



## BruWind

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## Knowledge & Technology Transfer Interface

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Vrije  
Universiteit  
Brussel

### ■ Noise & Vibration & Structural Health Monitoring AVRG (VUB); BATIR (ULB)

- Operational modal parameter estimation
- Load and source Identification
- Structural health monitoring
- Advanced measurement techniques
- "Intelligent metal structures" through additive manufacturing

### ■ Siting and Resource Assessment - INDI (VUB)

- Siting studies
- Wind resource assessment using CFD
- Wind measurements

### ■ Small Wind Turbines - INDI (VUB); ATM (ULB)

- Small wind turbines
- Vertical axis wind turbines (VAWT)

### ■ Optical Fibers - B-PHOT (VUB)

- Microstructured optical fiber sensors
- Embedded sensors within composite materials

## Expertise & Techniques

Within the **Brussels Wind Energy Institute 'Bruwind'** several research groups of Vrije Universiteit Brussel (VUB) and Université Libre de Bruxelles (ULB) join their expertise and technologies to boost innovation in wind energy, from small wind turbines in urban environments to large offshore wind farms:

### VUB research groups

- Fluid Mechanics & Thermodynamics Research Group (FTRG)
- Mechanics of Materials & Constructions Department (MEMC)
- Acoustics & Vibration Research Group (AVRG)
- Industrial Engineering (INDI)
- Electrochemical & Surface Engineering (SURF)
- Brussels Photonics Team (B-PHOT)
- Mobility & Automotive Technology Research Group (MOBI)

### ULB research groups

- Building, Architecture & Town Planning (BATIR)
- Bio, Electro & Mechanical Systems (BEAMS)
- Service d' Automatique & d' Analyse des Systèmes (SAAS)
- Aéro-Thermo-Mécanique (ATM)

Its research expertise covers various aspects of modern wind turbine technology:

- Aerodynamics and Aeroelastics
- Strength and Materials
- Noise and Vibrations
- Predictive Maintenance
- Structural Health Monitoring
- Advanced Measurement Techniques
- Siting and Resource Assessment
- Corrosion Management
- Grid Integration and Electrical Machines
- Fault Detection and Control
- Optical Fiber Sensors
- Life Cycle Assessment
- Small Wind Turbines
- Vertical Axis Wind Turbines ...



## Leading innovation in wind energy

BruWind offers solutions for the technological challenges the Belgian and European wind energy industry is facing today and in the near future. Discover its key expertise and topics:

### ■ Aerodynamics and Aeroelastics – FTRG (VUB)

- CFD simulation over complex terrains
- Wind farm optimization
- Simulation of individual wind turbines

### ■ Strength & Materials – MEMC (VUB)

- Composite material testing for turbine blades
- Biaxial material behavior Analysis
- Subcomponent testing

### ■ Corrosion Management – SURF (VUB)

- Corrosion management
- Corrosion sensors
- Corrosion prediction
- Corrosion monitoring

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#### ■ Grid integration and Electrical Machines

BEAMS (ULB); MOBI (VUB); ATM (ULB)

- Grid integration
- Design & modeling of electrical machines
- Electric power generation
- CO<sub>2</sub> gas turbine compensation

#### ■ Fault detection and control – SAAS (ULB)

- Fault detection and control
- Assessment and monitoring of the performance of the control loops

#### ■ Socio – Economic – Ecologic Assessment – MOBI (VUB)

- Life cycle assessment
- Ecodesign
- Sustainability assessment

### Your R&D partner

BruWind offers following services for the Belgian and European wind energy sector:

#### Testing for design validation

A lot of design parameters are very difficult to predict by numerical tools. Therefore performing **dedicated tests on existing offshore structures** is vital to verify the existing design assumptions. To increase power generation and limit weight, offshore wind turbines are becoming structurally more flexible, thus an accurate prediction of their dynamic behavior is mandatory.

#### Structural health monitoring for offshore structures

A way to minimize O&M costs is early detection or even prediction of a reduced structural integrity. Structural health monitoring is a key-expertise within BruWind. This involves **damage detection and characterization of structures** through the observation of the system over time using measurements from different sensors. Damage can be a change in material and/or geometric properties of the structural system.

When it comes to offshore structures, scouring, corrosion and reduction in foundation and grout integrity over time can be problematic. **Continuous monitoring** helps to prevent failures and make better decisions on when to plan maintenance.

**BruWind offers data-acquisition systems, dedicated sensors and analysis services for offshore testing and structural health monitoring.** This allows gaining the insights that are crucial to **minimize construction and installations costs, extend the lifetime of offshore structures and reduce their O&M costs.**

- **Dynamic monitoring:** continuous monitoring of the vibration levels, resonant frequencies and damping values of the fundamental modes of the wind turbine and its foundation structure.
- **Grout monitoring:** continuous monitoring of the loads taken by the grout connection and the relative displacement between the monopile and the transition piece.
- **Corrosion monitoring:** continuous monitoring of the corrosion rates, corrosion potential and oxygen concentration inside the monopile foundation.

#### Siting studies and wind resource assessment

BruWind has a wide array of wind measurement equipment allowing to perform adequate siting studies and wind resource assessments. This enables to predict the annual energy production and the optimal location on site.

### Patents portfolio

- A device for the continuous corrosion monitoring of the foundation tower.
- In the composite material embedded optical fiber for the condition monitoring of wind blades.
- An "intelligent metal" technology for the continuous monitoring of wind turbine gear boxes or wind turbine electric generators.
- An algorithmic methodology for the continuous vibration monitoring and life-time assessment of the wind turbine tower and foundation.

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