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MEMBER OF
BASQUE RESEARCH
& TECHNOLOGY ALLIANCE

WEBINAR BTI / PWEA/IBERDROLA/POMERANIA REGION

R&D Solutions and Innovation projects within the wind sector in the Basque Country

Perspectives of the wind energy sector in Pomorskie Region (Poland) and situation in Basque Region (Spain).

22 June 2021

R&D Solutions and Innovation projects within the wind sector in the Basque Country

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BRTA – A great alliance to boost the Basque Technological ecosystem

BRTA is born to meet the industrial challenges of Euskadi and to compete with the leading international organizations in research and technology development. This great alliance will be **the vanguard of Basque research in Europe and the rest of the world.**

The Basque Research and Technology Alliance has been created through a collaboration agreement between **16 technology centres and cooperative research centres belonging to the Basque Network of Science, Technology and Innovation, the Basque Government, the Councils of Araba, Bizkaia and Gipuzkoa and the SPRI Group.**

THE BET OF A COUNTRY ON RESEARCH AND TECHNOLOGY

3.700	300 M €	1.300	100
researchers	investment	scientific publications yearly	patents yearly

AZTERLAN / AZTI / CEIT / CICBIOGUNE

/ CICBIOMAGUNE / CICENERGIGUNE

/ CICNANOGUNE / CIDETEC / GAIKER / IDEKO

/ IKERLAN / LORTEK / NEIKER / TECNALIA

/ TEKNIKER / VICOMTECH

/ GOBIERNO VASCO

/ GRUPO SPRI

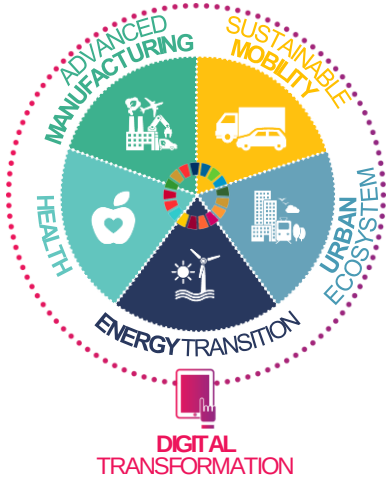
PROVINCIAL COUNCIL OF ARABA / BIZKAIA / GIPUZKOA

TECNALIA Research & Innovation

Benchmark Research and Technological Development Centre in Europe, with **1,446** experts of **29** nationalities, oriented towards transforming technology into GDP to improve People's quality of life, creating business opportunities in Companies.

1st private organisation in Spain in project contracting, participation and leadership under the EU **Horizon 2020** Programme.

SCOPES OF ACTION



IMPACT SERVICES

Laboratory Services

R&D and Innovation Projects

Development of **Investment Opportunities**

> 7.400 CLIENT COMPANIES

(2011 - 2019) **75%** **SMEs** **25%** **Large companies**

Wind Energy Context

Mega trends in wind energy technology

Getting fit for 55 and set for 2050

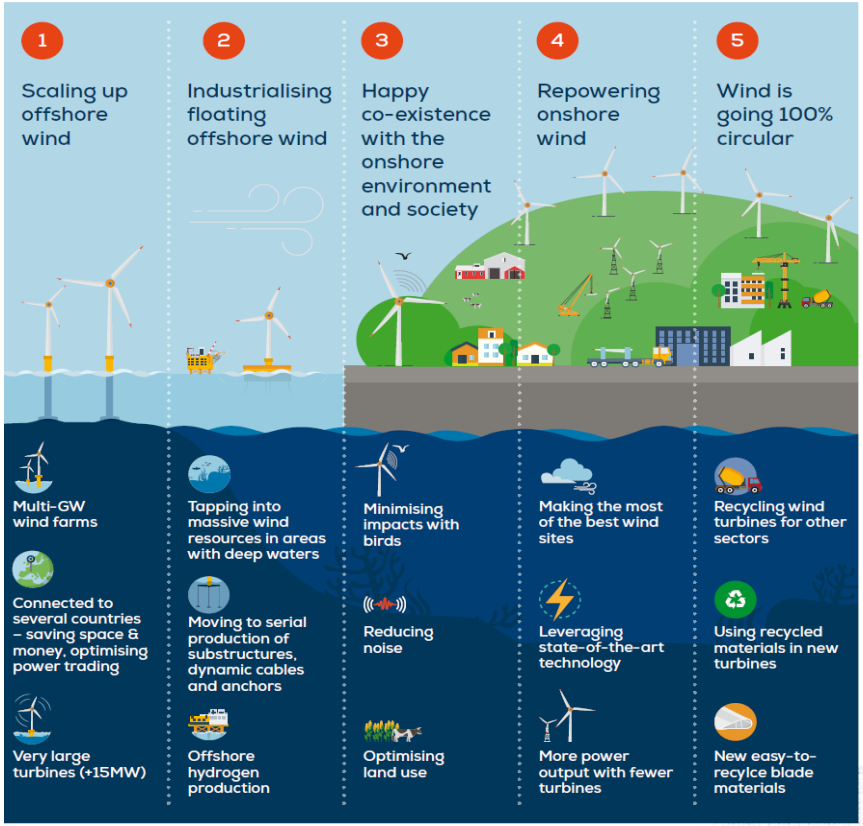
Electrifying Europe with wind energy

June 2021

etipwind.eu • windeurope.org

ETIP Wind

Wind EUROPE



Regional Context

energiBasque

Strategy on Wind Energy: Technological Areas and Lines

Scopes	Specific lines for the scope	Digitalization	Energy Storage	Power electronics	Circular Economy	Materials
Components and subsystems for wind turbines	• Value-added components for high-power wind turbines • Simulation and testing of components, equipment and subsystems • Optimization and standardization of new components	• Sensors for critical component and auxiliary systems • Algorithms for component design optimisation	• Storage systems and hybridisation with other sources of generation	• Power electronics equipment for power quality, protection, control and measurement • High power conversion equipment	• Component eco-design	
Operation and Maintenance of wind farms		• Simulation systems and digital twins • Component connectivity and cybersecurity • CMS systems for maintenance of offshore farms • Monitoring for the life extension of wind farms • Monitoring systems for maintenance tasks in offshore wind farms			• Climate change adaptation models for onshore and offshore wind	
Towers, structures, and offshore foundations (fixed and floating)	• New concepts in the manufacture of towers, foundations and auxiliary systems • Integrated design of fixed offshore foundations • Offshore floating platforms					• New solutions for materials and coatings resistant to degradation in offshore environments • New material concepts for towers and foundations

BRTA R&D research lines on wind energy

1. Technologies for **more competitive and sustainable** wind turbines (on- and off-shore)

- Circularity of materials (reuse and recyclability)
- Development and validation of new materials
- New components and systems for high power wind turbines (> 15 MW)
- Generate knowledge in basic sciences of critical phenomena for both onshore and offshore wind
- Experimental validation to increase the reliability and performance of components and systems (on- and off-shore)
- Optimal component designs, taking into account their entire service life
- New techniques and manufacturing processes to reduce costs and minimize the environmental footprint

BRTA R&D research lines on wind energy

2. **Grid integration**, **storage** and “**Power to X**” (on- and off-shore)

- Integrated forecasting of energy production and demand management
- Short-term energy storage systems
- Hybrid solutions with other renewables, large-scale storage and other energy vectors (in particular hydrogen) for better generation management
- High Voltage Direct Current (HVDC) for offshore parks
- Dynamic and integrated operation of large offshore wind farms to improve power quality and system stability

BRTA R&D research lines on wind energy

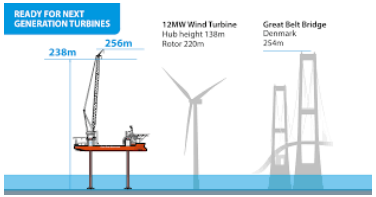
3. **Operation and Maintenance** of wind farms (on- and off-shore)

- Condition monitoring, new sensors and lifetime estimation
- Optimized generation control at wind turbine and farm level
- Digital techniques (in particular, digital twin and virtual sensors) for operation, maintenance and life extension
- Robotics and autonomous vehicles for inspection and / or fault repair
- Integrated data management using standards that facilitate data access and sharing

BRTA R&D research lines on wind energy

4. **Installation and logistics** for offshore wind farms

- Substations for ever larger offshore wind farms
- New means for transportation and installation of large components and electrical cables
- Intelligent planning of the installation and logistics of offshore parks (use of Artificial Intelligence)
- Port logistics for the manufacture and transportation of offshore wind turbine components
- New processes and means for heavy maintenance of offshore wind farms



BRTA R&D research lines on wind energy

5. Development of **floating solutions** for offshore wind power in deep waters

- Designs of floating structures for mass production
- Control strategies for floating wind turbines
- Validation of specific design tools for wind turbines and floating substations
- Optimization of anchoring systems to reduce costs and improve reliability
- Improved reliability of dynamic electrical cables

Floating
offshore wind

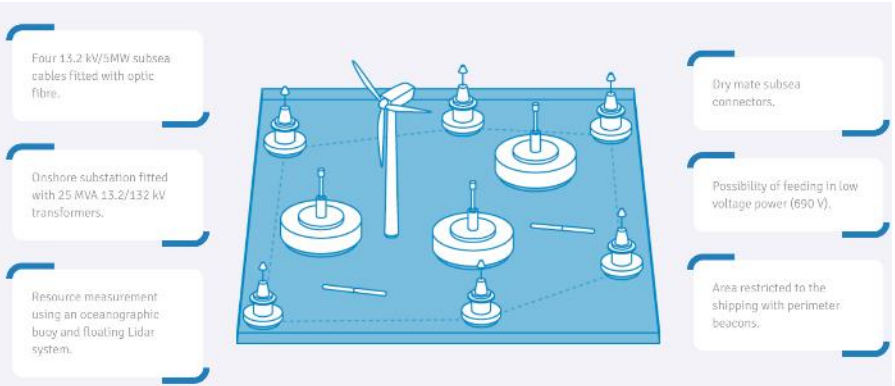
Test infrastructures

BiMEP Biscay Marine Energy Platform

Infrastructure for testing prototypes of wave energy, **floating wind** and auxiliary equipment on the open sea. It is located off the coast at Armintza. Operating since June 2015, BiMEP provides technology developers a site with suitable wave and wind resources for testing the technical and economic viability of different concept designs, offering security before advancing to the full-scale commercial phase.

TECHNICAL CHARACTERISTICS

The Cantabrian Sea offers exceptional conditions for testing the effectiveness of new mechanisms and technologies for harnessing wind and wave energy.



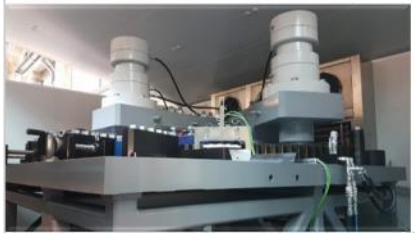
Test infrastructures

windbox
ADVANCED TEST & VALIDATION CENTRE FOR WIND POWER

HYDRAULIC PITCH TEST BENCH
Aimed at testing and optimizing wind turbines pitch actuation systems and their components under similar conditions to those of a wind farm.

GENERATOR SLIP RING TEST BENCH
Aimed at testing and optimizing wind power generator slip rings and brushes.

YAW TEST BENCH
Aimed at testing and validating the yaw system under changing temperature conditions (up to -40ºC).



BLADE BEARING TEST BENCH
Aimed at conducting tests on the hub, the blade bearings, and the bearing-hub and the blade-bearing joints.

PARTNERS

SUPPORTERS

Test infrastructures

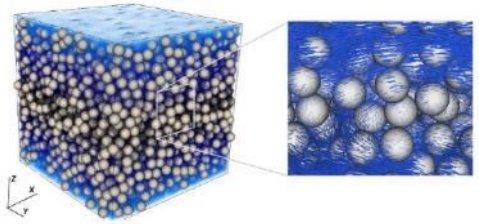
HarshLab
OFFSHORE MATERIALS & COMPONENTS LAB

Laboratory for Experimentation and Validation of Materials, Components and Subsystems in Real Marine Environment.

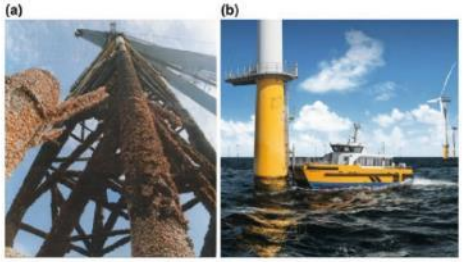
- Evaluation of materials, components and stand-alone systems in real offshore environment (installed in BiMEP since 2018, a new version to be installed in 2021)
- Tests in different conditions: atmospheric, splash, immersion, confined and marine bottom zones.
- Trial of solutions to protect against corrosion, fouling, corrosion-fatigue. Corrosion monitoring.
- Training of personnel in offshore operations.

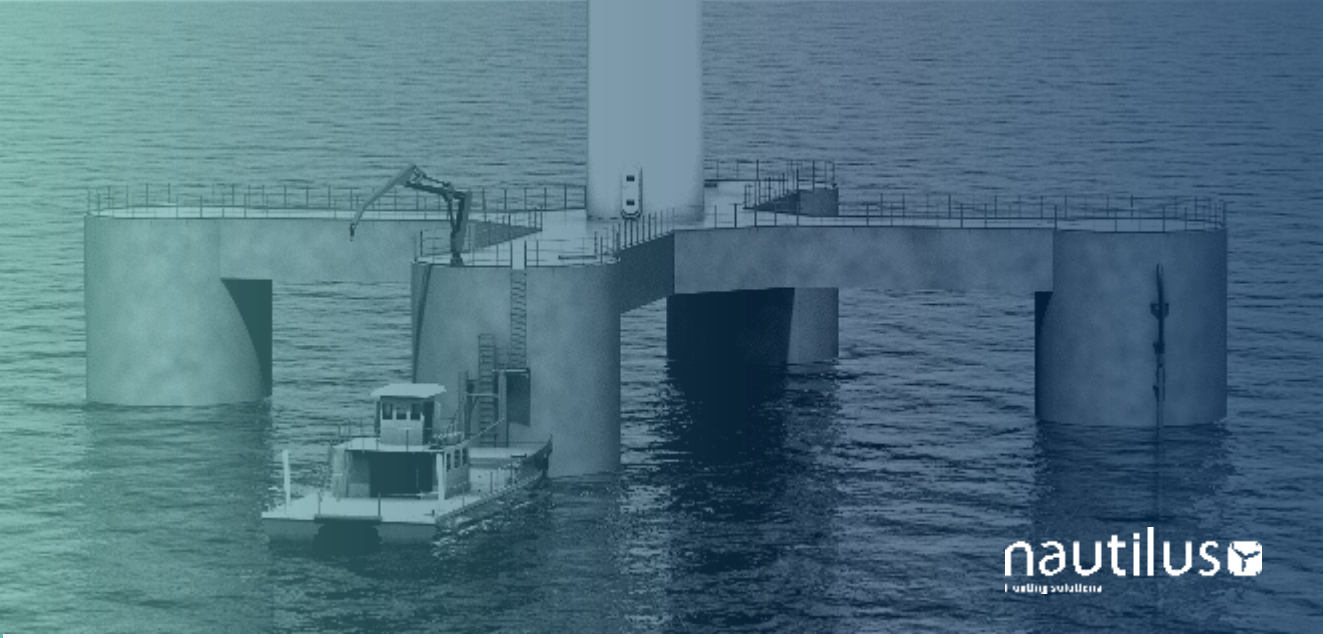
MATHEO
Matemáticas para Eólica Offshore

Project funded by the Basque Government in cooperation with TECNALIA, BCAM, and three department of UPV/EHU to advance in the **physical knowledge** and in the **mathematical modelling** of *offshore wind turbines*



- Development of **Lagrangian SPH approaches** for modelling the non-Newtonian fluid at the seabed, and investigate the interaction with piles and anchors and improve the future designs, validated experimentally in a wave flume
- Development and training of **algorithms based on data-driven Deep Learning** approaches for early-damage detection of critical structural failures, optimal sensoring, estimation of remaining life and future redesign of components
- **Empirical modelling** of non-linear phenomena occurring at the splash zone: overtopping, biofouling and corrosion
- **Finite element modelling** of fracture and extension to novel materials, as for example fibre reinforced concrete





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LIFES50+

Qualification of innovative floating substructures for 10MW wind turbines and water depths greater than 50m

- Advanced numerical modelling and experimental testing of floating structures.
- Tools for costs calculation and life cycle analysis of floating wind turbines, developed for concepts assessment.
- Methodology for the risk analysis and application to the design, for the identification of potential design constraints.
- Recommended practice for the design of floating wind turbines.
- Industrialization of NAUTILUS design, considering manufacturing, transport, installation, O&M and decommissioning stages.
- Pre-FEED and FEED designs for different wind turbines and offshore sites across Europe and USA.

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INNTERESTING

ikerlan
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INNTERESTING WILL ACCELERATE WIND ENERGY TECHNOLOGY DEVELOPMENT AND EXTEND THE LIFETIME OF FUTURE WIND TURBINE COMPONENTS (2030-2050) BY DEVELOPING INNOVATIVE TESTING METHODS FOR PROTOTYPE VALIDATION OF WIND COMPONENTS SUCH AS PITCH BEARINGS AND GEARBOXES

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Applied research to innovative and integral solutions for foundations, towers and auxiliary systems of high-power offshore wind turbines

SEAPOWER

- Numerical models for the design and evaluation of offshore wind turbines
- Design optimisation of jacket foundations.
- New solutions for join systems not screwed.
- Innovation in transition pieces for both fixed and floating
- Coatings resistant to corrosion and biofouling.
- Tower design optimisation for large wind turbines.
- Integrated lifting systems in offshore wind turbines
- Connection of dynamic cables to structures.
- New solutions for electrical transformers for large wind turbines

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WIND2GRID

Floating Offshore Substations and their potential in a green Hydrogen supply chain through power-to-gas

- Research into novel energy transmission systems: HVDC. Storage, H2 generation, Synthetic Natural Gas. Hybridization with other renewable sources.
- Development of new floating structures applied to both floating and fixed offshore wind farms.
- Advanced numerical modelling and experimental testing of floating structures.
- Research in specific concretes for marine structures, with self-repairing nanotechnologies, reinforcement of polymeric fibers for reinforcement, monitoring of loads and defects and of a positive environmental footprint.

Conclusions

- Strong network of R&D Centres with a multi-technology approach for wind energy
- 5 key Research & Development fields
  - More competitive and sustainable wind turbines
  - Grid integration, storage and “Power to X”
  - Operation and Maintenance
  - Installation and Logistics
  - Floating offshore wind
- Knowledge acquisition and early technology development throughout public funded projects (local and European) to be transferred to the industry.

ESKERRIK ASKO
GRACIAS
THANK YOU
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Jose Luis Villate
joseluis.villate@tecnalia.com

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