

NOWITECH

Innovations in offshore wind energy

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www.nowitech.no

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

Industry partners:

- ▶ CD-adapco
- ▶ DNV GL
- ▶ DONG Energy
- ▶ Fedem Technology
- ▶ Fugro OCEANOR
- ▶ Kongsberg Maritime
- ▶ Norsk Automatisering
- ▶ Statkraft
- ▶ 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 is in very good progress

- ▶ Strong consortium with leading industry and research partners
- ▶ Progress according to plan delivering successful innovations, excellent research and a strong educational programme



Successful innovations

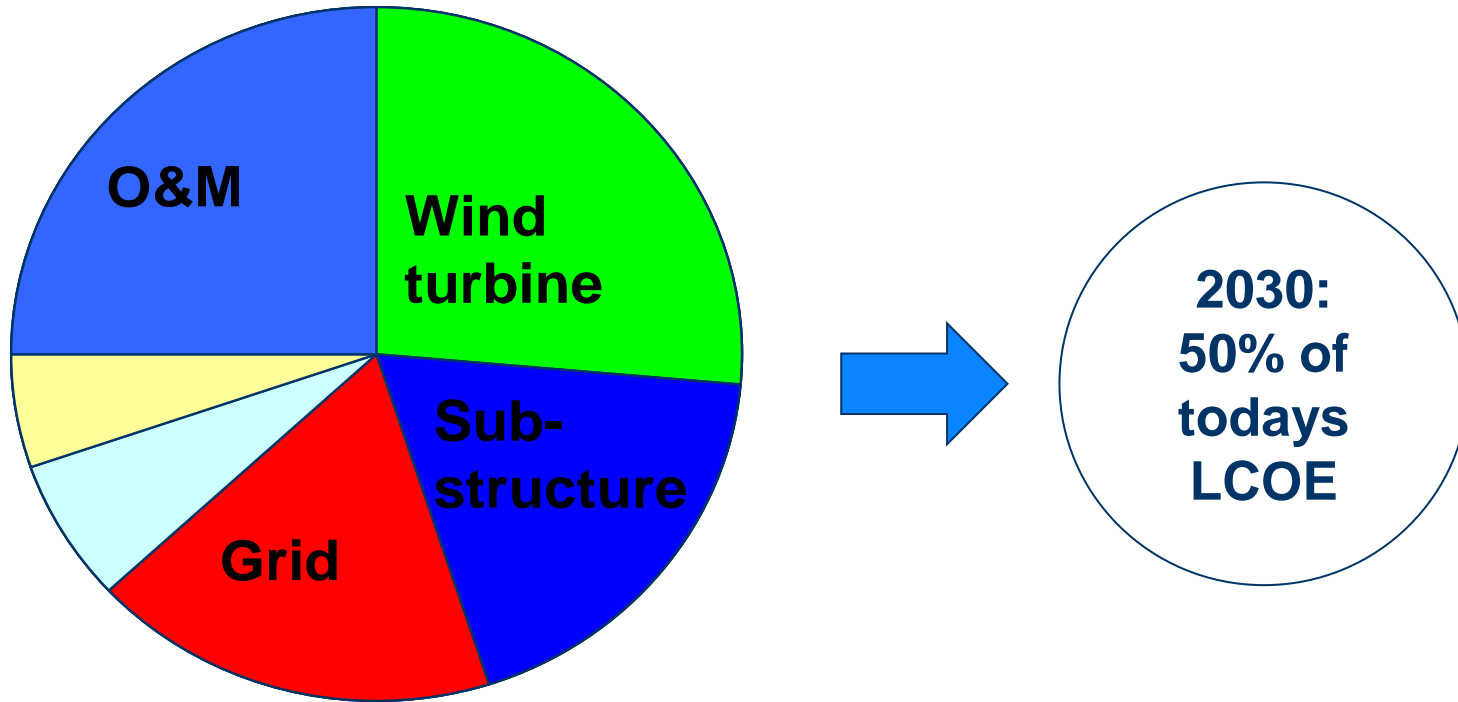


Excellence in research



Strong educational program

Offshore wind main challenge: Reduce Cost of Energy



EU TP wind KPI in new SRA:

Reduce LCOE by 50% from present levels for similar sites by 2030



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):

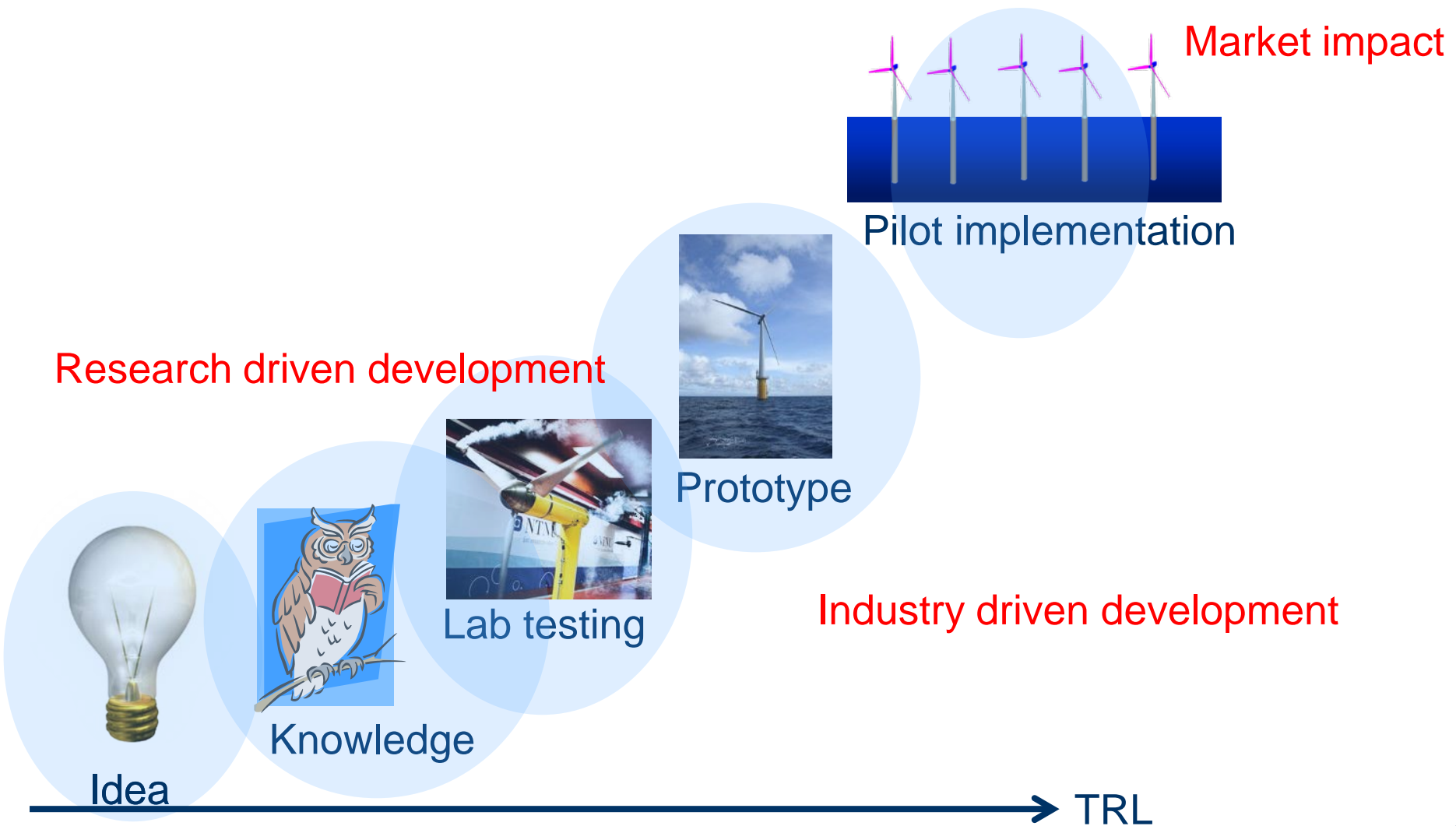
Proposed targets in offshore wind energy

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

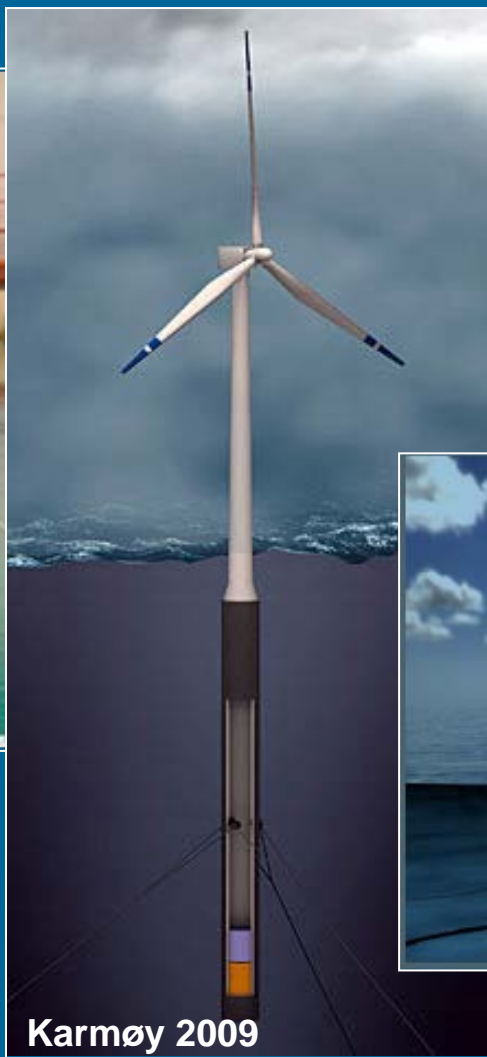
DRAFT

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

From R&I to cost reductions



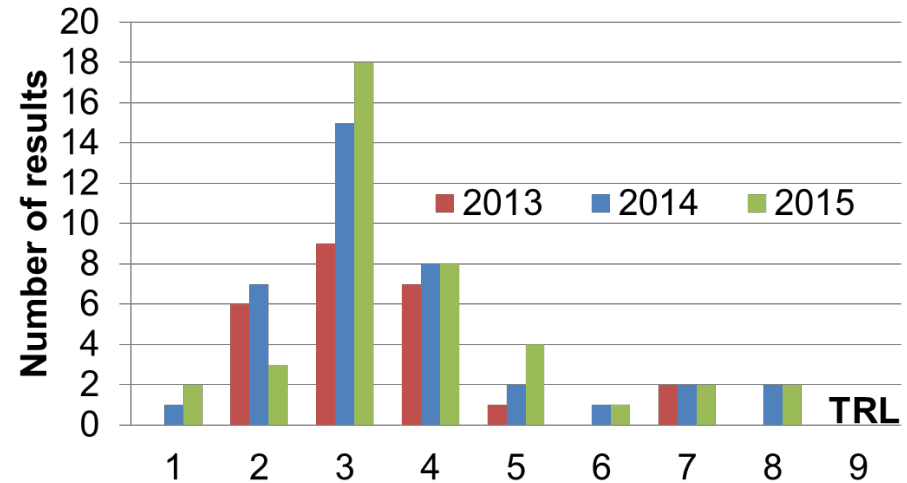
Hywind – Statoil is taking the next step



NOWITECH results provide cost reductions

- ✓ A total of 40 results are assigned a Technology Readiness Level (TRL)
- ✓ The results include new methods, software tools and hardware products
- ✓ The results are migrating to commercial use, licence agreements, and business developments providing value creation and cost reductions.

TRL distribution



NOWITECH Innovation Award 2015:
Pål Keim Olsen and Sverre Gjerde for
their work on HVDC generator technology
for offshore wind turbines.

An attractive partner on the international scene

- ▶ Active in EERA, TPwind, EAWE, IEA, IEC
- ▶ Heading offshore works within EERA JPwind and TPwind
- ▶ Partner in EU projects, e.g.: Twenties (2009-), DeepWind (2010-), HiPRWind (2010-), EERA-DTOC (2012-), InnWind (2012-), WindScanner (2012-), LeanWind (2014-), EERA IRP wind (2014-), BestPaths (2014-), Lifes50+ (2015-), AWESOME (2015-)

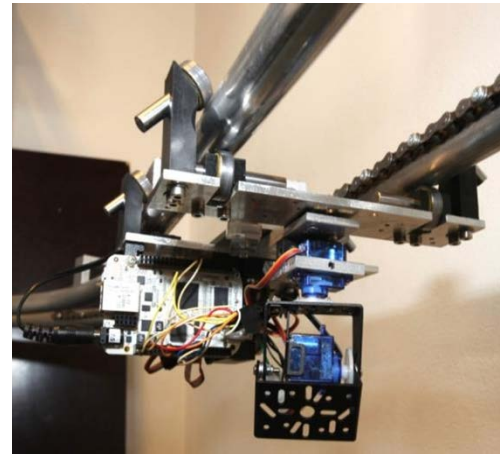
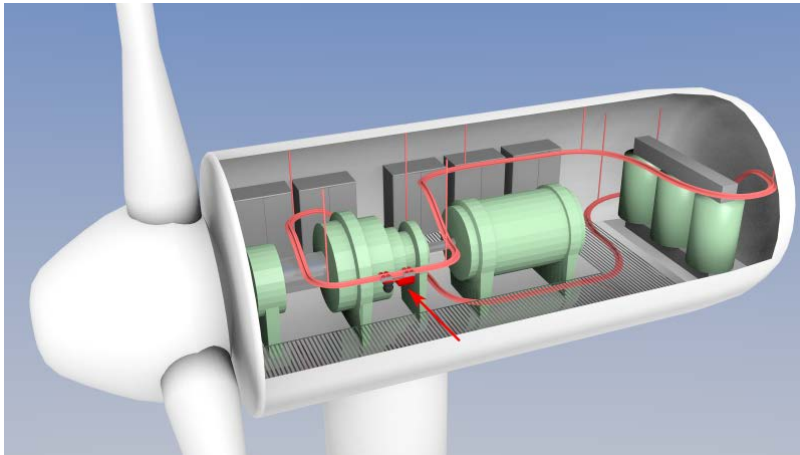


Thermally sprayed silicon carbide coating



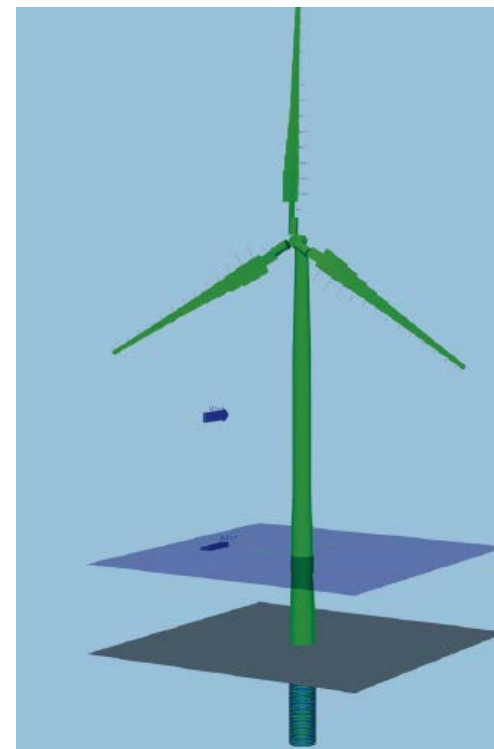
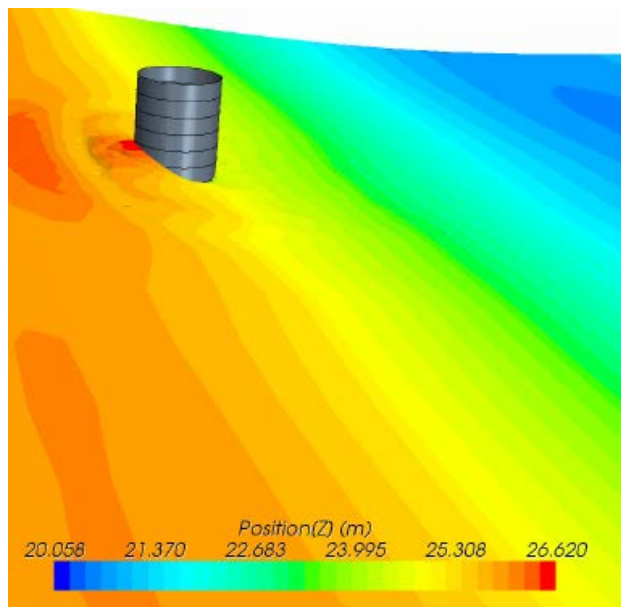
- ✓ Patented process result of NOWITECH PhD work.
- ✓ Being developed as a commercial product through the new spinout company Seram Coatings AS.
- ✓ The process provides for an extremely hard, wear-resistant, low friction ceramic coating that can be applied to rotating machinery like main bearings in large direct drive wind turbines; ultimately increasing lifetime and reducing cost for maintenance.

Remote presence



- ✓ **Technology developed in part through NOWITECH PhD work**
- ✓ **Remote presence through a small robot on a track in the nacelle equipped with camera / heat sensitive, various probes, microphone etc. reducing offshore work by service personnel, downtime and costs**
- ✓ **Technology is commercialized by Norsk Automatisering AS through the new company EMIP**

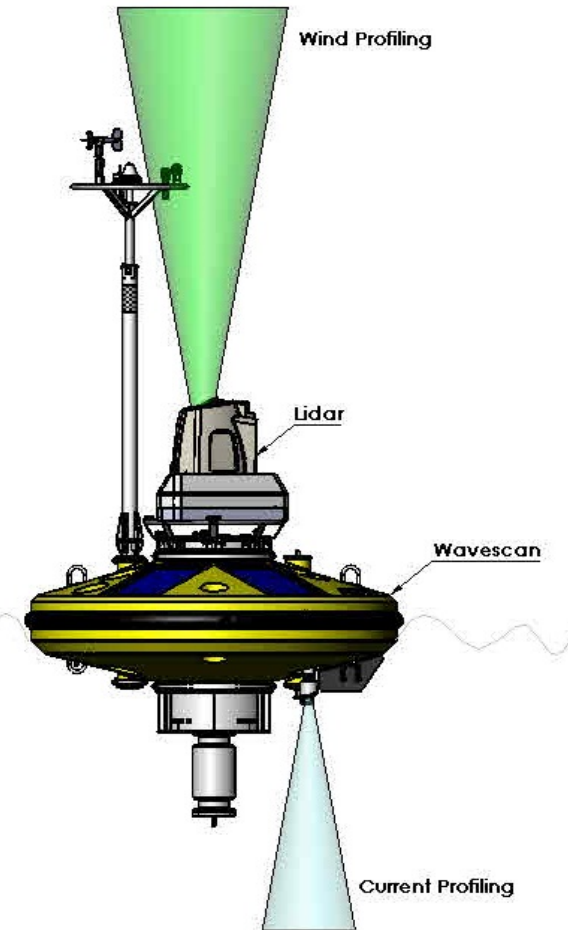
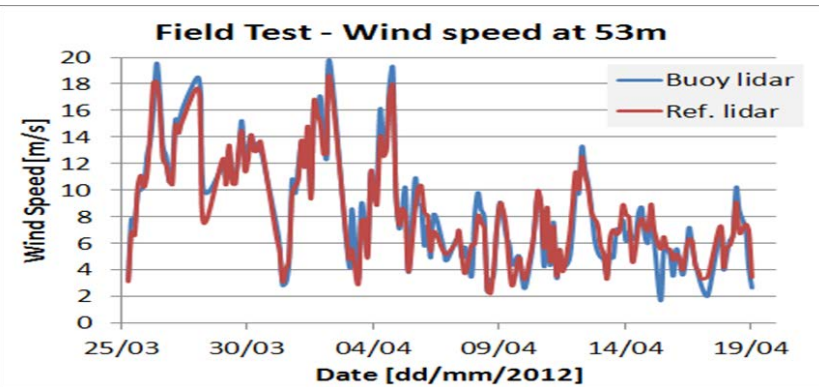
Savings costs with knowledge, models and labs



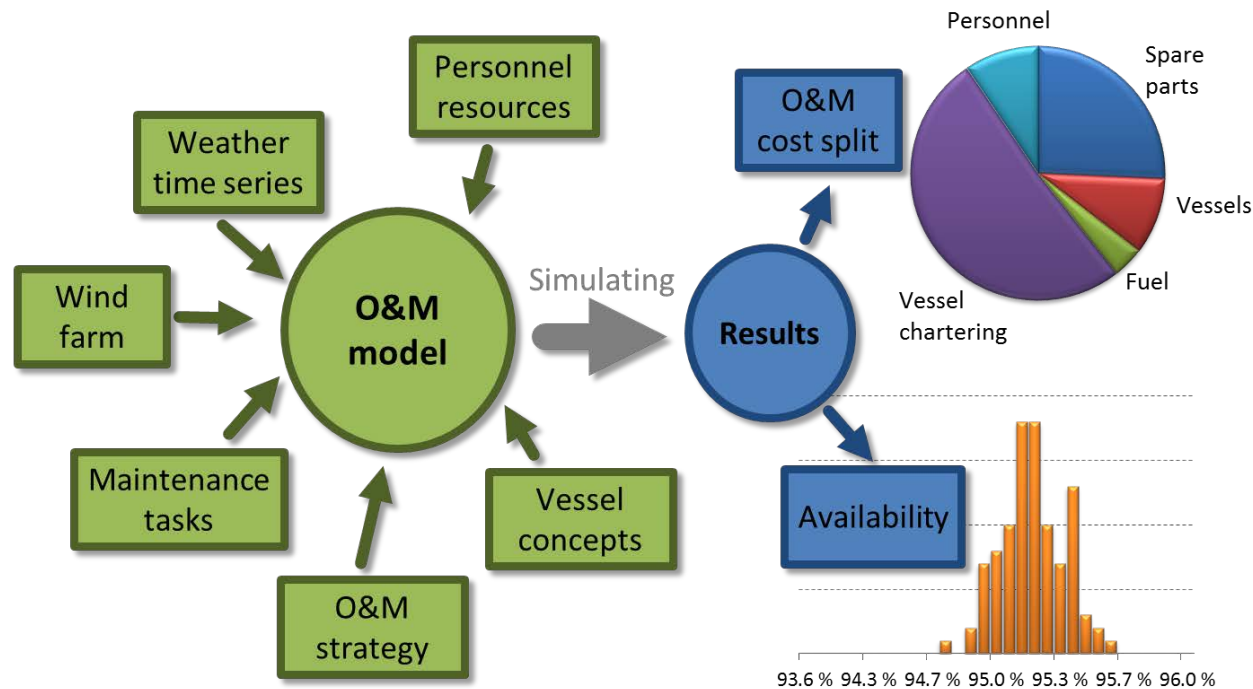
De-risking monopile for Dudgeon 402 MW Offshore Wind Farm
MARINTEK using CFD, lab experiments and FE SIMA analysis

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.



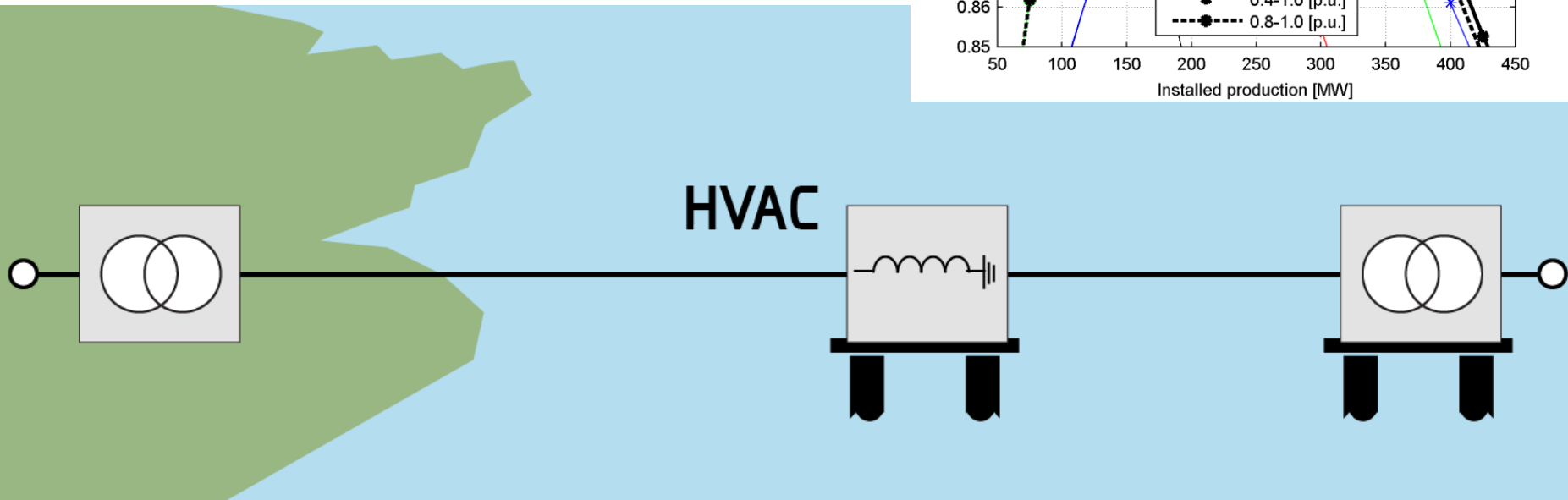
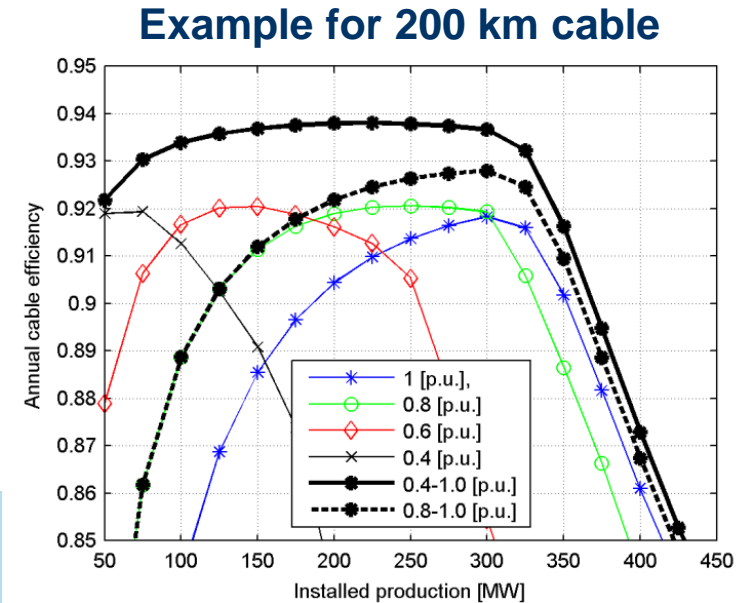
NOWIcob – O&M analysis tool



- ✓ Strategic discrete-event simulation tool for analysis of different offshore wind farm maintenance and logistics strategies
- ✓ Developed by SINTEF Energy in NOWITECH
- ✓ In use by Statkraft and others for wind farm O&M planning

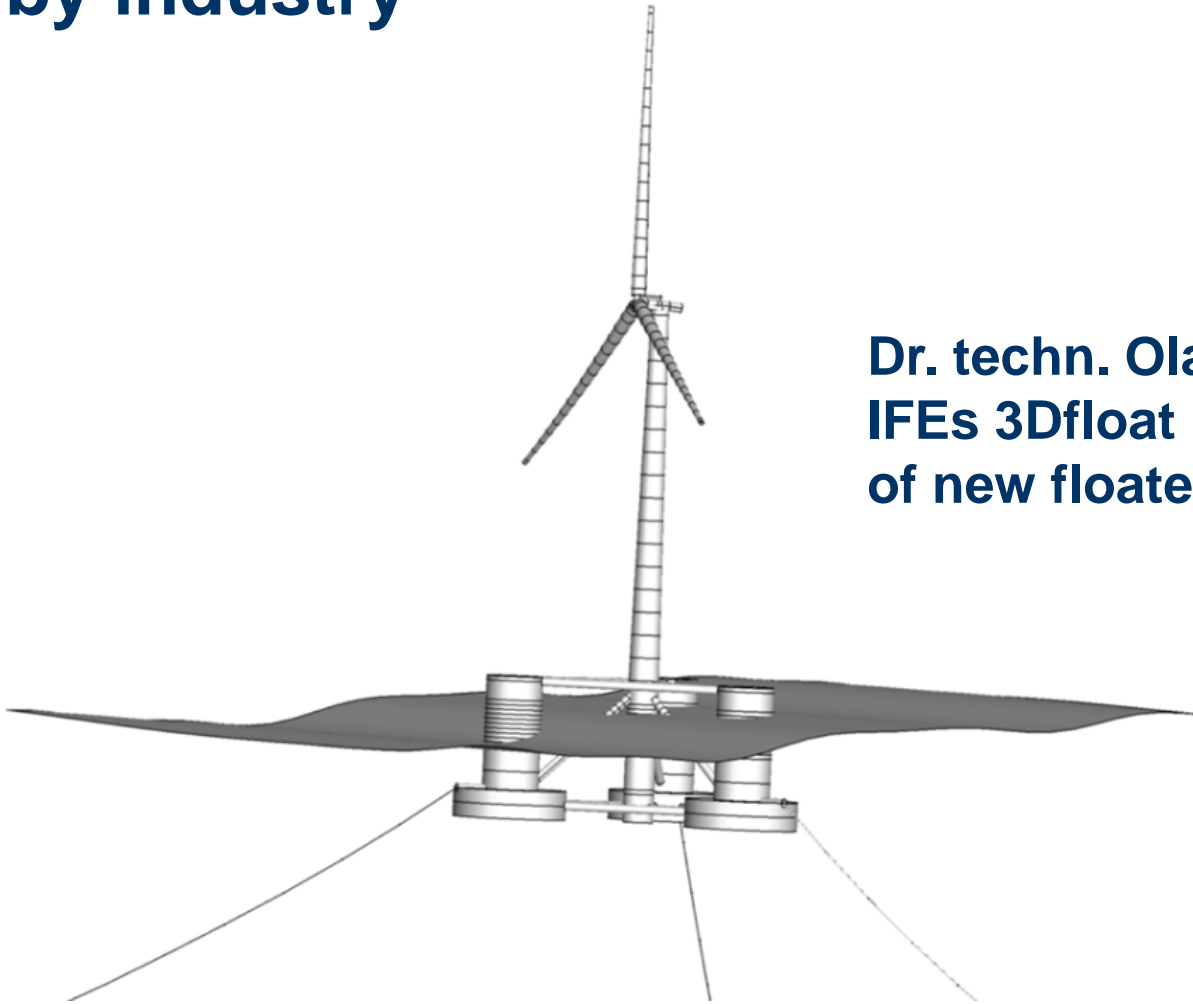
Extending HVAC transmission beyond 100 km

- Low frequency AC (16 2/3 Hz)
- Reactive power compensation
- Optimizing cable voltage
- Development by SINTEF Energy Research



New software tools are developed and applied by industry

Dr. techn. Olav Olsen use IFEs 3Dfloat for development of new floaters



Norwegian industry is ready for a green transition



Foto: John Olav Tande

To make Norway a leading exporter of offshore technology and services requires:

- ✓ Enhanced R&D efforts
- ✓ Support for a offshore demonstration wind farm

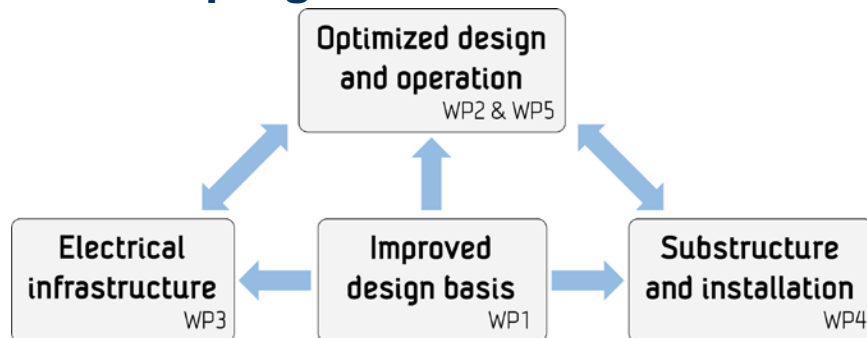
COWIND: Centre for Offshore Wind Energy Research

Application for a new FME on offshore wind energy research is submitted to the RCN

► Key ambitions:

- Reduce offshore wind LCOE with 30 %
- Increase value creation
- Accelerate innovation and commercialization.

► Work programme:



- **Start-up in 2016/2017, pending on funding. Duration 8 years. Decision by RCN 26 May 2016.**

► Annual budget 60 MNOK:

financed by RCN (50 %), user partners (25 %) and research partners (25 %)

- **Host: SINTEF Energy Research**

- **Research partners: CMR, IFE MARINTEK, met.no, NGI, NTNU, SINTEF Foundation, UiA, UiB, UiS + international**

► User partners:

ABB, Amon, Axys Technologies, CFD Marine, DNV GL, Olav Olsen, ESNA, Fedem, Ferrx, Fred Olsen Ocean, Fugro Oceanor, Impello, Kjeller Vindteknikk, Kongsberg, Maritime Robotics, Meventus, Mitsubishi Electric, Norsk Automatisering, Ship Modelling & Simulation Centre, SIMIS, Statkraft, Statoil, Vattenfall, Windmaster Technologies

- **Still open for more user partners**

- **Contact: John Olav Giæver Tande**
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Norwegian Parliament decision on floating offshore wind farms (1/12-2015)

Vedtak 50

Stortinget ber regjeringen i forbindelse med energimeldingen legge frem en strategi som bidrar til realisering av demonstrasjonsprosjekter for flytende havvind og andre former for havbasert fornybar teknologi, og ser på mulighetene for norsk leverandørindustri utvikling innenfor fornybar energiproduksjon.

Vedtak 51

Dokument 8:118 S (2014–2015) – representantforslag fra stortingsrepresentant Rasmus Hansson om en storsatsing på flytende vindkraft i Norge – vedlegges protokollen.

We make it possible!

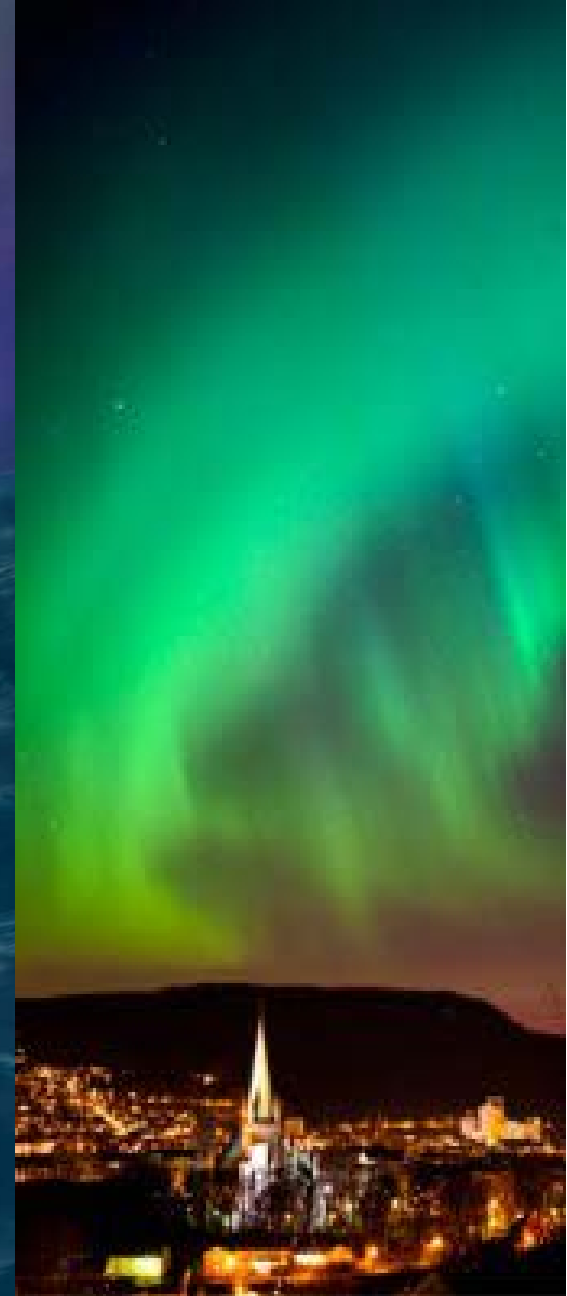
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EERA DeepWind'2016

13th Deep Sea Offshore Wind R&D Conference

Trondheim 20-22 January, Norway



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