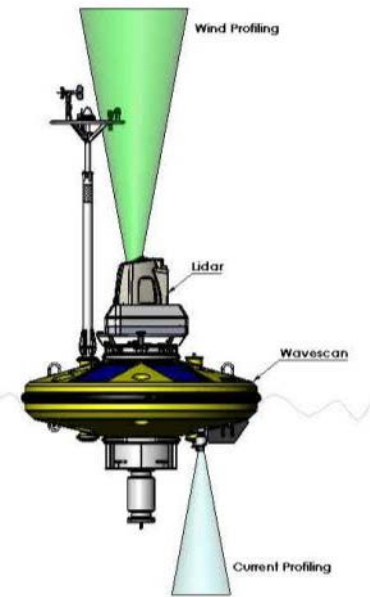


- ✓ Bedre modeller og metoder har gitt bedre design og lønnsomhet for Statoil og Statkrafts offshore vindparker
- ✓ Fugro har utviklet målebøye med Lidar basert på ide fra NOWITECH
- ✓ Kongsberg har etablert satsning på Wind Farm Management System
- ✓ Seram Coatings er etablert som nytt selskap og vunnet flere innovasjonspriser
- ✓ Modeller for fremtidig bærekraftig energisystem med Nordsjønett som kobler offshore vind og norsk vannkraft



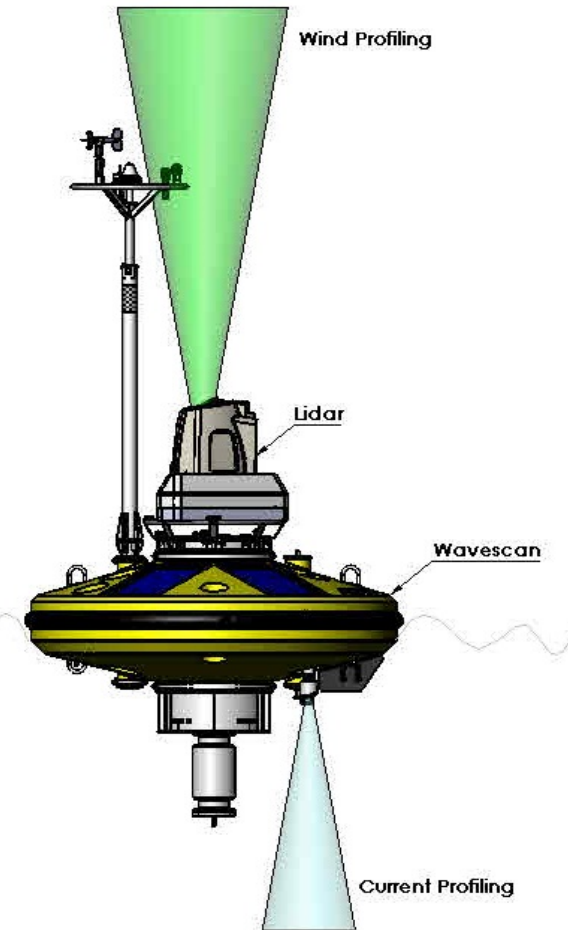
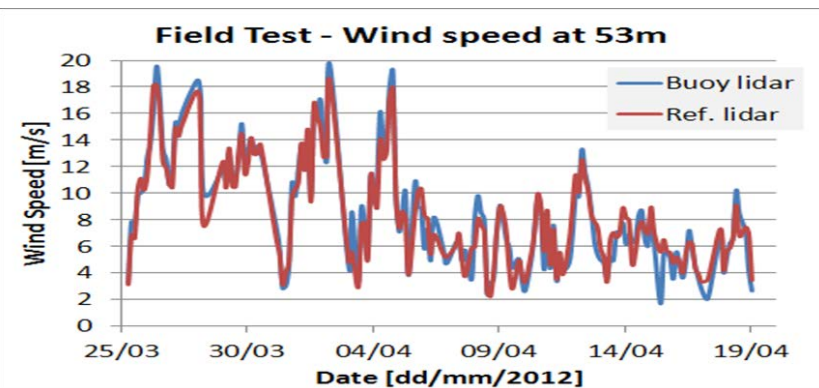
NOWITECH har gitt sterke resultat!

(her er 4 eksempler av 36 innovasjoner..)

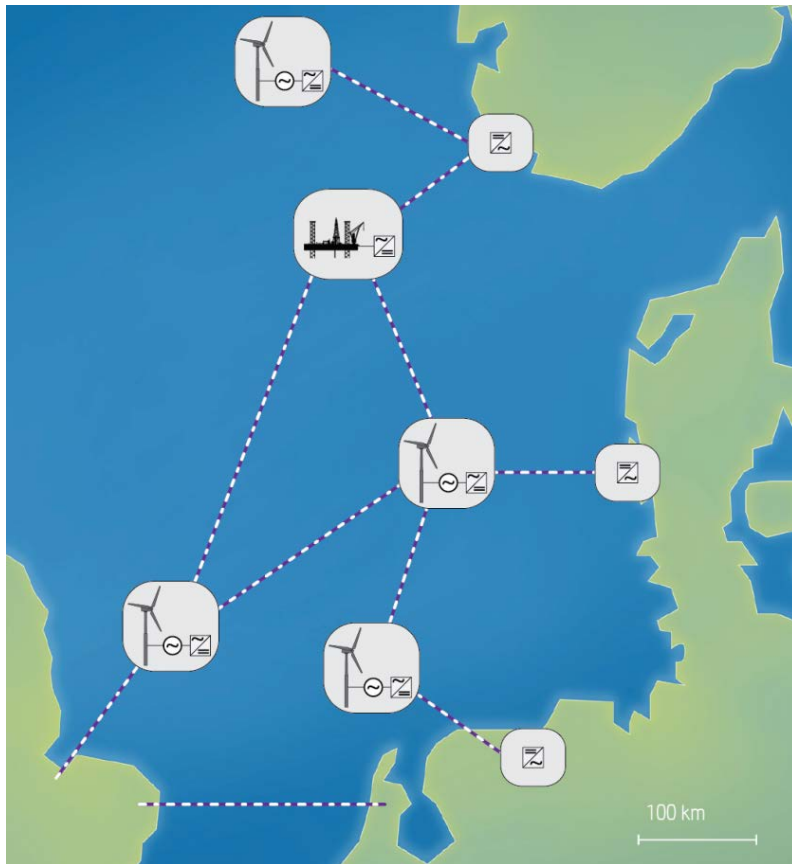


SEAWATCH Wind Lidar Buoy

- ▶ Cost efficient and flexible compared to offshore met mast
- ▶ Measure wind profiles (300 m), wave height and direction, ocean current profiles, met-ocean parameters
- ▶ Result of NOWITECH "spin-off" joint industry project by Fugro OCEANOR with Norwegian universities, research institutes and Statoil.



Laboratory demo of the future North-Sea grid

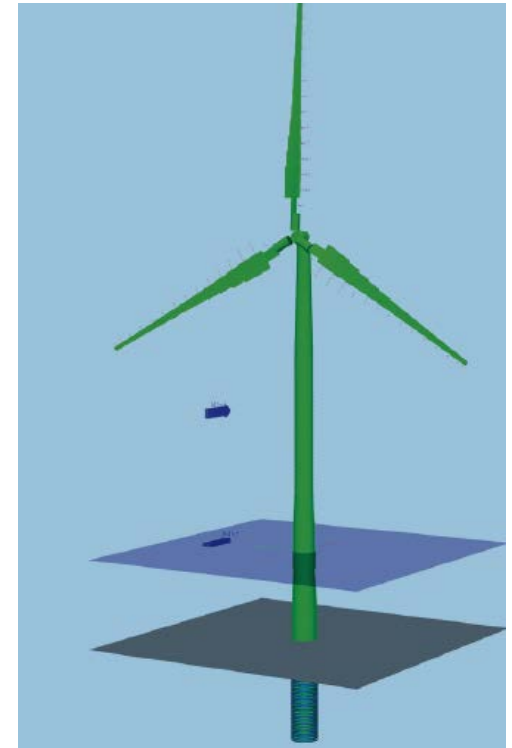
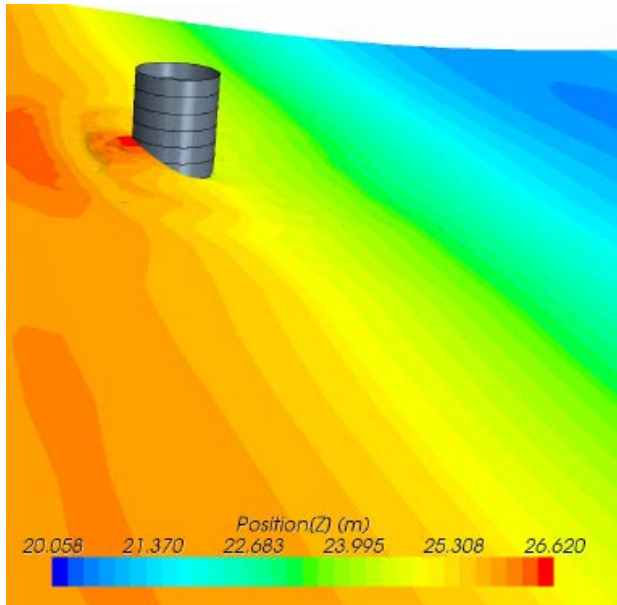


- ▶ Operation and control
- ▶ Converter interoperability
- ▶ System stability
- ▶ Fault handling
- ▶ System services
- ▶ Security of supply
- ▶ New market solutions



Validating new HVDC technology in BestPaths (EU FP7)

Savings costs with knowledge, models and labs



De-risking monopile for Dudgeon 402 MW Offshore Wind Farm
MARINTEK using CFD, lab experiments and FE SIMA analysis

Wind farm control and asset management



NOWITECH achievements include:

- ✓ **NOWIcob simulation software of O&M for use by wind farm operators (Statkraft, Statoil, etc)**
- ✓ **Support to Kongsberg, incl. projects aligned with NOWITECH for the development of their Wind Farm Management System.**

NOWITECH results give value creation and reduced cost of energy (LCOE) from offshore wind farms.