Final event 22 august 2017

NOWITECH

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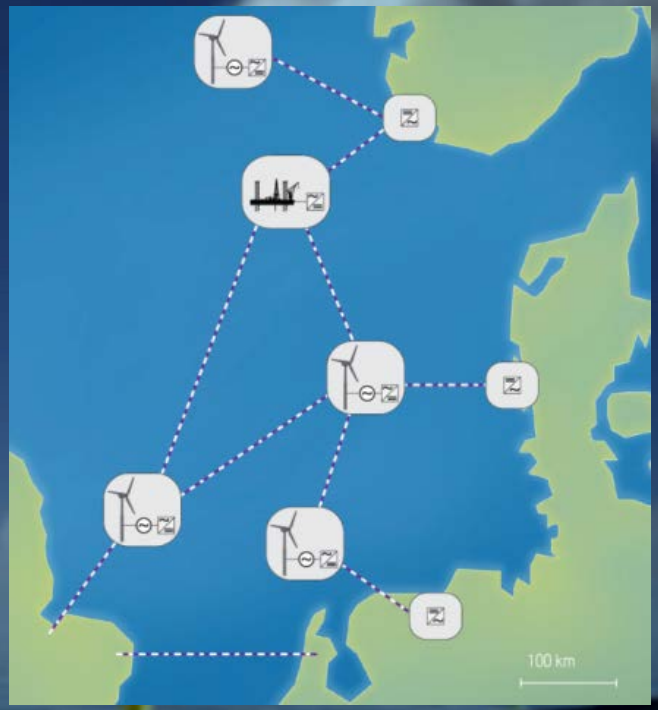


NOWITECH in brief

- 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
- SINTEF Ocean (MARINTEK)
- SINTEF Foundation

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

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

NOWITECH focus

Source: Siemens, MHI-Vestas, MAKE

2009: Yes, yes, yes!

2010: The Future's So Bright, I Gotta Wear Shades

GE investerer 600 millioner kroner i offshore vindkraftteknologi i Norge -- 100 nye grønne jobber

March 25, 2010

OSLO, NORGE -- 25. Mars 2010 -- GE (NYSE:GE) skal investere 600 millioner kroner i offshore vindkraftteknologi i Norge innen 2016. Et nytt senter for offshore vind i Oslo og en styrking av produksjonsenheten i Verdal vil resultere i opptil 100 nye jobber på de to stedene i løpet av de neste årene. Totalt vil GE investere 2,7 milliarder kroner i vindkraftteknologi for offshoresektoren i Europa innen 2020.

Det nye senteret for utvikling av offshore vindteknologi i Oslo vil kombinere GEs solide vindturbinteknologi med Norges offshorekompetanse, og skape en ledende teknologi innenfor offshore vind. Senteret skal fokusere på et bredt spekter av teknologiske løsninger for å gjøre offshore vindturbiner mer effektive. Samtidig planlegger GE å øke produksjonen av demonstrasjonsturbiner i Verdal. Totalt vil GE investere rundt 600 millioner kroner i Norge innen 2016, noe som vil resultere i opptil 100 nye grønne jobber.

2011-2012: hm..

– For dyrt med vindmøller til havs

AV: NTB | KRAFT | PUBLISERT: 17. MARS 2011 - 07:18

Olje- og energiminister Ola Borten Moe (Sp) mener det vil bli for dyrt å bygge ut vindmøller til havs.

– Det er ikke noen vits for meg å bruke mange skattemilliarder til å bygge en vindfarm til havs bare for at den skal ligge til havs, sier Borten Moe til Stavanger Aftenblad.

2013: Mid-term review

Research activities:

"The research work is of highest international standard."

Internationalization:

"NOWITECH has become an internationally recognised organisation for research on offshore wind power,..."

Organisation and Management of the Centre

"The Centre is well organized and led by a highly competent and deeply engaged Director, supported by an efficient management group."

Conclusion and recommendations to the Centre

"NOWITECH has progressed well towards becoming an internationally recognised organisation for research on deep sea wind power, with a uniquely comprehensive research agenda on this topic. The Centre is a well-managed unit in which communication and exchange of experience between all partners seem to run smoothly."

2014-2016: Good news and not so good news

- ✓ **Statkraft drops out of offshore wind (16 December 2015)**
- ✓ **Statoil enhances their offshore wind engagement**
- ✓ **Norwegian export within offshore wind is about NOK 5 billion (Eksportkreditt Norge)**
- ✓ **No funding for COWIND**
- ✓ **Cost is approaching grid parity: 49.9 EUR/MWh for Kriegers Flak (DK) 600 MW (Vattenfall, Nov 2016)**

Dolwin Beta HVDC at Aibel Shipyard in Haugesund

Internationally attractive

NOWITECH has proven a very effective spearhead for research, providing international visibility and impact. A set of separate projects could not have achieved this.

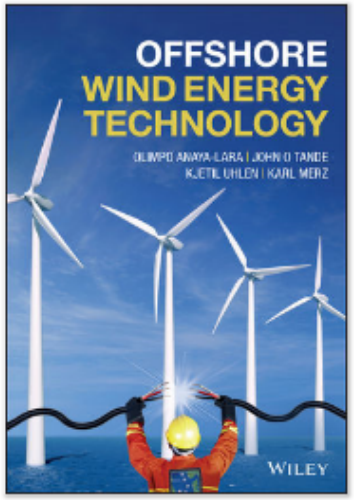
EU-projects:

- ✓ **Twenties (2009-), DeepWind (2010-), HiPRWind (2010-),**
- ✓ **EERA-DTOC (2012-), InnWind (2012-), WindScanner (2012-),**
- ✓ **LeanWind (2014-), EERA IRP wind (2014-), BestPaths (2014-),**
- ✓ **AWESOME (2015-), Lifes50+ (2015-),**
- ✓ **DACOMAT (2017-), TotalControl (2017-)**

Excellent academic results

864 publications*

*per end of 2016



Offshore Wind Energy Technology

Olimpo Anaya-Lara, John Olav Tande, Kjetil Uhlen, Karl Merz

ISBN: 978-1-119-09776-1

525 pages
January 2018

Hardcover	£93.50 €112.20	ADD TO CART

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Wiley Authenticity Guarantee

Books supplied direct from Wiley.com are 100% authentic, 100% brand new, and 100% Wiley - the trusted publisher of academic, scientific, and professional books since 1807.

Description

This reference book is based on research material developed by the Norwegian Research Centre for Offshore Wind Technology and teaching material developed by the authors over the last 20 years. It will cover all aspects of offshore wind energy technology including the wind resource and the offshore environment; wind energy conversion systems technology, control and materials; grid connection and system integration; novel structures including bottom-fixed and floating; operation and maintenance strategies and technologies; and design tools for novel offshore wind energy concepts.

Strong educational programme

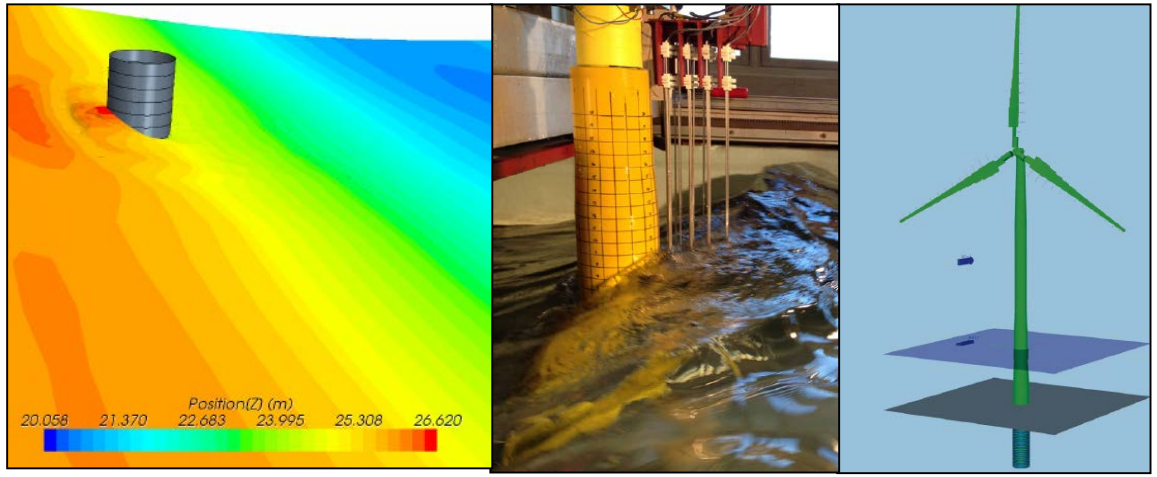
229 MSc and 25 PhD educated for industry*

MSc	229
PhD ongoing	7
PhD final	18
Post doc	3

***numbers are per end of 2016**

At service for industry

De-risking monopole for Dudgeon 402 MW OWF



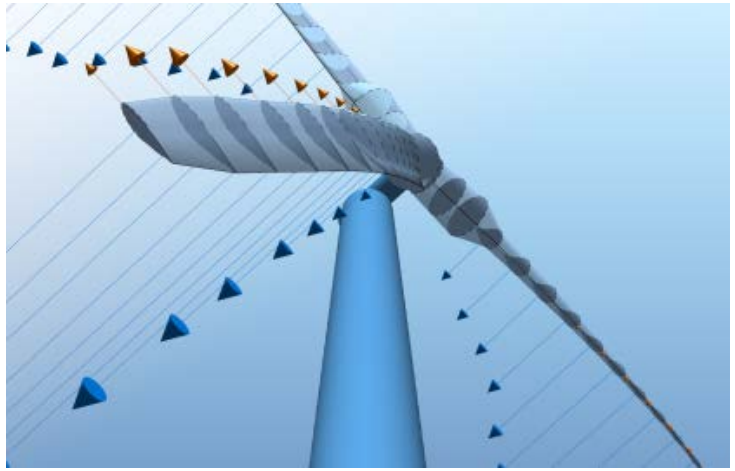
- ✓ The results of NOWITECH are migrating to commercial use, licence agreements, and business developments.
- ✓ Knowledge, models/software and lab facilities are developed, focusing on substructures, grid connection and O&M.

Three commercial spin-offs are established

Seram Coatings AS

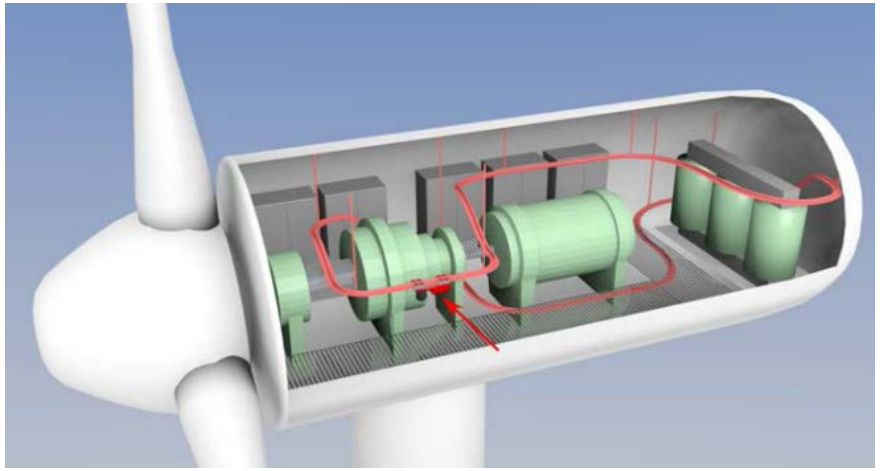
- **Thermasic** – an innovative method for thermal spraying of silicon carbide (SiC).
- Generic technology with a potential large range of future application areas.
- Based on NOWITECH PhD work
- www.seramcoatings.com

SIMIS AS



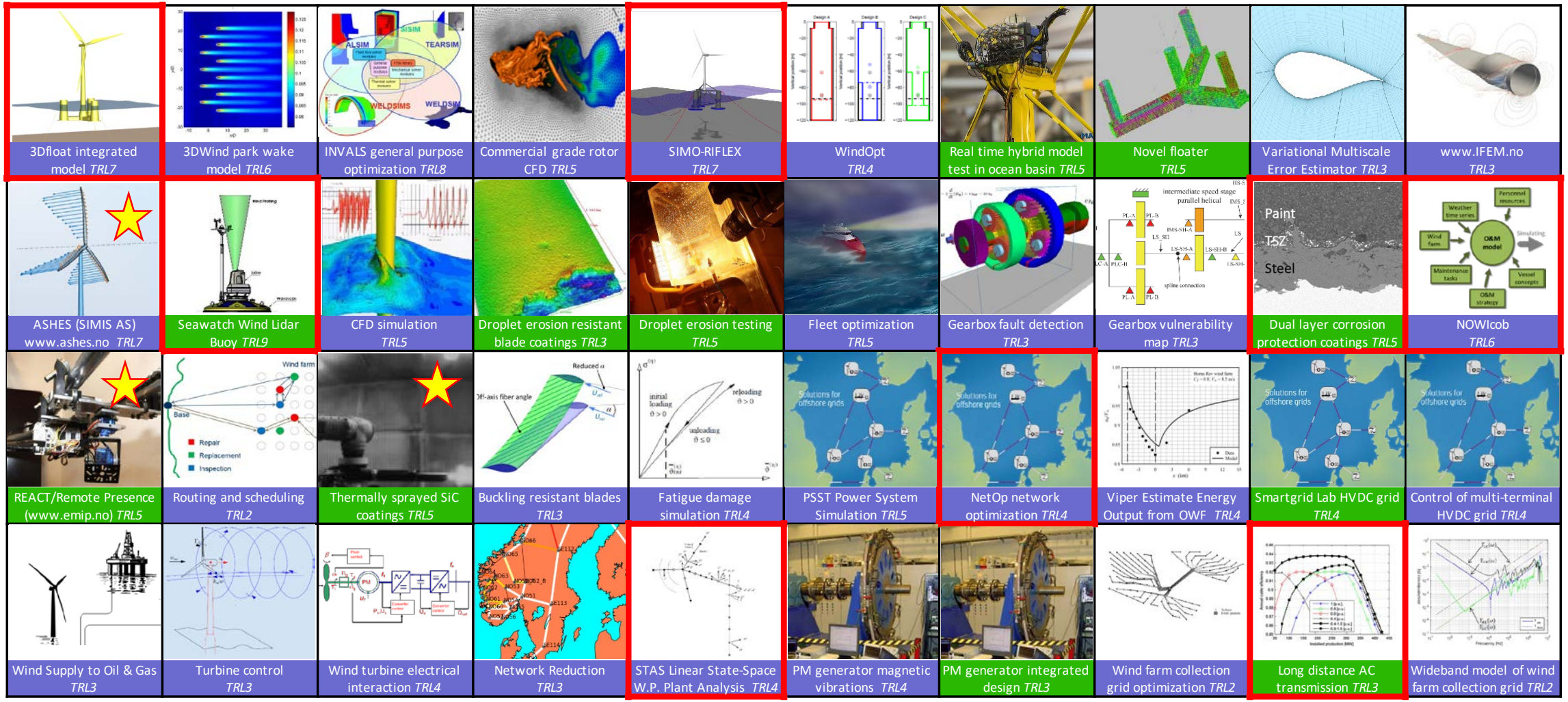
- **Ashes** – wind turbine simulation software
- Integrated simulation of e.g. wind loads, sea waves, gravity, buoyancy, and generator loads
- Based on post.doc in association with NOWITECH
- www.simis.io

EMIP AS



- **REACT** – technology for remote inspection and maintenance of offshore turbines
- Technology assessed by NOWITECH PhD work
- IP owned by Norsk Automatisering AS
- Continued development through RCN and EU projects.
- www.emip.no

40 innovations in progress



NOWITECH Norwegian Research Centre for Offshore Wind Technology

Numerical model

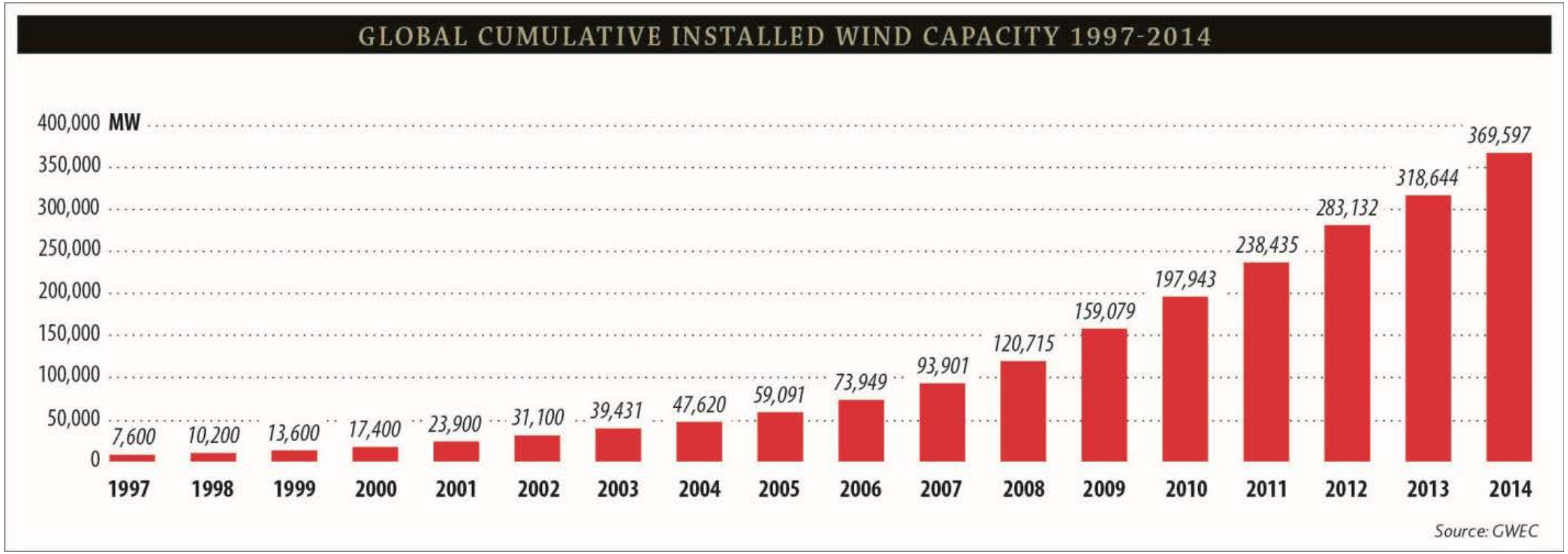
Technology / process

Quantified potential

New business entity (spin-off)

CENTRE FOR ENVIRONMENT-FRIENDLY ENERGY RESEARCH
The Research Council of Norway

And now, a moment of zen ☺



We make it possible!

www.NOWITECH.no

EERA DeepWind'2018

15th Deep Sea Offshore Wind R&D Conference

Trondheim 17-19 January, Norway

NOWITECH Norwegian Research Centre for Offshore Wind Technology

CENTRE FOR ENVIRONMENT-FRIENDLY ENERGY RESEARCH
The Research Council of Norway