

NOWITECH

International Strategy, EERA and TPwind

www.nowitech.no

John Olav Giæver Tande

Director NOWITECH

Senior Scientist

SINTEF Energy Research

John.tande@sintef.no

Outline

- ▶ **NOWITECH in brief**
- ▶ **Industry opportunities / market pull**
- ▶ **NOWITECH international strategy**
- ▶ **TPwind**
- ▶ **EERA JPwind**
- ▶ **NOWERI**
- ▶ **Rounding up**

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
- ▶ Vision:
 - large scale deployment
 - internationally leading

Key target: innovations reducing cost of energy from offshore wind

Research partners:

- ▶ SINTEF (host)
- ▶ IFE
- ▶ NTNU

Industry partners:

- ▶ Det Norske Veritas
- ▶ DONG Energy Power
- ▶ EDF R&D
- ▶ Fedem Technology AS
- ▶ NTE Holding AS
- ▶ SmartMotor AS
- ▶ Statkraft
- ▶ Statnett SF
- ▶ Statoil Petroleum AS

Associated research partners:

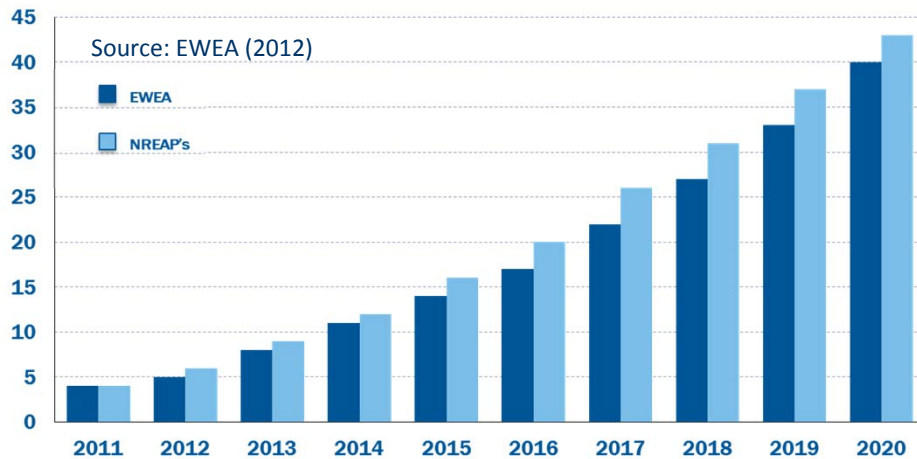
- ▶ DTU Wind Energy
- ▶ MIT
- ▶ NREL
- ▶ Fraunhofer IWES
- ▶ Uni. Strathclyde
- ▶ TU Delft
- ▶ Nanyang TU

Associated industry partners:

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

Industry opportunities: A large growing global market

EU OFFSHORE WIND FORECAST INSTALLED CAPACITY (GW)



OFFSHORE WIND KEY INDICATORS

Key indicators	2010	2016
Capex (NOK)	26.6 bn NOK	92bn NOK
Capex (USD)	4.7 bn USD	16 bn USD
Added capacity	1 GW	3.6 GW
Turbines	370	975
Foundations	639	1,435
Cables	518 km	1,972 km
Installation vessels	21	45
PTVs	86	277

Source: Douglas-Westwood (2012)

- ▶ Firm EU commitment to develop offshore wind
- ▶ EU offshore wind forecast 2020:
 - Total installed capacity 40 GW
 - Total investments EUR 65.9 billions
- ▶ EU offshore wind forecast 2030:
 - Total installed capacity 150 GW
 - Total investments EUR 145.2 billions
- ▶ Significant developments also in China, Japan, Korea and USA
- ▶ The near-term large commercial market is mainly for bottom-fixed wind farms at shallow to intermediate water depths (50 m)
- ▶ Significant interest in developing floating concepts expecting large volume after 2020
- ▶ Threat: financial crisis / economic recession

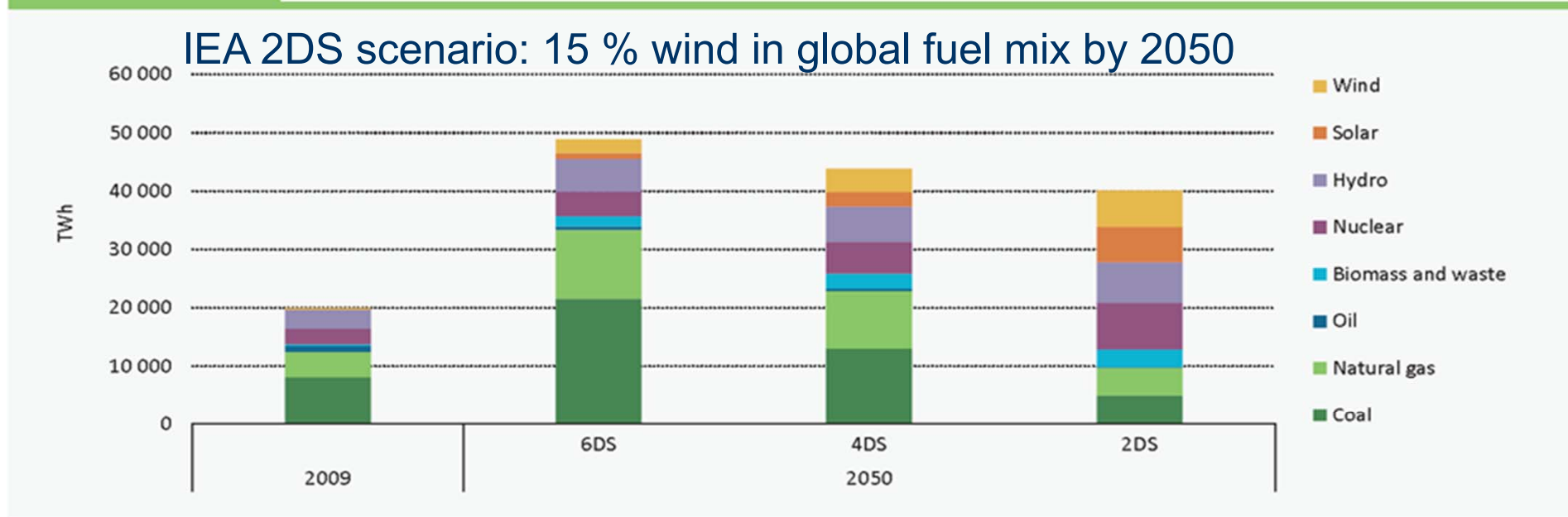
Main drivers

- ▶ 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

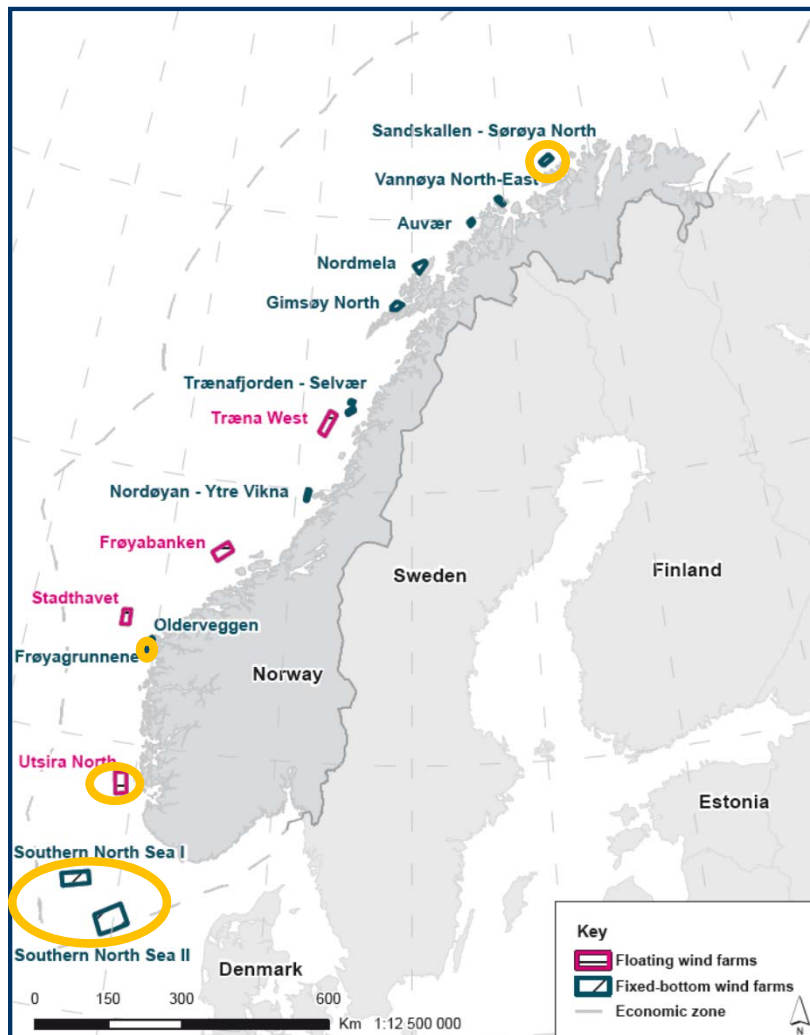


Key point

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

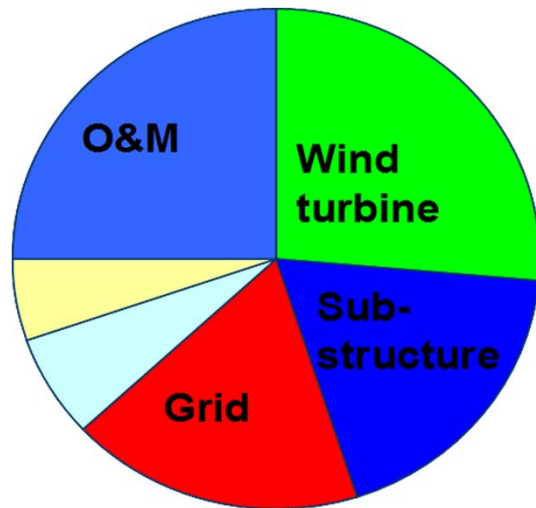
A possible Norwegian market, but uncertain



- ▶ NVE has identified 15 areas for development of offshore wind farms (total ~10 GW); five are suggested prioritized (public inquiry due 4/4-13)
- ▶ Applying the petroleum taxation regime to offshore wind farms for supply to oil and gas installations may create a immediate Norwegian market (total ~100-1000 MW)
- ▶ A significant Norwegian market for onshore turbines are expected through green certificates, e.g. 6 TWh by 2020 (total market for green certificates in Norway and Sweden is 26 TWh).

Industry opportunities – market pull

Cost of Energy – where to focus!



LPC distribution of offshore wind farm (example)

- ▶ The technology is at an early stage with big potential for improvements and innovations through R&D
- ▶ Big market opportunities within:
 - turbine technology (larger turbines, direct-drive generators, power electronic converters, control, tower)
 - sub-structures and installation (concrete foundations, steel jackets, installation vessels, floating concepts)
 - grid connection and system integration (transformers, HVDC converters, cables, balancing)
 - operation and maintenance (predictive maintenance, remote presence, PTVs)
- ▶ Key issue for NOWITECH: Innovations reducing cost of energy from offshore wind

NOWITECH international strategy main objectives

- ▶ Strengthen the core R&D activities in NOWITECH, bringing NOWITECH in front internationally as a leading research community on offshore wind technology
- ▶ Support and assist NOWITECH partners to seek common business opportunities and possibilities world wide

NOWITECH implementation of international strategy

► Approaches:

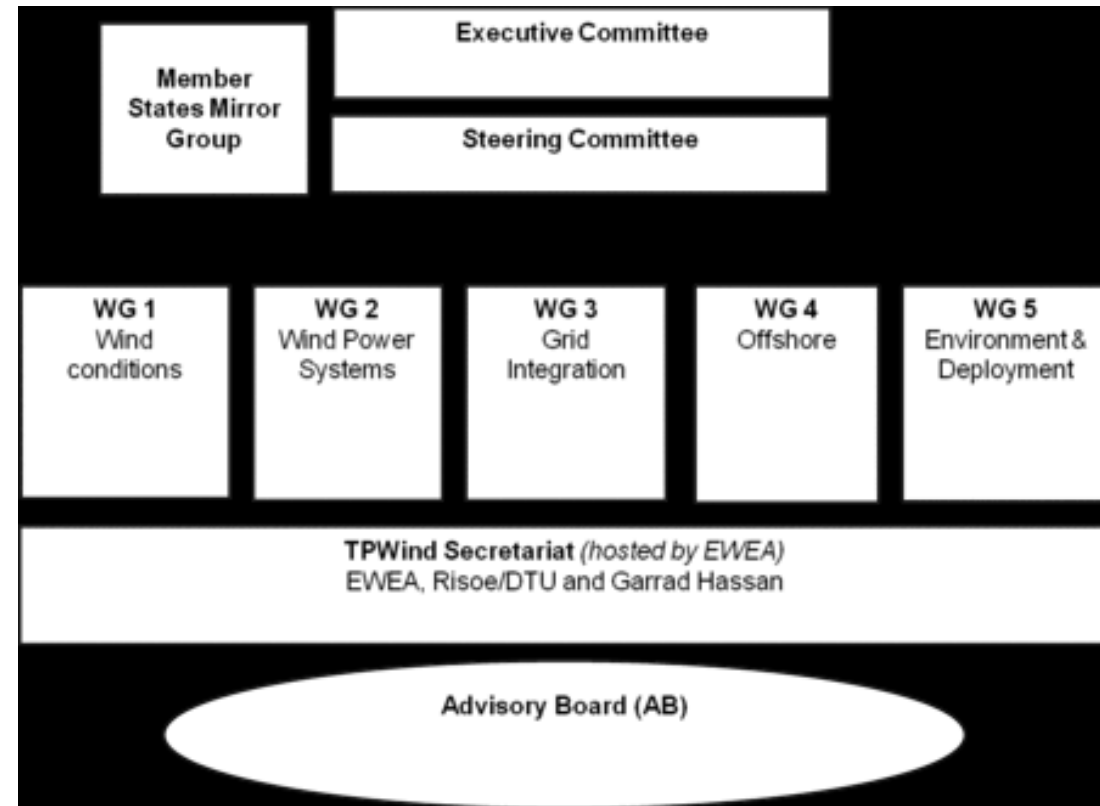
- Attract new international associate R&D partners
 - Attract new international industry partners
 - Link with international projects (incl. use of infrastructure) with participation from one or more of the NOWITECH research partners
- NOWITECH perspective is, as much as possible, to act as an “enabler” for NOWITECH industry partners internationally

NOWITECH strategic priorities

- ▶ Continued focus on offshore technology
- ▶ Regard the North and Baltic Sea as a "home-market"
- ▶ The main strategic partners for the centre are **European partners**, where the main platform for cooperative efforts are through the EU platform, but possibly also through PPP, RCN or bilateral arrangements.
- ▶ The centre will also actively seek international opportunities in both North America (USA) and Asia (Japan, Korea, Singapore, and China)

"A dedicated voice for Technology and Policy R&D, speaking for the wind energy sector and its stakeholders"

- ▶ established in 2005/2006
- ▶ a permanent forum composed of more than 180 wind energy experts representing the EU wind power sector (industry and R&D community).



Main deliverables so far:

- ▶ The “Strategic Research Agenda / Market Deployment Strategy” (SRA/MDS), published by TPWind in 2008, which outlines the R&D challenges faced by the European wind energy sector. This publication quickly became a reference text in the sector
- ▶ The “European Wind Initiative” (EWI), published by the European Commission in 2009 in its Communication on “Investing in the Development of Low-Carbon Technologies” (COM(2009) 519) suggesting total public and private R&D investment of €6 bn for 2010-2020.



– The European wind initiative

Wind energy has to accelerate the reduction of costs, increasingly move offshore and resolve the associated grid integration issues if it is to fulfil its huge potential. To support its rapid expansion, we need: to develop a better picture of wind resources in Europe, through

³ SEC(2009) 1296, 7.10.2009.

⁴ Other financing needs, mainly for deployment, to achieve the 20% renewables target in 2020 will be addressed in a Commission Communication in 2010.

⁵ As proposed in the SET-Plan Communication of November 2007 and endorsed by the Council on 28 February 2008 and the European Parliament on 9 July 2008 (the Buzek Report).

EN

4

EN

coordinated measurement campaigns; to build 5-10 testing facilities for new turbine components; up to 10 demonstration projects of next generation turbines; at least 5 prototypes of offshore substructures tested in different environments; demonstrate new manufacturing processes; and test the viability of new logistics strategies and erection techniques in remote and often hostile weather environments. All of this must be underpinned by a comprehensive research programme to improve the conversion efficiency of wind turbines.

The total public and private investment needed in Europe over the next 10 years is estimated as €6 bn. The return would be fully competitive wind power generation capable of contributing up to 20% of EU electricity by 2020 and as much as 33% by 2030. More than 250 000 skilled jobs could be created.

TPwind activities 2011 – 2013

2011:

- ▶ Develop the EWI 2013 – 2015 Implementation Plan
- ▶ Prepare EWI 2012 Work Programme
- ▶ Renew the Steering Committee

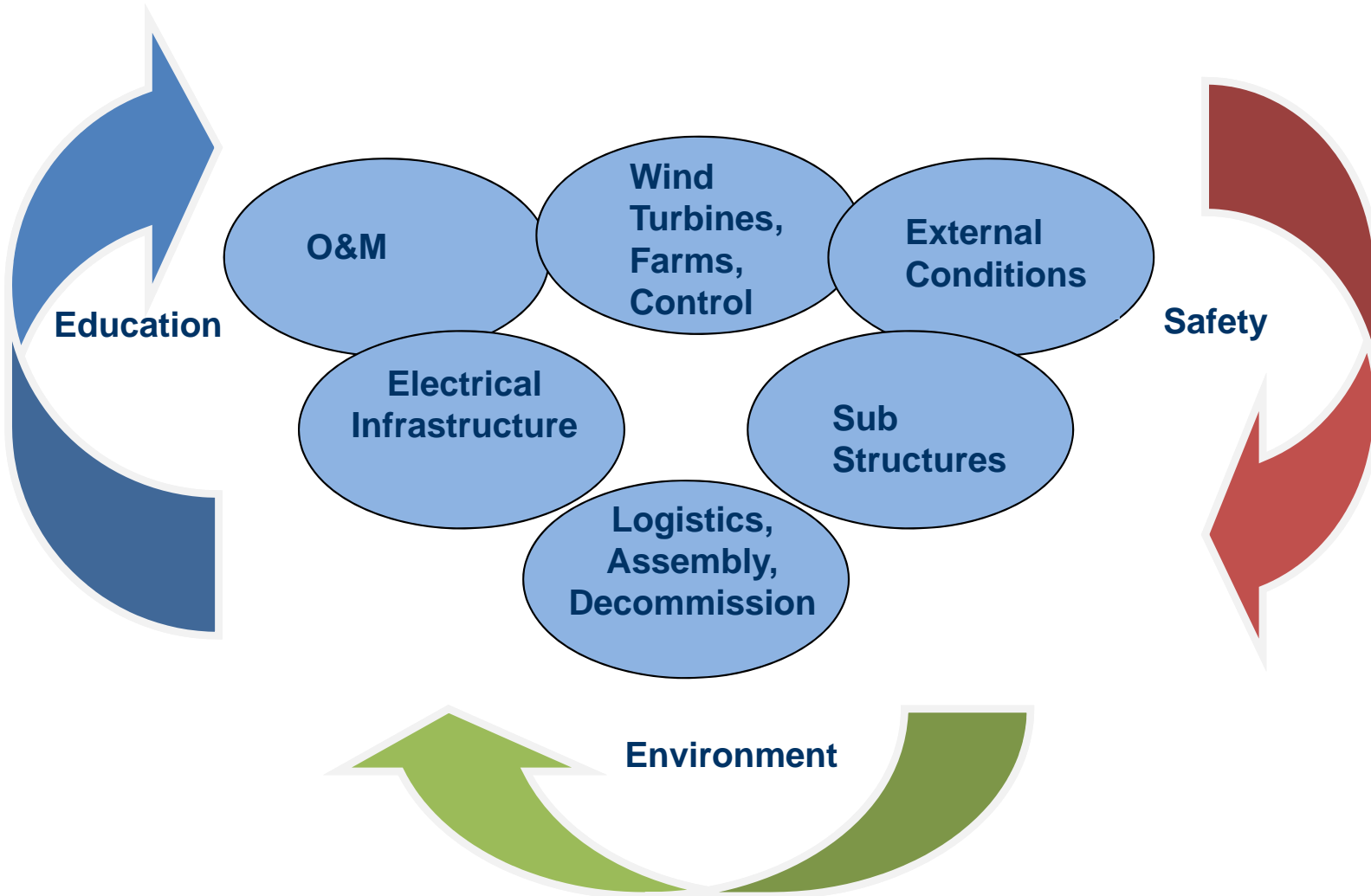
2012:

- ▶ Update the SRA/MDS to be published ultimo 2013
- ▶ Prepare EWI 2013 Work Programme

2013

- ▶ Update the SRA/MDS to be published ultimo 2013
- ▶ Develop the EWI 2016 – 2018 Implementation Plan
- ▶ Prepare EWI 2014 Work Programme

TPwind – new SRA offshore topics



"Coordinating energy research for a low carbon Europe"

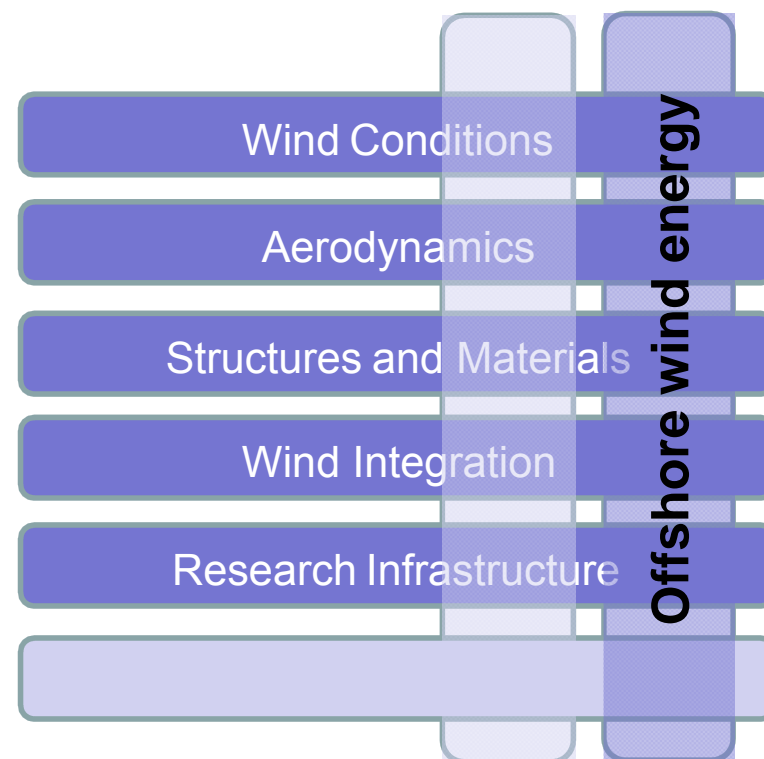
- ▶ established in 2009/2010.
- ▶ a permanent forum with 13 full participants & 23 associated participants from 14 countries, and increasing....
- ▶ committed resources 200 py

The programme vision is:

- ▶ to provide strategic leadership for the scientific–technical medium to long term research
- ▶ to support the European Wind Initiative and the Technology Roadmap's activities on wind energy, and on basis of this
- ▶ to initiate, coordinate and perform the necessary scientific research.

The joint programme comprises the following 6 sub-programmes:

- ▶ Wind Conditions. Coordinated by Risø DTU in Denmark.
- ▶ Aerodynamics. Coordinated by ECN in the Netherlands.
- ▶ Offshore Wind Energy. Coordinated by SINTEF in Norway.
- ▶ Grid Integration. Coordinated by FhG IWES in Germany.
- ▶ Research Facilities. Coordinated by CENER in Spain.
- ▶ Structures and Materials. Coordinated by CRES, Greece



SP Offshore: Overall objective

Pre-competitive research laying a scientific foundation for the industrial development of **more cost effective** offshore wind farms and enabling large scale **deployment at any seas**



SP Offshore Wind Energy

Research objectives

- Integrated numerical design tools for large deep offshore WTs
- Characterization of wind, wave and current cond.
- Tools for offshore grid and WF electric design
- Predictive tools for O&M
- New deep sea concepts

Participants

- Risø DTU (DK)
- ECN (NL)
- CRES (GR)
- CENER (ES)
- FhG IWES (DE)
- LNEG/INETI (PT)
- **SINTEF (NO) – SP coordinator**
- VTT (FI)
- Uni of Strathclyde (UK)
- Forwind / Uni of Oldenburg (DE)
- Forwind / Uni of Bremen (DE)
- Forwind / Uni of Hannover (DE)
- NTNU (NO)
- IFE (NO)
- DHI (DK)
- Uni of Aalborg (AAU) (DK)
- TU Delft (NL)
- ... (to be updated)

SP Offshore Wind Energy

2010-2012 Key results

- Expert workshops:
 - Integrated design tools (2010)
 - Offshore grid development (2010)
 - Predictive tools for O&M (2011)
 - Offshore wind farm grids (2012)
- New FP7 projects
 - EERA DTOC kick-off (Jan 2012)
 - EERA InnWind granted (June 2012)
- Project proposals for national funding
 - ModelWind (NO), not approved (2011)
 - COWER (DK), not approved (2011)
 - ABYSS (DK), not approved (2012)

2012-2014 Key activities

- Update strategy (SRA)
- Prepare FP7 application IRPWIND
- Prepare joint national projects
- Implement e-room (web hotel)
- Expert workshops:
 - Optimized O&M (03-2013 SINTEF)
 - Offshore learnings (06-2013 SINTEF)
 - Bottom-fixed substructures (10-2013 AAU/Leibniz)
 - Offshore R&D conference (01-2014 SINTEF)
 - Reschedule to 2014:
 - External design conditions (02-2011 DTU/IWES)
 - Innovative wind turbines (03-2012 ECN)
 - Validation numerical tools (10-2012 DTU)

SP Offshore Wind Energy

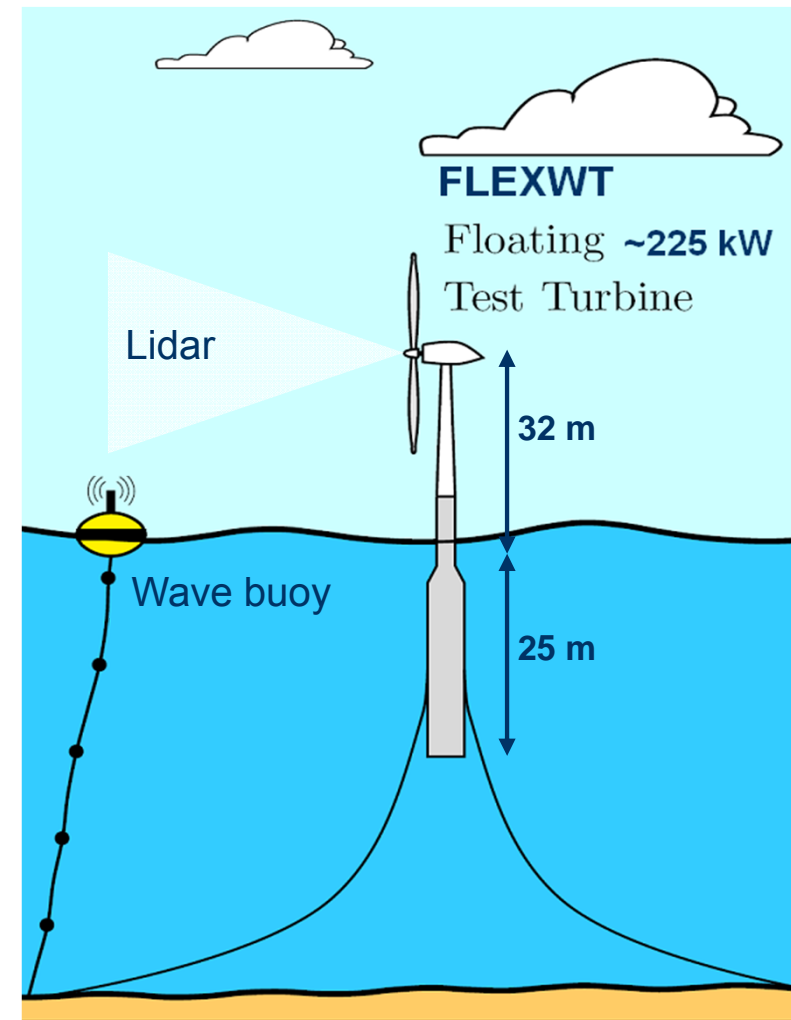


Offshore SRA (draft)

Key topics (based on gap analysis)	Schedule
✓ Design optimization through validation studies offshore	2013-2016
✓ Characterization and interaction of wind, wave and current	2014-2018
✓ Innovative wind farm internal grids for offshore applications	2015-2020
✓ Control, operation and maintenance of offshore wind farms	2015-2020 2020-2030
✓ Novel concepts for deep sea, incl. multi-use of wind farm areas	2015-2020 2020-2030

NOWERI – FLEXWT: Floating Test Turbine

- ▶ FLEXWT is to be ready for installation offshore Norway in 2014 as a platform for open research
- ▶ FLEXWT is part of EU applications:
 - LeanWind for Condition Monitoring and demonstration of Remote Presence
 - IRPWIND for validation of integrated design tools
- ▶ FLEXWT will be a globally unique open research infrastructure



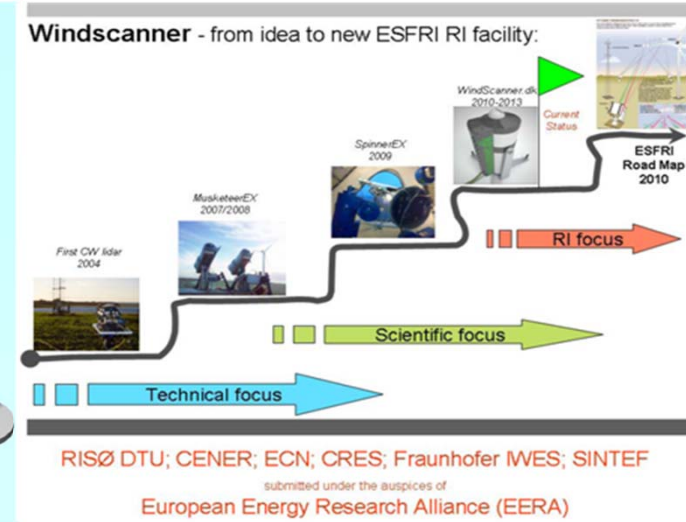
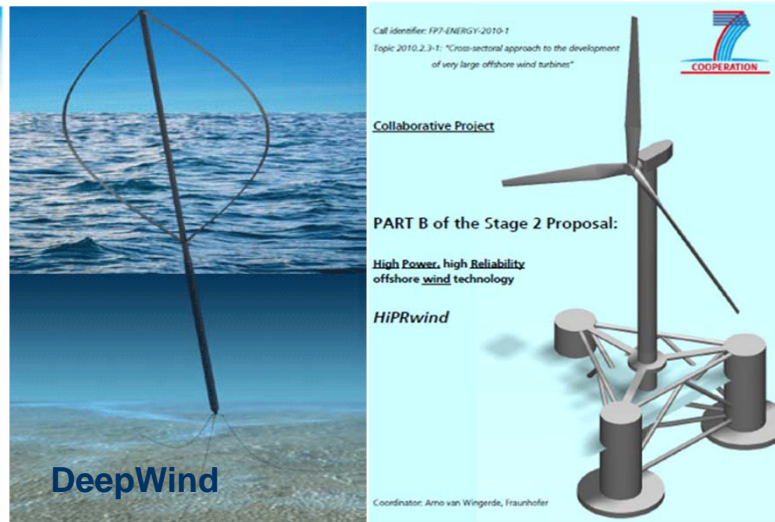
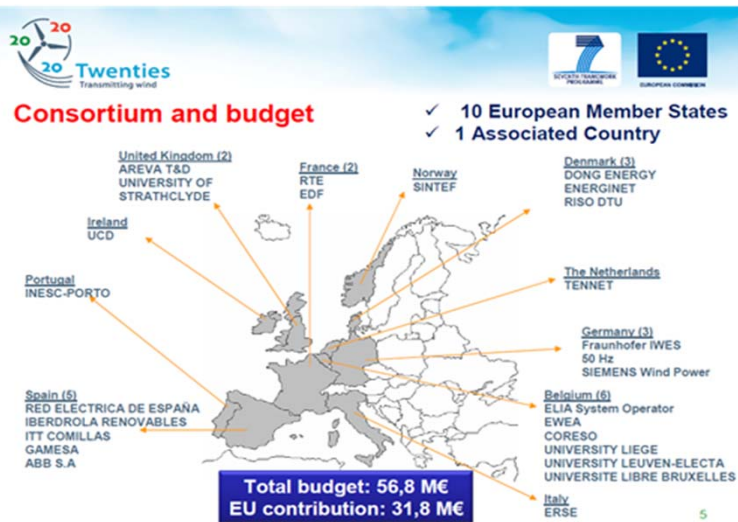
Drawing for illustration only; not in scale

NOWITECH achievements

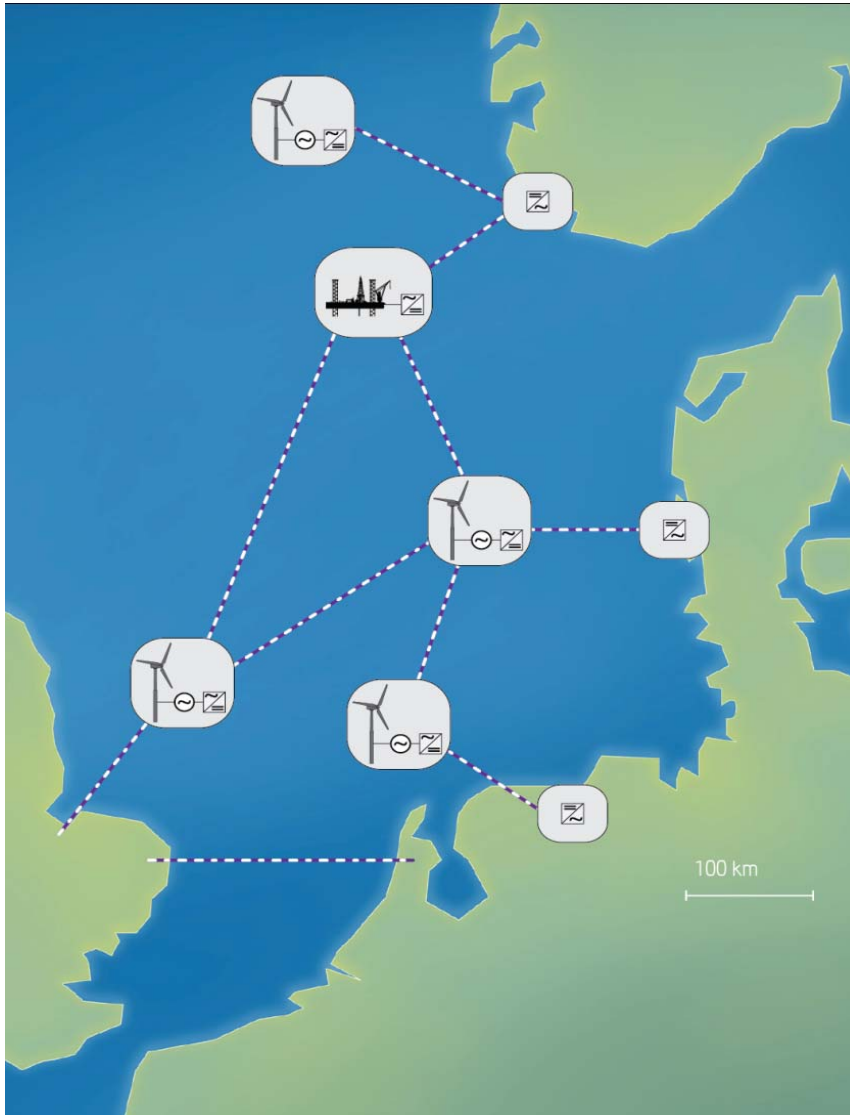
- ▶ **NOWITECH is about education, competence building and innovations reducing cost of energy from offshore wind**
- ▶ Significant budget and duration: EUR 40 millions (2009-2017)
- ▶ Strong consortium with leading research and industry parties
- ▶ Excellent master and PhD programme: 25 PhD & post doc grants
- ▶ Strong scientific results: ~100 peer-reviewed publications
- ▶ R&D results give value creation and cost reductions
- ▶ Innovation process is enhanced through TRL
- ▶ Two new business developments (Remote Presence + SiC coatings)
- ▶ Strong infrastructure in development: NOWERI
- ▶ A high number of spin-off projects: total volume EUR 125 millions (EU (11), KPN etc. (10), IPN (7) and research infrastructure (3))
- ▶ **Vision: large scale deployment & internationally leading**

An attractive partner on the international scene

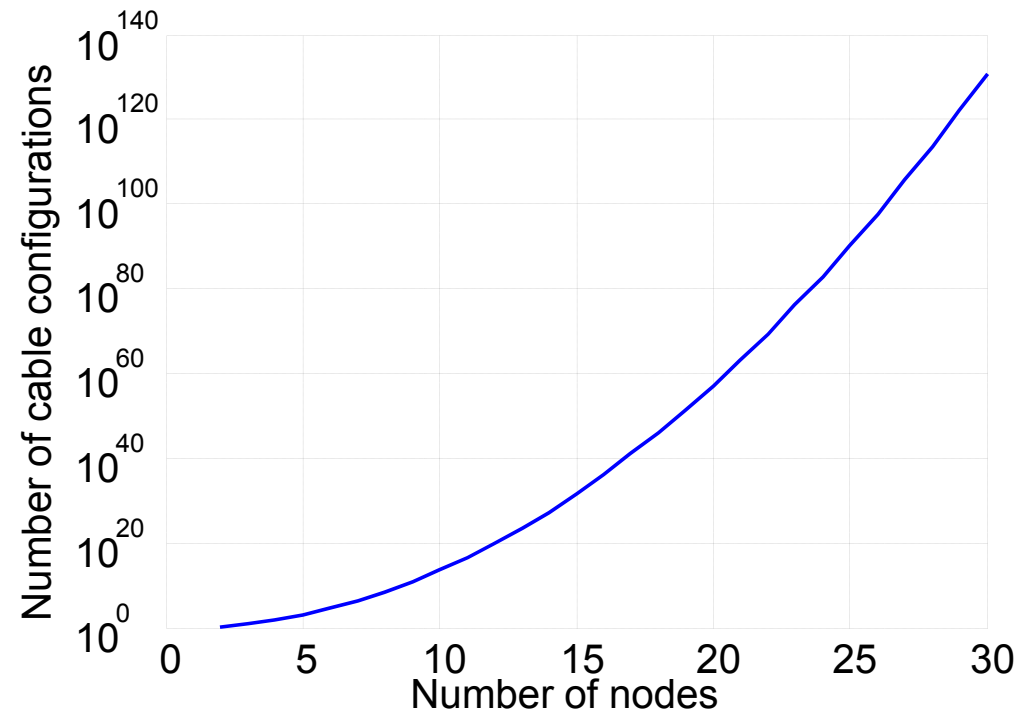
- ▶ Active in EERA, TPwind, EAWE, IEA, IEC
- ▶ Partner in EU projects, e.g.: Twenties (2009-), DeepWind (2010-), HiPRWind (2010-), EERA-DTOC (2012-), InnWind (2012-), LeanWind (application), EERA IRP wind (application), BestPaths (application)
- ▶ ESFRI WindScanner, <http://cordis.europa.eu/esfri/>



Optimization of the offshore grid



- ▶ Inside and between wind farms
- ▶ New market solutions are required
- ▶ New technology (HVDC VSC, multi-terminal, hybrid HVDC/HVAC, ..), Protection, Fault handling, Operation, Control, Cost, Security of Supply..
- ▶ Initiative to develop North-Sea grid (UK-DE-NO-..)

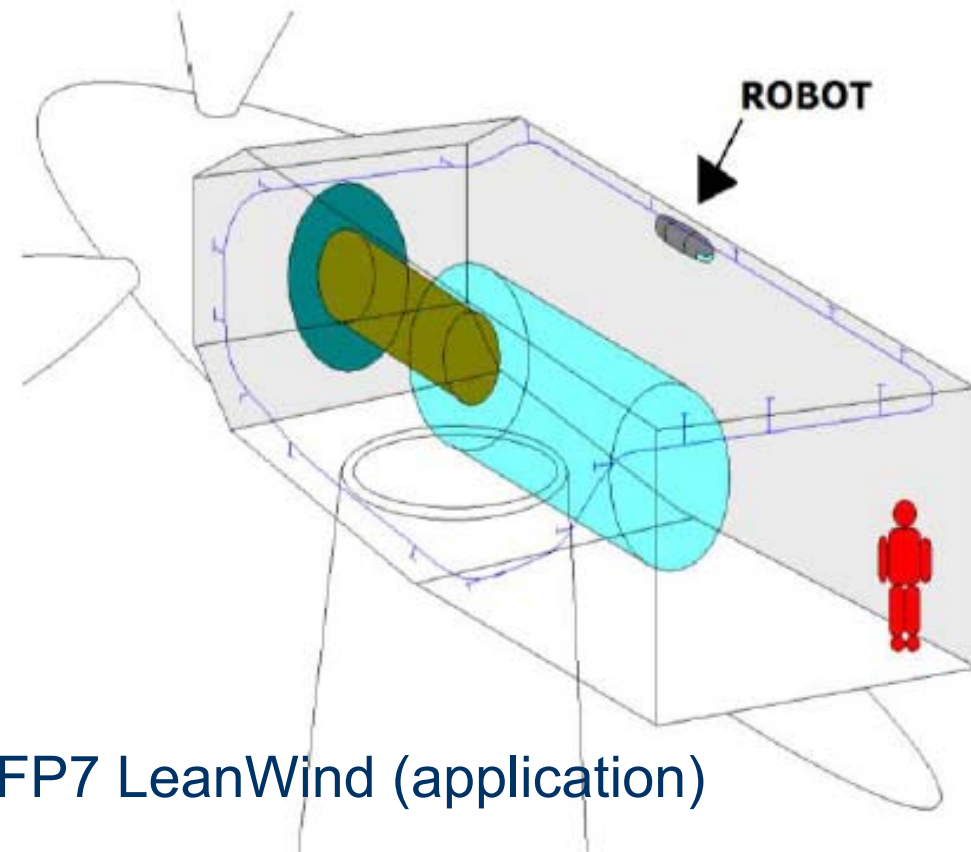


Remote presence reduce O&M costs

- ▶ It is costly and sometimes impossible to have maintenance staff visiting offshore turbines

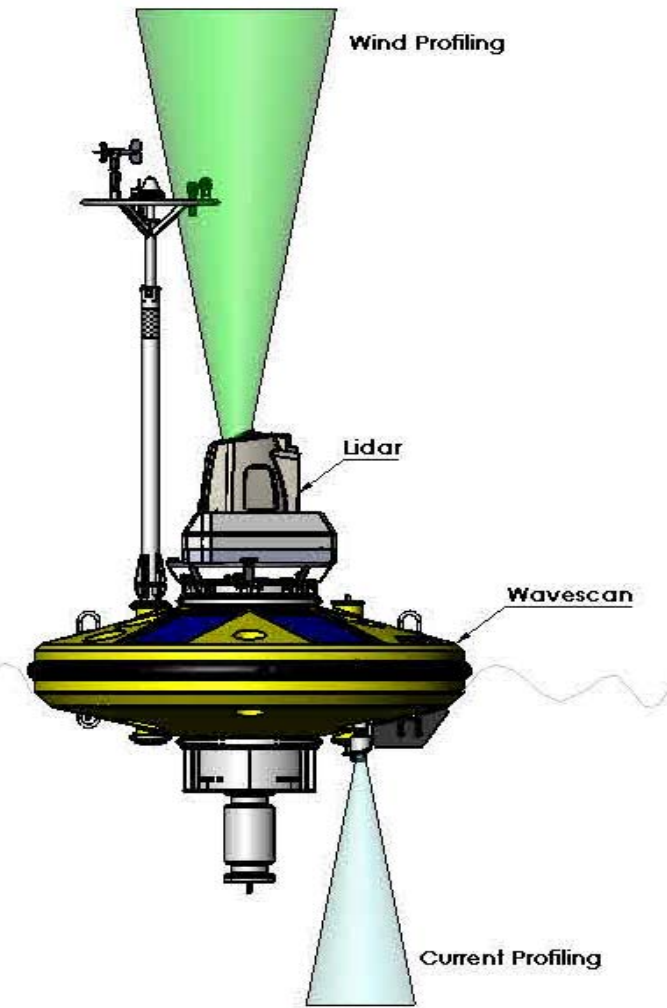
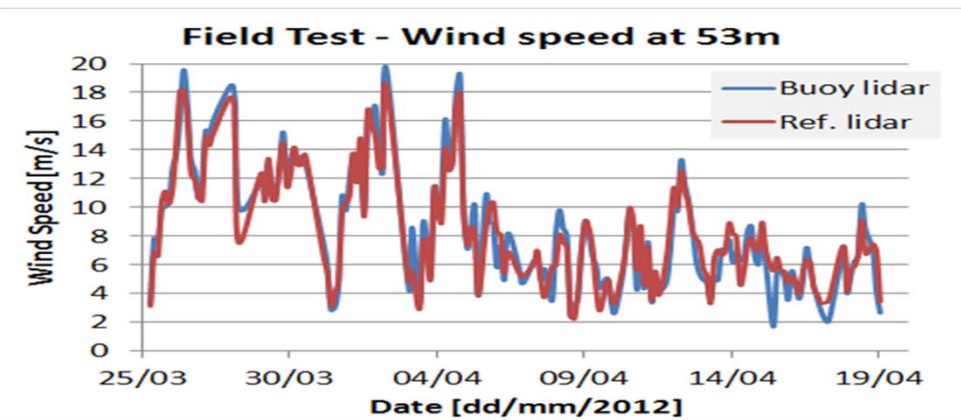


- ▶ Remote presence:
 - Remote inspection through a small robot on a track in the nacelle equipped with camera / heat sensitive, various probes, microphone etc.
 - Remote maintenance through robotized maintenance actions
- ▶ Norsk Automatisering to supply system for FP7 LeanWind (application)

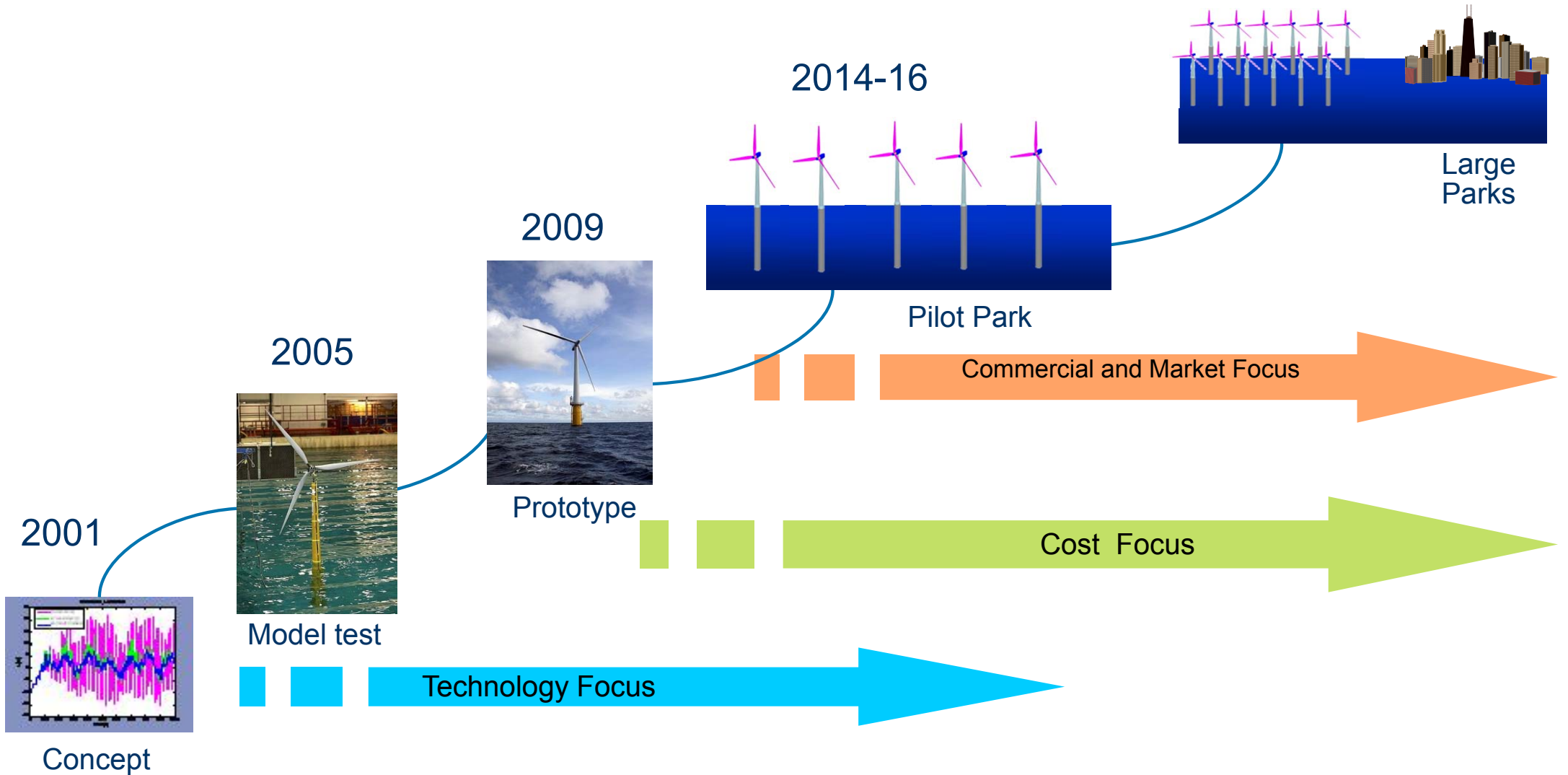


SEAWATCH Wind Lidar Buoy

- ▶ 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.



From Idea to Commercial Deployment



Graphic is copy from Statoil presentation on HyWind at Wind Power R&D seminar; 20-21 January 2011, Trondheim, Norway



Rounding up

- ▶ International strong commitment to develop offshore wind power
- ▶ Europe is in the lead, uncertain Norwegian market
- ▶ Norwegian industry and research have relevant competence and internationally leading within specific sectors
- ▶ The EU R&D arena can be applied for developing and demonstrating internationally leading excellence
- ▶ The sound development of EU strategic research agenda and R&D calls requires broad, long term and qualified engagement
- ▶ Prepare national shadow-groups to enhance engagement

- ▶ Offshore wind is a multidisciplinary challenge – international collaboration is the answer!
- ▶ Outlook is demanding, but prosperous with a growing global market

We make it possible

NOWITECH is a joint 40M€ research effort on offshore wind technology.

- Integrated numerical design tools
- New materials for blades and generators.
- Novel substructures (bottom-fixed and floaters)
- Grid connection and system integration
- Operation and maintenance
- Assessment of novel concepts

www.NOWITECH.no

NOWITECH er et forskningssenter for miljøvennlig energi finansiert av Norges Forskningsråd, industri og forskningspartnere. Hovedaktiviteter er utdanning, kompetansebygging og innovasjon med mål om å redusere utbyggings- og driftskostnader for offshore vindkraft. Senteret har vært i drift siden 2009 og oppnådd sterke resultat med betydelig internasjonal oppmerksomhet. SINTEF Energi er vertsinstusjon for NOWITECH.

Sentral rolle i utviklingen av fremtidens offshore vindkraftteknologi



Som koordinator for senteret vil du samarbeide med kunnskapsmiljøer, leverandørindustri, energiselskap, bransjeorganisasjoner og offentlig forvaltning. Du vil få en sentral rolle i å videreutvikle NOWITECH i samspill med partnere og styre.

Senterkoordinatoren har erfaring fra etablering og ledelse av kompetansebaserte prosjekt, samt relevant bransjeerfaring. Stillingen innebærer bred nasjonal og internasjonal kontakt, og krever interesse og erfaring innen disse områdene.

Vi tilbyr en spennende og utfordrende lederjobb i et nettverk av profesjonelle virksomheter med høye ambisjoner. Senterkoordinatoren vil inngå i ledergruppen for NOWITECH og arbeide tett sammen med senterleder i utforming av strategi og faglig innhold. Viktige oppgaver er oppfølging av framdrift, rapportering av resultat, forberedelse av styredokument, budsjett og arbeidsplaner.

Stillingen gir store muligheter for den rette kandidaten. Vi tilbyr konkurransedyktige betingelser. Stillingen er med fast ansettelse ved SINTEF Energi. Arbeidssted er Trondheim.

Se også www.sintef.no/jobb og www.nowitech.no

Hvis du har spørsmål om stillingen kan du gjerne ta kontakt med senterleder John Olav Tande, tlf 9136 8188, john.tande@sintef.no, eller styreleder Knut Samdal, tlf 901 43 638, knut.samdal@sintef.no.

Søknad med CV sendes innen 10 mars 2013 til anne.jegthaug@sintef.no. Alle henvendelser behandles konfidensielt.

NOWITECH

