Offshore Wind Infrastructure Application Lab (OWI-Lab)

For efficient and reliable offshore wind energy.




OWI lab
Offshore Wind Infrastructure Application Lab

Introduction Sirris

AGORIA
no future without technology

Federation
for the technology industry

sirris
driving industry by technology

Collective centre
of the technology industry

- Non-profit organisation
- Industry owned

Mission: To help companies implement technological innovations

Introduction Sirris

- Collective centre
- Industry driven
- Technological Innovation
- Shared R&D
- Knowledge transfer
- Innovation projects
- Shared capacity
- High tech infrastructure
- Multi-disciplinary approach
- Large partner network
- 130 Experts

Introduction Sirris/ OWI-Lab

Introduction Sirris/ OWI-Lab

Sirris Leuven
Composites
Application Lab

Sirris **Smart Coating**
Application Lab

Sirris
Microfabrication
Application Lab

Offshore Wind
Infrastructure
Application Lab

"The Sirris Application labs focus on technological themes that will be crucial for the future of our companies in the coming years".

Why OWI-Lab?

Why OWI-Lab?

1) The offshore wind energy market fast expanding !

- Offshore wind energy is a critical energy component in may countries low carbon strategy (target 2020)

- Interesting alternative energy technology (grid parity forecasted in 2030)
  - Large untapped resources
  - Relative high energy yields
  - Potential to develop projects on a large utility scale (bulk energy harvesting)

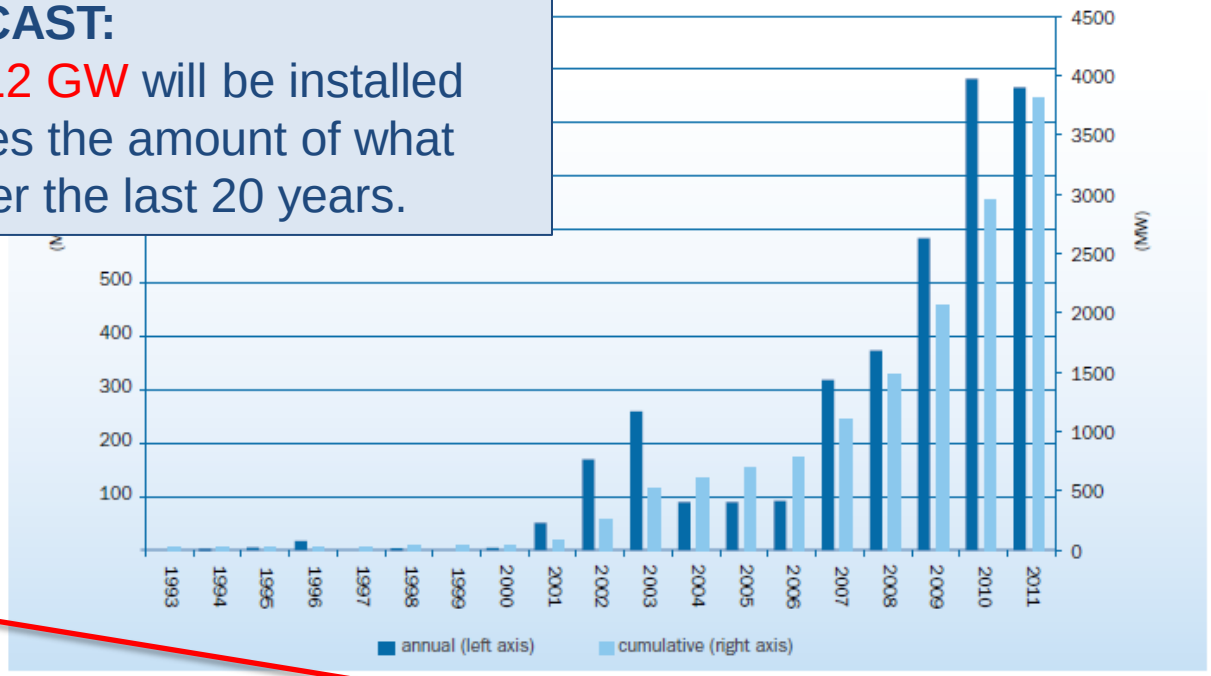
- Economic opportunity
- Latest numbers 2012 (EU):
  - 3.5 GW currently online
  - 2 GW under construction at the moment
  - 100 GW under development

Why OWI-Lab?

EU MARKET FORECAST:
The coming 4 years 12 GW will be installed offshore, this is 3 times the amount of what has been realized over the last 20 years.

FIG 7: CUMULATIVE AND ANNUAL OFFSHORE WIND INSTALLATIONS (MW)

Source EWEA 2011



Belwind Offshore Energy

C-Power

→ **PIONEERS !**

Country	UK	DK	NL	DE	BE	SE	FI	IE	NO	PT	Total
No. of farms	18	13	4	6	2	5	2	1	1	1	53
No. of turbines	636	401	128	52	61	75	9	7	1	1	1,371
Capacity installed (MW)	2,093.7	857.3	246.8	200.3	195	163.7	26.3	25.2	2.3	2	3,812.6

Why OWI-Lab?

- Belgium committed to realize **13%** of energy mix out of **renewable energy**
- **1/3** of this → **Offshore wind energy** (planned offshore wind capacity = **1.622 GW)**

Belwind Offshore Energy

Phase 1 = 165 MW
Annual generation for 175.000 inhabitants
Phase 2 = + 165MW

C-Power

Phase 1, 2 and 3: 325,20 MW
Annual generation for 600.000 inhabitants

Comming up: Northwind, Phase 3 C-Power, Norther, Rental
Seastar, Mermaid

Why OWI-Lab?

2) Creation of jobs and export opportunities

Employment	European Union	Belgium	% Belgium
Direct	135.863	3.476	2,6 %
Indirect	102.292	2.564	2,5 %
Total	238.155	6.040	2,5 %

- 40 % of Belgian wind energy jobs are related to ‘offshore wind’
- Forecast 2020: 13.000 jobs in general with biggest impact in offshore wind energy
- Large international component suppliers active in Belgium (export)
- Pioneering experience in installing and operating offshore and deep sea wind farms (Belwind, C-Power)

Why OWI-Lab?

3 a succes

- , salt,…)
- ze components
- go down to reach grid parity
- MW in design) ; Bigger means better design

"Only a cost optimized and reliable wind turbine is bankable"
dixit Jean Huby CEO Areva Wind

→ Technological innovation throughout het industrial value chain is needed

What does OWI-lab do?

- Investing 5.5M € in test and monitoring infrastructure to support (offshore) wind power R&D in the whole industrial value chain → 4 investment programs in R&D infrastructure

- platform to initiate local and European research projects together with industry and universities (SBO, O&O, FP7,…)

- Innovation projects with / for companies in the wind power sector

SHARED CAPACITY
Access to high-tech infrastructure

SHARED R&D
Technological developments with industrial partners

INNOVATION PROJECTS
Realisations from idea to product

Introduction OWI-Lab

Development of R&D infrastructure

Proposal OWI-project submitted to the Flemish government

Operationalize infrastructure

Kick-Off OWI-Project

Launch OWI-Lab Platform

OWI lab — Offshore Wind Infrastructure Application Lab

Expansion of the research infrastructure

- Inauguration OWI-Lab Test Facility
- 24 Companies / universities participating in user group
- Kick-off feasibility study Flanders Wind Farm Test Site

Creation of innovation

Kick-off Shared R&D project OptiWind (SBO)

OptiWIND

Introduction OWI-Lab

2008

sirris
driving industry by technology

Smart solutions. Strong relationships.

ZF

3E

GeoSea
Geotechnical Offshore Contractor

Vrije Universiteit Brussel

AGORIA RENEWABLE ENERGY CLUB
belgian technologies for the renewable energy market

OWI lab
Offshore Wind Infrastructure Application Lab

+

10/2012

LMS ENGINEERING INNOVATION

KATHOLIEKE UNIVERSITEIT LEUVEN

COCAS
we catalyse your growth

LABORELEC
GDF SUEZ

G&G International

GEOXYZ

UNIVERSITEIT GENT

Belwind
Offshore Energy

FABRICOM
GDF SUEZ

TRACTEBEL Engineering
GDF SUEZ

VINÇOTTE

IMDC
International Marine & Dredging Consultants

rebo
Supporting the winds of change

SMULDERS
WIND TURBINE CONSTRUCTIONS

Cenaero

ALSTOM

elsyca
electrochemical intelligence

Haven Oostende

Coservices
International

CIT ENGINEERING
WWW.CITENGINEERING.COM

LEUVEN air bearings

MAINTENANCE PARTNERS

24 **19**

USER-COMMITTEE

OptiWIND

OWI-Lab in detail

5.5 milj€ investment in state-of-the art test & monitoring infrastructure

1. Stationary and Floating LIDAR (FLIDAR™)

2. Wind turbine component Test Lab with large climate chamber (Temperature testing)

3. Remote measurement & monitoring systems (SHM & CMS)

4. O&M simulation tool & Cost estimator

SHARED CAPACITY
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SHARED R&D
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INNOVATION PROJECTS
Realisations from idea to product

Stationary and Floating LIDAR (FLIDAR™)

1.

NOT FACING BUT SHAPING THE CHANGES

GeoSea

Geotechnical Offshore Contractor

SLIDAR & FLIDAR

DATA

- Datasets and ongoing measurements around Belgian North Sea

ANALYSIS & MODELLING

- Wind flow modelling
- Meso-scale modelling
- Long term correlation
- On-site data reconstruction
- Advanced wake modelling
- SCADA data analysis
- Turbine siting
- Turbulence and extreme wind speeds

ENERGY CALCULATIONS

- Long term yield calculation
- Detailed analysis of energy losses
- Uncertainty analysis
- Bankable reporting

> *It would be nonsense to claim that we can predict everything by the use of computer simulations. We need tests for verification and validation of our models".*
>
> **Carl Erik Skjølstrup,** Vice President, Mechanical Systems, Vestas R&D

ZF

Smart solutions. Strong relationships.

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driving industry by technology

Wind turbine component Test Lab with large climate chamber (Temperature testing)

2.

Large cold climatic test chamber

- On- and offshore wind turbines are standard designed to operate in a temperature range from -10°C to +40°C, **BUT** in some (remote) locations this specification is not enough to ensure reliable operations:
  - Example: Finland → turbine operate @ -40°C
  - Desert of India → turbines operate @ +50°
- These inhospitable locations form a huge challenge for the machine and also for the maintenance and repair teams

Large cold climatic test chamber

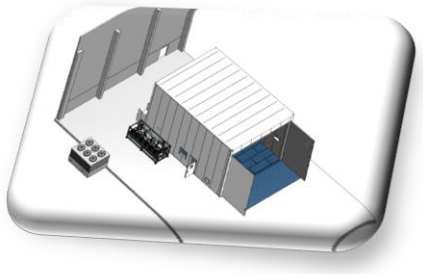
- High operations and maintenance (O&M) costs have to be avoided for remote located wind turbines (arctic wind turbines, offshore located wind turbines, turbines installed in high mountains, etc…).

- How? → testing their components up to their limits ; ensure reliability in all operational conditions.

  "Only a cost optimized and reliable turbine is bankable"

- **Industrial challenge: find appropriate test infrastructure and datasets for these wind turbine components which get bigger and bigger every years**

Large cold climatic test chamber



- Unique climatic test chamber in EU
- Components up to **150 ton** (30 ton/m² floor capacity)
- 560 m³ test space → components up to 10m x 7m x 8m (L X W xH)
- **-60°C** to +60°C
- **408kW** installed cooling power
- +60°C to -40°C air in **1 hour**
- +20°C to -60°C of 100 ton steel in 60 hours


LARGE CLIMATIC TEST CHAMBER

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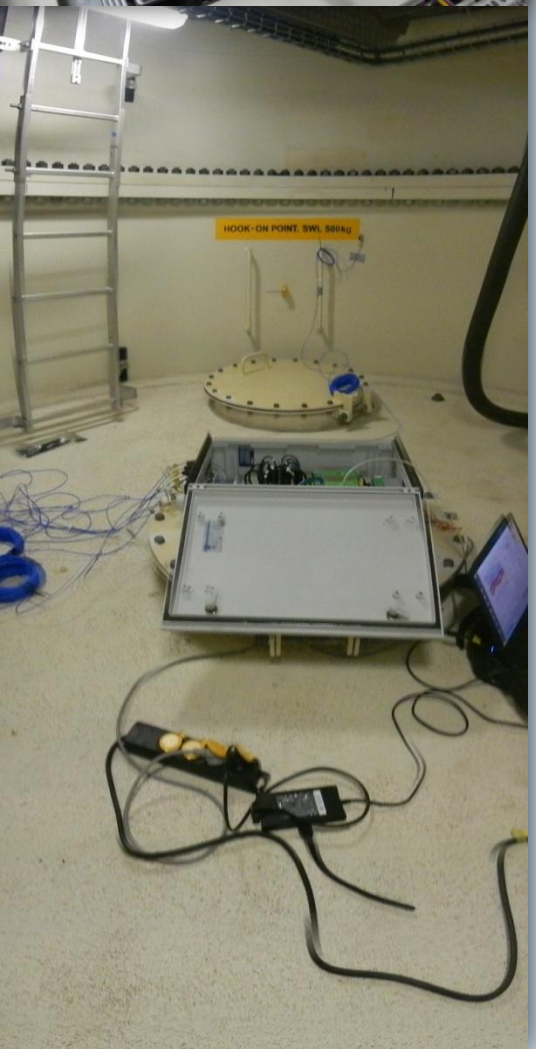
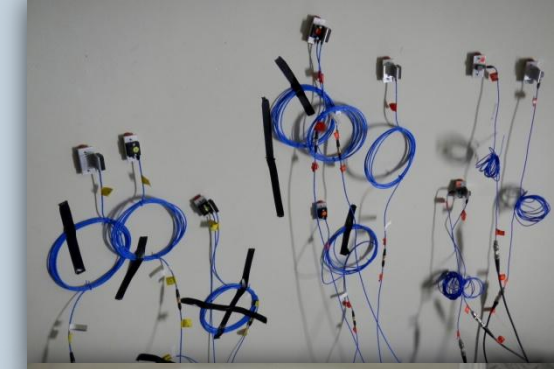
driving industry by technology

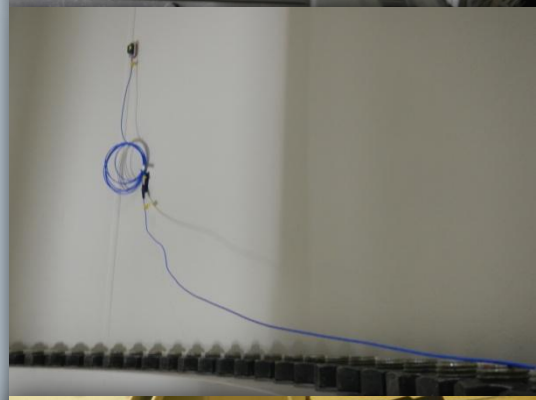
Vrije Universiteit Brussel

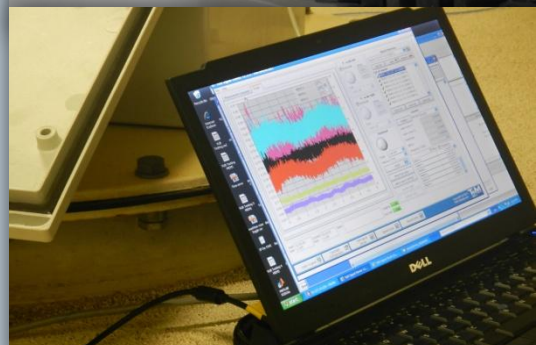
Remote measurement & monitoring systems (SHM & CMS)

3.


HOOK-ON POINT. SWL 500kg






DELL

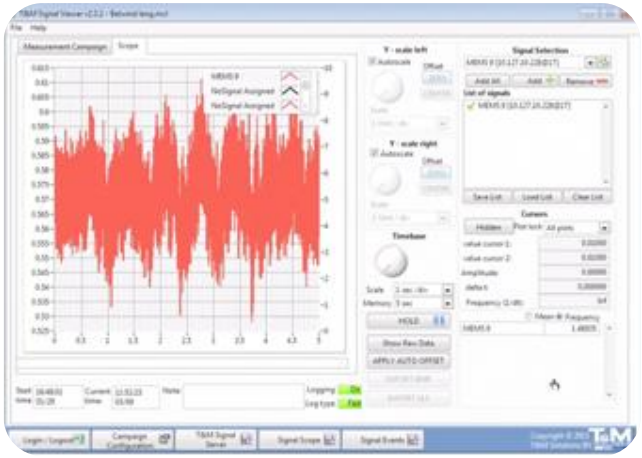
Dedicated offshore measurements & monitoring system

- Datasets as input for component design

→ Get better understanding of the behavior how the turbines operate far shore

- Monitoring for O&M optimization

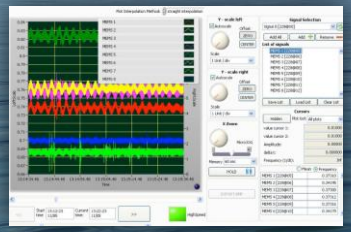
- Multi-purpose:
  - Vibrations
  - Corrosion
  - Temperatures
  - …



CASE: Ongoing research project

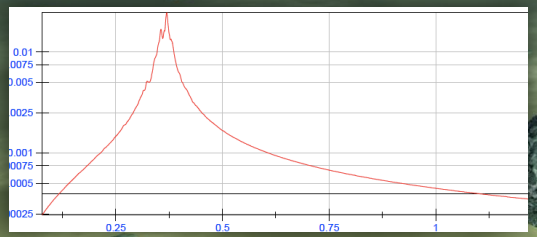
Vibration-based Structural Health Monitoring (SHM) : CONTINUOUS DYNAMIC MONITORING OF AN OFFSHORE WIND TURBINE

Belwind Offshore Energy



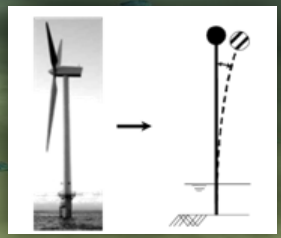
Advanced post-processing techniques for continuous dynamic monitoring of the structure (damping, frequency,…)

Vrije Universiteit Brussel



O&M

DESIGN

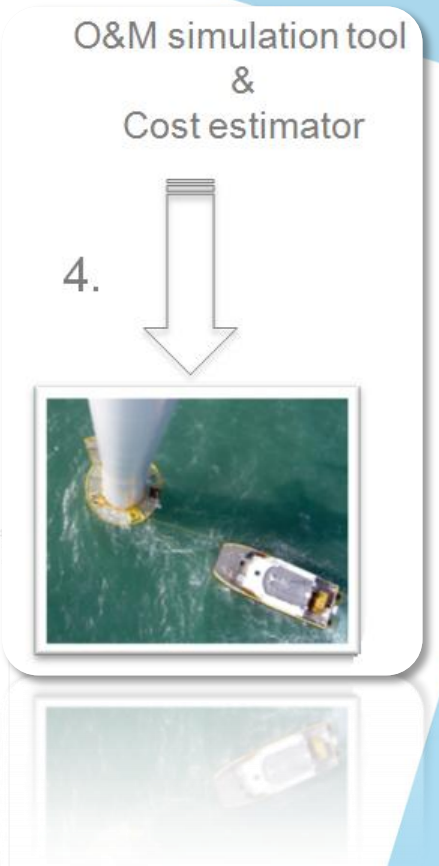


Belwind
Offshore Energy

At this moment ***Belwind already cooperates*** *with OWI for a structural health monitoring measurement campaign, with very interesting results.* ***It is inspiring to see how all involved partners can benefit from such knowledge build-up****: Belwind and their suppliers to learn about the behavior and performance of their wind turbines, OWI in the fact that they get access to a real offshore wind farm environment.*

Frank Coenen, CEO Belwind

O&M software tool



- Purpose O&M tool: study the interplay between:
  - Maintenance strategies
  - Tools
  - Lifetime predictions–CMS
  - Statistical data
  - Wind & meteo data
  - …

and their impact on uptime wind turbine (farm), O&M cost

What is next?

Shared R&D
Technological developments with industrial partners

Innovation Projects
Realisations from idea to product

Strategisch Basis Onderzoek (SBO)

- SBO OptiWind granted by IWT this summer !
- Key topic: Serviceability optimization of the next generation offshore wind turbines
  - Improvement of the design and concepts of offshore wind park, components and their serviceability, and development and validation of dedicated numerical modeling and component testing
  - Development of robust and effective Structural Health and Condition Monitoring techniques for offshore wind energy through advanced data-processing and new sensor technologies

- Project partners VUB / Ugent / KUL / Sirris / LMS / 3E
- Timing: Okt 2012 – Sept 2016
- Budget 3.2 Mio Euro

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INNOVATION PROJECTS
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Flanders Wind Farm

- Feasibility study for developing an offshore test site
- Study granted by ‘Agentschap Ondernemen’
- Experimental offshore test field to test & demonstrated the newest generation of wind turbines (>6MW)

SHARED CAPACITY
Access to high-tech infrastructure

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INNOVATION PROJECTS
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OWI lab

Floating factory of the future

- Mission: High Wind provides a solution to install offshore wind turbines at “high wind” conditions. We are designing, developing and constructing a tool, used for offshore wind turbine installation to make wind farm installation faster, cheaper and more reliable.

- TINA- project
  (‘Transformation, Innovation and Acceleration’ of Flanders’)

- Started February 2012

- Sirris = knowledge partner


NIEUWS

Eerste investering TINA-fonds: 18,7 miljoen euro

14 februari 2012 — Innovatiecentrum Vlaanderen

Het TINA-fonds zal 18,7 miljoen euro investeren in High Wind nv. High Wind nv is een consortium dat een nieuwe robotarm zal ontwikkelen om windturbines op zee te installeren.

In windparken die zich ver van de kust bevinden, kan de hevige wind ervoor zorgen dat de installatie twee- tot driemaal langer duurt. Met behulp van nieuwe robotarmen zullen de bedrijven van High Wind nv de turbines ook kunnen installeren als er veel wind is.

Dat zorgt onder andere voor deze voordelen:

- de installatie wordt goedkoper;
- er is meer zekerheid over de planning;
- de windturbines zijn sneller klaar om elektriciteit te produceren.

De sector van de offshore windenergie groeit erg snel. Om te voldoen aan de doelstellingen van de Europese Unie moet België zijn windmolenpark op zee uitbreiden van 1100 windturbines tot 7000 in 2020 en meer dan 20.000 tegen 2030.

Over het TINA-fonds

Het TINA-fonds (Transformatie, Innovatie en Acceleratie) geeft innovatieve ondernemingen een duwtje in de rug. Dat doet het door geld te investeren in samenwerkingsverbanden tussen ondernemingen (consortia) die een belangrijk innovatief project uitvoeren. Op die manier draagt het TINA-fonds bij aan de doorbraak innovatiecentrum Vlaanderen.

High Wind nv groepeert zes bedrijven die samen de installatierobot zullen ontwikkelen: GeoSea nv (DEME Groep), Alstom, Iemants, G&G International, SBE en Egemin.

PMV DOE- EN DURFBEDRIJF

GeoSea Geotechnical Offshore Contractor

sarens group

ALSTOM

SBE Raadgevende Ingenieurs Studiebureau voor bouwkunde

G&G International

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High wind

What is next?

- OWI +

Thank you for your attention!

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