



**Contact Person: Ariane Frère**  
**BERA Wind coordinator**  
www.bera-set.be  
ariane.frere@cenaero.be  
Cenaero Headquarters  
Rue des Frères Wright, 29  
6041 Gosselies - Belgium  
Tel.: +32 71 910 955  
Fax: +32 71 910 931

## APPLICATION AS PARTICIPANT TO THE EERA JOINT PROGRAMME ON WIND ENERGY

Belgium has a rich tradition in energy research. Its universities and research institutes are recognized for their leadership in many energy fields. Although individual players have often built prominent positions in their niches, it is hard to attain overall critical mass. Belgium's federal structure compounded this problem. At the same time it became clear that a more consolidated and programmatic approach towards energy research was required to stay competitive at the international – and especially European – level.

To address both concerns, the top research players in Belgium united in August 2011 to found the Belgian Energy Research Alliance - BERA. This not-for-profit association was created with the explicit purpose of *“promoting collaborative research and innovation in the field of energy in Belgium. To this end, the association stimulates its members to collaborate and to take part in international energy research programs, especially in the context of the EERA (European Energy Research Alliance). The goal for the association is to take on a strategic role in the priority setting of the European Energy Research Agenda. The association will pool expertise in different domains related to energy. Moreover, it will stimulate intensive interaction between industry, government and research institutes.”*

The BERA is already an active member of different Joint Programs, i.e. Smart grids, PV, Geothermal, CCS, Materials for nuclear, Smart cities and Storage. With this application, the BERA would like to submit its application as a Full Participant to the EERA Joint Program on Wind Energy.

The BERA Wind strength is found in the complementarity of its eleven members. Their main Wind Energy expertise and research facilities are concisely given below:

- Cenaero: research center in aeronautics, recognized for high fidelity numerical simulation and Tier 1 HPC facility
- Ghent University (UGent): university founding member of the GOwind, Ghent Oostende Wind research institute group and of the OptiWind project (Optimization of the next generation offshore Wind turbines)
- KU Leuven (KUL): university strongly active in wake, wind-farm and atmospheric boundary layer simulations and in drive-train structural analysis



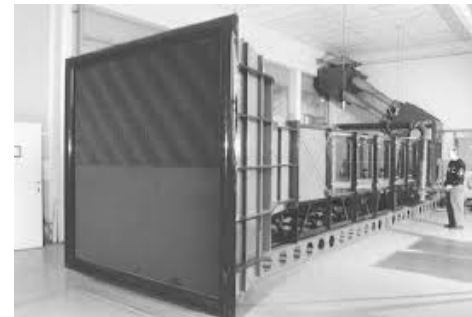
- Laborelec: a cooperative Research and Knowledge center specialized in electrical energy technologies, active for many years on renewable energy production, with a privileged access to GDF SUEZ fleet (n°1 in France, large offshore development)<sup>1</sup>
- Université Catholique de Louvain (UCL): university developing advanced numerical tools for the investigation of wind turbine aerodynamics and wakes (international and national projects with General Electric Research Center, GDF SUEZ...)
- Université Libre de Bruxelles (ULB): university active in grid connection projects, fault detection algorithm validation and storage capabilities with different studies performed using test validation on test-benches (its site is used for urban wind measurement)
- University of Liège (ULg): university with strong research team on aeroelasticity, wind loads and structural analysis and remarkable test facilities (subsonic wind tunnel, vibration testing laboratory, mockup of a monopile offshore wind turbine)
- University of Mons (UMons): university focusing on predictive maintenance and monitoring, e.g. fiber optic sensors, power electronics cooling control and anti-icing coatings
- Sirris: collective center of Belgian technological industry, strongly supports R&D and innovation projects for the offshore sector with the OWI-Lab, offering access to dedicated research infrastructure (climate chamber, offshore field test for foundation and LIDAR)
- Von Karman Institute of Fluid Dynamics (VKI): institute worldly recognized for its research in fluid dynamics, wind resource and turbine aerodynamic studies, combining numerical expertise to large wind tunnel testing facilities
- Vrije Universiteit Brussel (VUB): university coordinator of BruWind, launched to support research in increasing turbine availability, and scientific coordinator with Sirris in the OWI-Lab project, focusing on offshore foundation and turbine monitoring



*Illustration 1: OWI-Lab Floating LIDAR*



*Illustration 2: ULg subsonic wind tunnel*



*Illustration 3: VKI: Low speed wind tunnel*

The collaboration of these different research centers and universities provides BERA Wind with a highly valuable research capacity in Wind Energy. BERA Wind indeed represents a workforce of 45 people and several research facilities: wind tunnels, electrical test-benches, climate chamber, Tier 1 HPC and access to offshore and onshore tests sites. With this application, BERA Wind commits to share to EERA JP Wind the work of 26 person years per year and a privileged access to its research facilities.

As BERA structure is unusual for the EERA JP Wind, it seems important to provide some more information on BERA organization and way of operating.

First of all, BERA is an incorporated legal entity. It exists as such and can act autonomously both within

<sup>1</sup> *As part of the GDF SUEZ group, Laborelec has opportunities to access field data from wind farms operating worldwide (e.g. France, Italy, the Netherlands, Canada, ...) and even implement some R&D projects on operating wind turbines from the group's fleet (e.g. extended instrumentation of the drive train and nacelle of a wind turbine in France with 80 probes with high rate data capture; LIDAR installed on the nacelle of a wind turbine in Belgium, ...).*

Belgium and abroad. BERA can hence act as the representation of the affiliated Belgian energy research players. Its goal and structure are such that BERA is fully equipped to focus on the pooling and coordination of the efforts expended by its members. By accepting BERA Wind as participant to the EERA Wind JP, it is hence clear that only the BERA Wind coordinator, chosen by the eleven members for a two-years period, will come to the steering committee and act as representative towards the EERA JP Wind management. Also, this clear structure and coordination gives BERA a definite capacity for taking care of associated participants.

Secondly, the members put emphasis on BERA taking up a strategic role on the European scene by focusing on EERA and the agenda set in its joint programmes. For each relevant EERA joint programme a thematic team is built amongst the BERA members. In the case of the Wind thematic, the BERA Wind team has the same structure as the EERA Wind JP. A steering committee, composed of the representatives of the eleven members and led by the Wind coordinator, meets every quarter to discuss BERA Wind organization. BERA Wind is also organized into five sub-programmes<sup>2</sup>, which have their own coordinator and focus on technical discussions, presentations of new projects and expertise exchange. BERA R&D priorities are hence by essence conformed with the JP in Wind Energy. Furthermore, BERA as a legal body aims to become an essential EERA partner and take part in the overall steering of the European Energy Research Alliance.

Finally, BERA is the only truly national platform on the Belgian research scene today. R&D policy is a competence of the autonomous regions of Belgium (Flanders, Wallonia and Brussels), with the exception of R&D policy on nuclear energy, which is a federal matter. Many organizations and networks exist at the regional level, but – apart from BERA - none that brings all players together. The necessity of a countrywide approach was obvious in all matters relating to Europe (where the member state is the relevant unit). BERA has provided an answer to this.



*Illustration 4: OWI-Lab test facility in Antwerp Port - Climate chamber*

In Belgium, there are no big wind turbine manufacturers. However, Belgium counts some of the main wind turbine components suppliers, e.g. gearbox from Hansen transmission/ZF Wind Power, transformer from Pauwels/CG Power Systems and rings from Arcelor Mittal. Furthermore, Belgium aerodynamic and structural wind turbine simulation expertise is well recognized, e.g. Numeca, Fluent/Ansys and Samtech/LMS. It is also important to point that Belgium is a major player in the offshore market with its deepest and furthest wind farms in operation (Belwind, C-Power).

The BERA research themes in Wind Energy are closely linked to these Belgian technology interests. The BERA Wind main research topics are Aerodynamics with numerical simulation as well as wind tunnel

<sup>2</sup> Wind Conditions, Aerodynamics, Structures and Materials, Wind integration and Offshore Wind Energy. The EERA JP Wind Research Facilities sub-programme is not essential at BERA level as the Belgian Wind research facilities are already well known and shared between the members.

experiments and Structures and Materials, especially on composite materials and on drive-train. The BERA Wind team has also a strong expertise in numerical simulation and monitoring, knowledge used for Wind Conditions modeling and Offshore Wind Energy prediction, integration and maintenance. Committing 5 PY/Y or more in these underlined topics, the BERA would like hence to integrate the EERA JP Wind and these sub-programmes.

It is important to add that, if it is possible for EERA JP Wind management, BERA would like as well to join the Wind Integration sub-programme as BERA commits to 3 PY/Y and is convinced on a quick increase of this commitment. Also if the BERA Wind counts only 2 PY/Y in the Research Facilities sub-programmes it is due to the fact that the facility users are counted in the other sub-programmes (like in Aerodynamics for the wind tunnel users). Considering the important tests facilities, the BERA would hence suggest its integration as well in this last sub-programme.

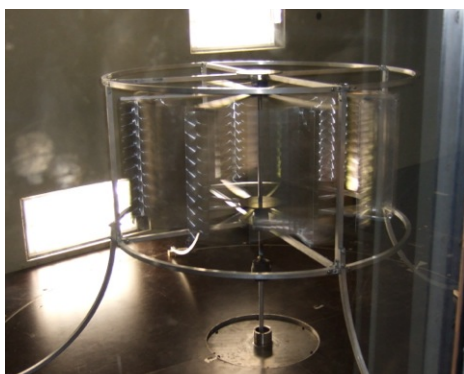
The collaboration between the BERA members is the key to its success. In addition to frequent student exchange, BERA members collaborate on multiple research projects. To illustrate this cooperation, a few recent examples are presented below. Some international collaborations are also introduced. BERA main contribution to EERA JP Wind, in addition to the access to its large research facilities, is hence the sharing of the expertise and knowledge built in these projects.

- The OptiWind project (2012-2015), coordinated by the VUB and Sirris, unites universities (VUB, UGent, KUL) and enterprises to optimize serviceability of the next generation off-shore wind turbines by working on, for example, segmented blades, grid coupling of wind turbines using DC, AC, HVDC lines and use of Condition Monitoring Systems for improved O&M services.
- Laborelec and the UCL collaborate currently on modeling wind turbine wake effects. Laborelec provides on-field measurements from an on-nacelle LIDAR (GDF SUEZ turbine in Belgium), precious data used to validate and improve the UCL high-fidelity computational methods for the simulation of wind turbine wakes.
- The POWER project (2011-2014), collaboration of the ULB and the UMons, aims at improving the reliability of an existing wind turbine and at optimizing the energy production and quality by acting on parameters that do not interfere with the design of the machine (components state diagnose, innovative sensors and production prediction).
- In the D4Wind project (2012-2013), the UCL and Cenaero work on the design of an advanced VAWT concept. Different aerodynamic methods (BEM, CFD and Vortex Method) are compared and used to optimize the VAWT design. The prototype will be tested in wind tunnel for tools and design validation.
- Sirris and the VUB are coordinating the Offshore Wind Infrastructure Application Lab (OWI-Lab)<sup>3</sup> which aims to increase the reliability and efficiency of offshore wind farms by investing in testing and monitoring equipment (large investments to install multi-purpose monitoring equipment on an offshore V90 Wind turbine/BelWind Wind Farm).
- Wind in Brussels (IBGE E11-359) where ULB and VUB are participating: a wind measurement campaign and data analysis is organized and will take place during 12 months spread over 2013 and 2014 at 7 different sites in the Brussels Region with among others (high) buildings. A feasibility study of installing wind turbines at these sites will also be done.
- FP 7 Mare Wind project (2012-2016): new MAterials and REliability in offshore WIND Turbines technology. Partners: IMP PAN, Riso DTU, ECN, CTO, LIV, LMS, Numeca, TWI, NTNU, WMU,

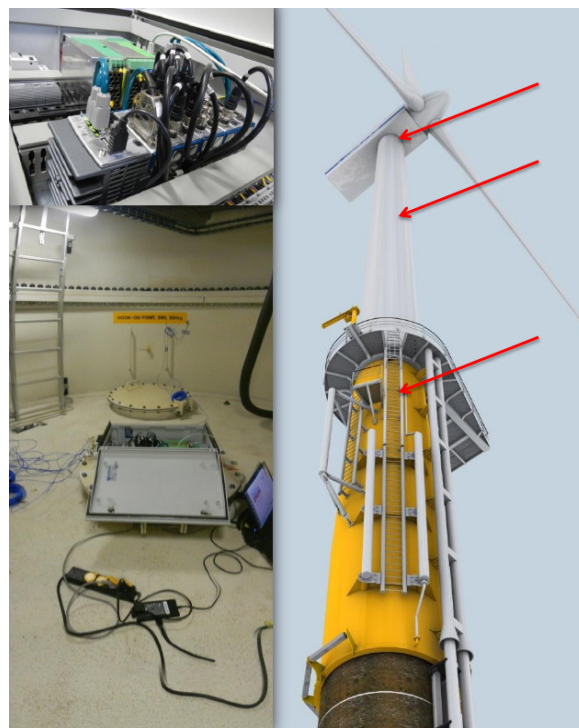
<sup>3</sup> The VUB and the OWI-Lab received the best scientific poster award during the 2012 EWEA conference (Title: Damping Estimation of an Offshore Wind Turbine on a Monopile”).

Relex, SSP, ZF Wind, Stocznia Gdansk, Axsym, NAREC, CENER, CTC, TASK, UNIFE. PIs (KU Leuven)

- NSF - PIRE: USA/Europe Partnership for Integrated Research and Education in Wind Energy Intermittency: From Wind Farm Turbulence to Economic Management. With among others C Meneveau (Johns Hopkins University), J.N. Sørensen (DTU, Denmark), J. Mann (Risø & DTU, Denmark), O. Ozdemir (ECN, Netherlands) and J. Meyers (KUL, Belgium)
- ERC grant - FP7 Ideas (2012-2017). Active Wind Farms: Optimization and Control of Atmospheric Energy Extraction in Gigawatt Wind. Farms. PI: Meyers (KUL)



*Illustration 5: Urban wind turbine performance tests in ULg wind tunnel*



*Illustration 6: Vibration analysis on offshore wind turbine on a monopile / Belwind park*

To conclude, the BERA Wind team is young but composed of recognized institutions within Wind Energy Research. The BERA Wind is a living organization, its members are used to work together on national and international research projects. BERA main added-value to the EERA JP Wind is its strong expertise in aerodynamic models (for turbine design as well as wake and wind assessments) and in structural analysis (mainly for blades, drive-trains and offshore foundation). This knowledge gives BERA a strong instrument to improve energy production, energy prediction and turbine availability. In addition to this expertise, the BERA Wind team gives the possibility to the EERA JP Wind to increase considerably its research facilities with the VKI and Ulg wind tunnels, a Tier1 HPC facility (10000 cores, 120 Tflops), multiple electrical test-benches, a climate chamber and a privileged access to offshore and onshore tests sites.

*By the present letter, the BERA Wind team formalizes its commitment to the EERA JP Wind. Miss Ariane Frère, the BERA Wind coordinator, will be acting as the single contact person. If you need any additional information, please contact her. She will remain available and will gladly answer any question you might have.*