

BRETAGNE^{BE} OCEAN POWER

A photograph of several white wind turbines against a clear blue sky. The turbines are positioned diagonally across the frame, with the largest one on the left and smaller ones receding into the distance on the right. The image is partially covered by a blue diagonal band at the top and white text boxes.

**TEAM UP WITH
BRETAGNE**
TO DEVELOP MARINE RENEWABLES

Marine Energies IN BRITTANY



/ PILOT FARMS

GROIX BELLE-ÎLE PILOT FLOATING WIND FARM

Eolifi Offshore France, Naval Energies

- / Goal:** set up a pilot farm with 4 turbines to deliver 24 MW.
- / Project developers:** Eolifi Offshore France, CGN Europe Energy, Naval Energies, GE, VINCI, VALEMO
- / R&D Centres:** IFREMER, ENSTA Bretagne, LBMS Brest.
- / Technology employed:** Free floating platform (FFP), floating offshore wind turbine deployed in deep waters on a semi-submersible platform attached to the seabed with catenary cables (ease of maintenance).
- / Size & siting:** Height of the multi-MW prototype: 175 m. Water depth: from 50 to 200 m.
- / Output power:** 24 MW.
- / Overall cost:** €200 m. This project enjoys support from the French investment expenditure programme.

TIDAL CURRENT TURBINE / Sabella D10

- / Goal:** develop a simple & robust marine turbine, with high reliability and low maintenance.
- / Project developers:** Sabella, in conjunction with AKUO Energy and CDK Technologies.
- / Output power:** 2 tidal turbines generating 2 MW each.
- / Technology employed:** Bottom-fixed tidal current turbine designed by Sabella. 10 year operational lifespan.
- / Size & siting:** Rotor diameter: 10 m
- / Overall cost:** €10.3 m. This project received funds from the French 'Investments for the Future' expenditure scheme, the European Union and the Bretagne Regional Council.

/ COMMERCIAL FARMS

A commercial farm is a production site that delivers the generated power to the electricity grid.

/ Tidal energy
(Rance Tidal Power Plant, operated by EDF).

/ Wind energy
(offshore wind farm located off St. Brieuc, operated by the Ailes Marines consortium).

/ Floating Wind Farm
(1 GW - Calls for tender from 2020 - South Brittany)

/ TEST SITE

TIDAL TURBINE / Chantier Bretagne Sud

- / Goal:** construct, install and qualify an industrial demonstrator.
- / Project developers:** Guinaud Energies (partners: Bernard Bonnefond, ENSTA Bretagne, IFREMER, etc.).
- / Technology employed:** High-output ducted tidal turbine (doubles the power output), self-orientes in the direction of the tidal stream; low weight-to-power output ratio and compactness making it efficient even in shallow waters (10 to 12 m depth), floating base that can be immersed and retrieved using ballast tanks (limiting operating costs).
- / Size:** height on the seabed, 8 m.
- / Weight:** 90 t (32 t without the base).
- / Output power:** 350 kW.
- / Overall cost of the demonstration phase:** €4.25 m (expected financing: 60% private funds and 40% public funds).

FOATING WIND TURBINE / Ifremer

EOLINK PROJECT

- / Goal:** Produce a new floating wind turbine on tripod (scale 1/10)
- / Project developers:** Eolink with the support of IFREMER and Regional Council of Bretagne
- / Technology:** EOLINK design targets the biggest power/weight ratio in order to get the best-in-class LCOE. First time such ratio between swept area and floater's size is tested.
- / Output power:** 12 MW (Scale 1).

PAIMPOL-BREHAT CMN - HYDROQUEST TIDAL TURBINE

- / Goal:** Produce a turbine of 1 MW
- / Project developers:** CMN, Hydroquest (Partner : EDF)
- / Size:** vertical axis, 25 x 10 x 11 m
- / Output power:** 1 MW
- / Weight:** 1400 t

Western France build the future OF FLOATING WIND POWER

IN THE ATLANTIQUE

/ OPTIMAL CONDITIONS FOR SUCH AN INITIATIVE

Thanks to its strong ocean waves, currents, and winds, Bretagne is a region with a high potential for harnessing marine renewable energy. It also enjoys a strong skills base in the maritime industry, which is crucial for growing this emergent sector along with the new technology required.

Bretagne is turning to marine renewables as a way to meet its energy demands, and is keen to back industrial projects and identify areas that are attractive to develop this technology commercially. To address the needs of local energy production, Bretagne is committing to floating wind turbines, backing industrial projects and identifying areas that are commercially attractive for the technology so as to encourage the development of this new sector. Floating wind turbines with their now mature technology will allow for arrays further offshore, in waters between 50 and 200 metres deep, which will help cater for the needs of various sea-users.

/ AGENDA

- 2021
Commissioning of Groix pilot farm
- 2020
Call for commercial floating wind farm in Brittany



In Brittany, A MAP OF SALES AREAS FOR FLOATING WIND TURBINES

Brittany is getting ready to identify and organise a map of zones suitable for the development of floating wind turbines. These maritime areas have been identified by the MRE group at the Regional Conference for the Sea and the Coast, following consultation with all stakeholders, including fishing professionals.

To determine the suitable areas, over two years the CRML MRE group collected numerous contributions taking account of the challenges of **biodiversity**, professional **fishing and aquaculture** activities, and the industrial development of wind farms. From companies in the MRE sector to sea professionals, everyone agreed on the zones that will be used to organise future public debates aimed at specifying the exact final scope of new calls for tender.

In the south, an area of roughly **500 km²**, 25 km south-west of Belle-Ile, could host up to **1 GW by the year 2030**. In the **north**, several areas will require additional studies to install a **500 MW farm** and to define the best possible conditions of acceptability. Both sites together will enable Brittany to meet its **1.5 GW** target that it set in order to rank among the **leaders in floating wind turbines by the year 2030**. To date, it is **the only region in France to have completed these plans**.



Brittany

ACCELERATES THE DEVELOPMENT OF MRE PROJECTS

No fewer than 3 test sites and 2 pilot sites will be housing a range of tidal turbine and floating wind turbine technologies.

/ EDF TIDAL TURBINE TEST SITE IN PAIMPOL BRÉHAT

After EDF, in partnership with Naval Energie, achieved a world first by connecting its tidal turbine to the grid in 2008, today the site is making all its underwater installations available (submarine cable, connection station, submarine converter, etc.) and has the necessary permits to occupy the publicly-owned maritime domain.

/ IFREMER TEST SITE SAINT-ANNE-DU-PORTZIC (BREST)

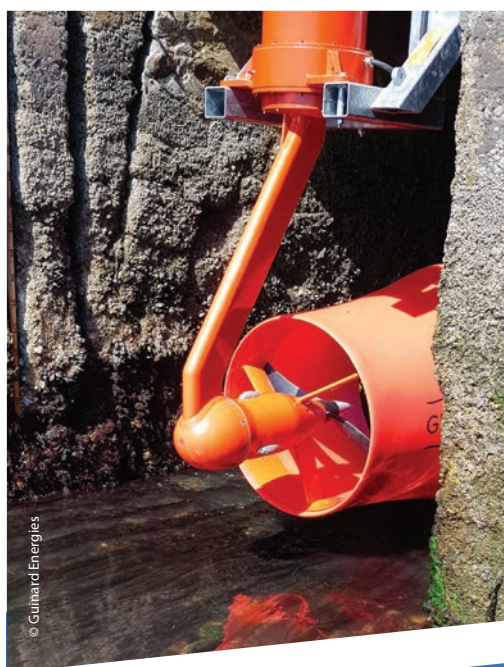
As well as its tanks for testing wind turbines, IFREMER enables companies such as Eolink to test the most innovative floating wind turbine prototypes at 1/10th scale.

/ TIDAL TURBINE TEST SITE IN ETEL

To make the most of the strong currents, the shipbuilder Chantier Bretagne Sud enables companies such as Guinard Energies to immerse and connect tidal turbines and monitor the environment with Ifremer, impact studies with TBM and machine wear and tear.

/ FLOATING WIND TURBINE PILOT SITE AT GROIX BELLE-ÎLE

1st real-scale test for the 4 x 6 MW Eolfi wind turbines. Commissioning planned for 2021.



/ OFF-GRID ISLAND MODEL

The island of Ouessant is a model of a 100% autonomous island using 100% renewable energy and includes the connection of a tidal turbine, a photovoltaic power plant and an electricity storage system. Smart grids regulate and manage consumption and production using an energy management system.

It is a genuine model of energy autonomy that is ready-to-market and can be replicated in other energy-isolated areas.



The power of an ecosystem

TO CREATE WIN-WIN PARTNERSHIPS

WITH BRETAGNE OCEAN POWER

/ A BALANCED INDUSTRIAL VALUE CHAIN

Bretagne is a leading region in the maritime economy, and home to ideal industrial conditions for successful MRE projects. In addition to close familiarity with the specific considerations of a marine environment, the region's network of some 180 companies offers extensive industrial know-how, spanning everything from composite materials to mechanics, via shipbuilding and repairs, design and engineering, and smart grids. Bretagne's resources and industrial skill sets cover every link in the MRE value chain.

/ A REAL-LIFE TEST BED FOR MARINE ENERGY

The Bretagne Region accounts for fully one half of all French R&D skills in marine science and technology. Leading players in research, development, and innovation are all based in the Region, including France Energies Marines, Pôle Mer Bretagne-Atlantique, ENSTA Bretagne, Ifremer, SHOM, and other bodies.

/ TRAINING SCHEMES WITH A SPECIAL FOCUS ON THE SEA

As France's leading maritime economy, Bretagne boasts a training offering that caters for all maritime professions. The region benefits from highly-qualified personnel in maritime industries including shipbuilding and repair, operational oceanography, ICTs, maintenance, and more. All the resources for MRE projects are to be found here, thanks to the region's familiarity with the particular challenges of marine environments, coupled with its industrial and scientific expertise.

/ BRETAGNE OCEAN POWER, A POTENT ACCELERATOR

Prompted by the Bretagne Regional Council, all the MRE stakeholders in Brittany have joined forces as a single entity to foster more efficient industrial projects.

Bretagne Ocean Power seeks to:

- / Facilitate access to industrial know-how for commissioning authorities,
- / Facilitate skill development and market access for Brittany businesses,
- / Attract national and international players who wish to develop marine renewables,
- / Promote local know-how under a single banner.

BRETAGNE^{BE}

OCEAN POWER

A potent MRE industry accelerator



Bretagne INVESTS IN MREs

All phases of MRE development can be carried out in right here in north-western France. From the demonstrator to the pilot farm – and ultimately the commercial farm – the Bretagne Regional Council is mobilising all of its assets to accompany the new MRE business sector. With its investment in the construction of an MRE-specific port terminal and the creation of Bretagne Ocean Power, an MRE accelerator federating industrial and academic expertise, the Bretagne Regional Council is your ideal team player for the development of MREs.

/ TOOLS FOR BOOSTING PROJECTS

The Bretagne Region has developed several instruments to accompany innovative MRE solutions and demonstrator projects. It has elaborated on its existing financial engineering tools and investment funds to promote the emergence and the development of MRE projects. The Regional Council has also secured European funds through three projects: Set-Up to carry out foresight studies on smart grids, ICE to validate technology bricks and ERA-NET to fund demonstrator projects.

/ PORT FACILITIES

The Port of Brest is one of the building blocks in the development of MREs in Brittany. Beyond its natural and industrial assets, the Bretagne Region has made it its priority to deploy state-of-the-art equipment for the production, storage and transport of large machinery weighing more than 2000 t.

- Lorient MRE service port
- Multimodal port logistics
 - In-service support facilities
 - Maritime training programmes

The MRE Terminal in the Port of Brest:

A MODERN PORT FACILITY CATERING TO INDUSTRIAL MRE PROJECTS

To boost commercial port business and to host new MRE-related industrial activities, the Port of Brest is developing its facilities to accommodate new needs and goals.

/ PORT INFRASTRUCTURE

- 390 LM of dock (two units with 150 LM of work space) with a handling berth of 100 m depth that can accommodate any type of handling equipment (heavy-lift cranes, SPMT)
- Channel depth of 8 m below CD; docking depth of 12 m below CD and width of 100 m
- 38 ha of industrial lots connected to transport networks
- Heavy-duty access roads from the industrial lots to dockside and to the naval repair areas in dry docks 2 and 3
- Car park with 1100 spaces
- Meets ISPS - Industrial safety standards

/ TIMELINE

- **2018** / 5.5 ha
- **2019** / + 5.5 ha and 150 LM of dock with handling equipment
- **2020** / + 150 LM of dock with handling equipment
- **2021** / + 13 ha
- **2024** / + 14 ha

/ CAPACITY

- **Dock and handling berth:** minimum of 18 t/m² for end-bearing loads
- **On-land platforms:** 4 t/m² for evenly distributed loads
- **Load transport:** 4th generation SPMT (40 t per axle line)

/ MARINE ACCESS

- **Channels and berths:**
 - > Channel: draught of 8 m below CD
 - > Berths: 12 m below CD in depth and 100 m in width
- **Tidal range in Brest:**
 - > Spring tide: 7.05 m above CD
 - > Average water height: 4.13 m above CD



Join us

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A potent MRE
industry accelerator

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/ Have a project? Contact us!

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