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THE JOURNAL OF CAMPUS MONDIAL DE LA MER

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MARINE RENEWABLE ENERGY



## MARINE RENEWABLE ENERGY: AN OPPORTUNITY FOR FRANCE

Anne Georgelin in charge of a French Renewable Energy Trade Association (Syndicat des Energies Renouvelables) on MRE and hydroelectricity.

FRANCE HAS VAST MARITIME SPACES, GIVING IT SOME OF THE WORLD'S GREATEST POTENTIAL FOR GENERATING MARINE RENEWABLE ENERGY. NOT AS GOOD AS OTHER EUROPEAN COUNTRIES, FRANCE IS STILL PLAYING CATCHUP IN TERMS OF RENEWABLES, ALTHOUGH INVESTMENT AND AMBITIOUS GOALS ARE HELPING TO BRIDGE THE GAP. WE TAKE STOCK WITH ANNE GEORGIN, WHO REPRESENTS THE FRENCH RENEWABLE ENERGY TRADE ASSOCIATION (SYNDICAT DES ENERGIES RENOUVELABLES) ON MRE AND HYDROELECTRICITY.

### HOW DO YOU SEE TODAY'S MRE SECTOR IN FRANCE?

**Anne Georgelin:** The first offshore wind farm began operating in 2022 off the Loire-Atlantique coast, and three further farms are under construction in 2023. Our European neighbours have already deployed 6,000 wind turbines, so France is on the back foot. Yet France has certainly succeeded in creating an industrial value chain: out of a total of twelve factories in Europe, four in France produce the nacelles and blades for the latest generation of turbines. **Chantiers de l'Atlantique** makes electricity substations for Europe's renewable generation sites, and of course we have factories producing cables in Burgundy and the Paris region. Our industry dynamics also mean we're seeing rapid growth in MRE jobs.

### WHAT ARE FRANCE'S FUTURE PROSPECTS?

France has enormous potential, whether in wind turbines, tidal power or wave energy converters. Besides our maritime spaces, this country has major assets on land: ports have been investing and preparing, we have a robust maritime industry plus a solid electricity network. Both public and private sectors have helped finance these emerging technologies. In terms of offshore wind, the President has set an objective of 50 farms by 2050, which will contribute 40 GW - or 20% of France's electricity generation. As we pull out of fossil fuels, we will need to develop more renewables, including offshore wind. We also need to plan so that everyone involved, especially in industry, has a better overview of where the work will be done in future. That's what's

happening with the draft legislation to accelerate renewable energy generation: it requires priority zones for offshore wind to be mapped over a ten-year period in the lead-up to 2050. Both the PPE\* and LPEC\*\* laws are due to be amended from the second half of this year, which should help chart our course.

### WIND TECHNOLOGY IS THE MOST ADVANCED: FLOATING WIND TURBINES AHOY!

A 500 MW wind farm with 80 fixed turbines is already in operation at Saint-Nazaire. A further three farms will follow, each with a capacity of around 500 MW: off Saint-Brieuc, Fécamp and Courseulles-sur-Mer. Two farms already have planning permission (Le Tréport and Noirmoutier), and another at Dunkirk has applied (600 MW). There are currently two calls for tenders for 1,000 and 1,500 MW farms in the Channel, with another one open for a deep-water offshore project at Oléron. The floating turbine sector is also growing nicely: three pilot wind farms are being built in the Mediterranean, one demonstrator has operated since 2018 offshore at Croisic (2 MW), and there is a call for tenders covering 15 to 20 turbines in southern Brittany (250 MW). This is one of the world's first commercial calls for tenders for floating wind turbines.

Tidal power is in the ascendancy too: in Normandy, a pilot project with seven turbines is planned in the Raz Blanchard area, as well as the **Sabella** demonstrator at Fromveur in Brittany, which supplies the island of Ouessant. A second project will see two tidal turbines installed in the Gulf of Morbihan. The advantage of tidal turbines is that they generate over predictable periods with predictable output, since they depend on the tides, at different times to wind. They complement wind power really well and are beneficial for island communities and for outlying areas like Brittany.

\* Multiannual Energy Programmes Act

\*\* Energy and Climate Programming Act

# NEWS IN BRIEF

## FRANCE ATLANTIQUE, EOLINK'S FLAGSHIP PROJECT

BREST-BASED **EOLINK** FIRM IS WORKING ON A PROJECT TO FLOAT AN INNOVATIVE WIND TURBINE. WHAT MAKES IT SPECIAL? THE USUAL MAST IS REPLACED BY A LIGHTER AND MORE RIGID PYRAMID STRUCTURE, EQUIPPED WITH LARGE DIAMETER TURBINES. AFTER TESTS IN IFREMER'S TEST BASIN AND THEN IN THE BREST HARBOUR, **EOLINK** WILL CONTINUE ITS TESTS IN 2024 ON THE **SEM-REV** TEST SITE OFF LE CROISIC, IN THE LOIRE-ATLANTIQUE REGION.

The 5 MW turbine will supply 7,000 residents with their annual electricity requirements. **Eolink** has joined forces with **Valorem** and **École Centrale de Nantes** to manufacture, install and operate the turbine. The prototype implements an innovative solution which, by reducing the steel mass used for the floater by over 40%, will also reduce the cost of the electricity generated.

"In 2022, **Eolink** benefited from a fundraising to boost its technology and anticipate the maturation of its first 5 MW unit. The project also received financial support from **ADEME** to the tune of €14.9 million as part of the France 2030 plan," explains Antoine Autson, **Eolink's** administrative and financial manager.



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INFO + [eolink.fr/fr/](http://eolink.fr/fr/)

## HYTECH-IMAGING, AT THE SERVICE OF MARINE ENERGY

LAUNCHED IN 2016 AND SUPPORTED BY **TECHNOPÔLE BREST-IROISE**, **HYTECH-IMAGING** AIMS TO DEVELOP AND DEMOCRATISE THE USE OF SPECTRAL IMAGING IN CARTOGRAPHY AND MONITORING.

"We've developed a digital aerial monitoring service for marine mammals and seabirds. One particular application for this service is in environmental surveys of offshore wind turbine sites" explains **Marc Lennon**, co-founder of the Brest-based firm **Hytech-imaging**.

The company developed its high-resolution optical system to assist marine megafauna aerial surveys, or **STORMM**<sup>\*</sup>, together with the

\* Système de Télédétection Optique d'aide au Recensement de la Mégafaune Marine



©HyTech Imaging

**Pelagis** observatory in La Rochelle. The system was specially designed to meet the challenges of observing marine megafauna. According to **Marc Lennon**, "**STORMM** is used for both national monitoring campaigns in the Channel, the Bay of Biscay and the Mediterranean, as well as across Europe."

The system is also used in marine reserves and offshore wind turbine sites (Dieppe, Le Tréport, Courseulles-sur-Mer, Centre Manche and southern Brittany). **STORMM** is also being used for major "**France Énergies Marines**" pilot programmes such as offshore wind farm surveys of marine megafauna (**OWFSOMM**), which aims "to establish a method for calibrating aerial observation protocols to ensure continuity when analysing the spatial distribution of species." Another example is the **MIGRATLANE** programme, with its aim "to determine the way terrestrial migratory species and seabirds use the North-East Atlantic arc in the context of wind farm developments in the region."

INFO + [hytech-imaging.fr](http://hytech-imaging.fr)



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## TIDAL POWER: FRANCE AND EUROPE FORGE AHEAD

From left to right: Sabella's Sales Director Jérôme Le Moigne and the CEO of Ocean Energy Europe Rémi Gruet.

MARINE RENEWABLE ENERGY IS ESSENTIAL FOR EUROPE'S ENERGY TRANSITION. WE RELY ON MRE FOR GREENER ELECTRICITY. TIDAL POWER IS STILL EMERGING, BUT HAS ALREADY CAPTURED THE ATTENTION OF MANY GOVERNMENTS AND INDUSTRIES. WE INTERVIEWED **SABELLA'S SALES DIRECTOR JÉRÔME LE MOIGNE AND THE CEO OF OCEAN ENERGY EUROPE RÉMI GRUET.**

### COULD YOU TELL US A BIT ABOUT YOUR ORGANISATIONS?

**Rémi Gruet, OEE:** Ocean Energy Europe is the world's largest network for MRE professionals (excluding wind): we cover tidal turbines, wave energy converters, salinity gradient generation, ocean thermal energy conversion and more. Our 120 members span the entire value chain, from universities and consultancies to industry, ports, developers, energy firms and even regional authorities.

**Jérôme Le Moigne, Sabella:** Sabella has been developing tidal turbines since 2008. We launched our first in the Odet estuary, Finistère. Since 2015 we have run a number of sea trials with a turbine installed in the Fromveur passage, a strait off the island of Ouessant: we're now on our third trial period. The 1 MW demonstrator **D10** generates electricity for the island, meeting up to 49% of demand in summer. The **Sabella** design is simple and robust, designed to work reliably at depth with minimal intervention. We have also acquired the patents for an **Alstom** concept using more high-tech parts. At present we are merging the two designs to combine durability with high performance, to produce next-generation turbines.

### HOW DO FRANCE AND EUROPE STAND IN TERMS OF TIDAL POWER?

**Rémi Gruet, OEE:** France has some of the best natural resources for this in Europe. The potential generation capacity worldwide is 100 GW, five times the potential in Europe. Current technologies are already

exported and have good prospects for international development. In Scotland and Denmark's Faroe Islands, we currently have four pilot plants in the water. Two major projects are underway in France: one at Fromveur in Brittany and the other - working with **Hydroquest** - at Raz Blanchard in Normandy. This will be the world's biggest pilot installation, at over 17 MW. **Brittany Region** has made significant investments in welcoming tidal power to its ports. This energy source has the benefit of being fully predictable and is therefore easier to manage on the electricity grid. It's a brilliant complement to wind energy and solar power, and is easy to export.

**Jérôme Le Moigne, Sabella:** The European Union is financing major projects to develop tidal power. This is the case with **TIGER**, a joint project involving multiple organisations the U.K. and France including Bretagne développement innovation, the University of South Brittany and Morbihan Hydro Energies **Sabella** is readying two turbines for immersion in the Gulf of Morbihan in late 2023, where they will operate as demonstrators for three years. Ahead of the industrial production phase, French infrastructures are being upgraded. For example, the Port of Brest now has a **marine renewable energy** terminal that can handle very heavy loads. Internationally, there are markets with strong growth potential: the United Kingdom, the United States, Canada, the Philippines, Indonesia and more. France just needs to position itself accordingly.



Hydroquest © Ocean Energy Europe

#### WILL THE EU'S PLANS HELP TIDAL POWER DEVELOPMENT?

**Rémi Gruet, OEE:** Yes, the Commission has set out a strategy for offshore renewables, with targets for MRE (excluding wind) of 100 MW by 2025, 1 GW by 2030 and 40 GW by 2050. We believe that France and Europe ultimately have the technical capacity and natural resources needed to achieve 100 GW. This Europe-wide planning enables us both to confirm market potential, meeting private investors' expectations, and to use European funds to finance innovations and development in these new technologies.

**Jérôme Le Moigne, Sabella:** Europe is a driving force, with clear targets to finance projects and support the development of new technologies. The European Commission programme for R&D, **Horizon Europe**, is helping to fund the deployment of two pilot tidal power arrays, where multiple turbines will work together. These will benefit from small-series production as a means of reducing turbine manufacturing costs. The EU's aim is to demonstrate that tidal power is cost-effective and robust, which will in turn reassure investors and insurers, and start the move towards industrial-scale turbine production.

#### WHAT DO YOU THINK OF NETWORKS LIKE CAMPUS MONDIAL DE LA MER?

**Rémi Gruet, OEE:** Cross-cutting networks are really beneficial. For instance, we're working with a Europe-wide professional association for shipbuilding and repair, which means we can access existing supply chains such as those for wind turbines. Operating as a network means being able to open up new opportunities, move forward, and share skills and experience. It's really essential.

**Jérôme Le Moigne, Sabella:** We've already presented tidal power at the **One Ocean Summit** thanks to the Campus, and we need to do a bit more in terms of promoting our activity. It's really important that we can access a network like **Campus mondial de la mer**. We're growing, so we need it in order to recruit, procure services and set up collaborations.

INFO +

[www.sabella.bzh](http://www.sabella.bzh)  
[www.oceanenergy-europe.eu](http://www.oceanenergy-europe.eu)



## BREST MRE TERMINAL - MAKING WAVES IN EUROPE

THE NEW TERMINAL AT THE PORT OF BREST IS DESIGNED TO CATER FOR THE MARINE RENEWABLE ENERGY (MRE) INDUSTRY, WITH A PARTICULAR FOCUS ON OFFSHORE WIND. THE UPGRADE WILL SUPPORT THE DEVELOPMENT OF THESE TECHNOLOGIES IN FRANCE. THE EU HAS SET AMBITIOUS TARGETS IN THIS AREA AND THIS NEW DEVELOPMENT COULD PLAY AN IMPORTANT ROLE AT A EUROPEAN LEVEL.

With a 400-metre quay capable of taking very heavy loads, a draught allowance of 8 metres and 40 hectares of quayside industrial lots, the Port of Brest has been transformed and expanded to accommodate operations linked to marine renewable energy. **Daniel Cueff, Vice President of Brittany Region responsible for maritime affairs**, is enthusiastic about the project: *"The plans announced for marine renewable energy by France and Europe mean we're looking forward to a bright future here."*

### REAPING THE REWARDS

Twelve years ago, **Brittany Region** began work on the Port of Brest upgrade with the construction of a new polder which was expected to be used in the building of the planned Saint-Brieuc offshore wind farm. **Daniel Cueff** says, *"It was about getting involved in supporting the industrial development of marine energy."* **Christophe Chabert, Director of the port's operating company, Société Portuaire Brest Bretagne**, takes up the thread. *"It was a logical next step for the Port of Brest. The Port of Brest infrastructure has been developed through a process of successive polder constructions to accommodate activities such as heavy commerce and ship repair. It makes sense to expand into marine renewable energy with our sea-focused industrial base."* Although the sector has been slow to start in France, renewable energy development is now picking up pace. *"There's been a clear shift - before the war in Ukraine it was about developing a competitive market, whereas now it's a strategic issue of national sovereignty. This change has boosted the role of the Port of Brest which has the capacity to support the government's ambitions for offshore wind. We were right to plan ahead and go further than other ports."*

### AN INNOVATIVE ECONOMIC MODEL

The development of the marine energy terminal at the Port of Brest is accompanied by a significant commitment from **Brittany Region** which is providing support for the project. *"The Port of Brest operating company was established with a long-term vision - a licence for more than ten years to make this investment pay"* says **Christophe Chabert, The Chamber of Commerce and Industry, Brest métropole and Brittany Region** are therefore the shareholders in the port's operating company which runs the infrastructure and superstructure for the Port of Brest, *"a pioneering model which has already been emulated elsewhere"*. In addition, the Port of Brest is working with the ports of Lorient and Saint-Nazaire, *"with the intention of establishing an inter-port partnership to enable France to become a global player in the wind power sector. This partnership includes the construction of floaters in Brest, the installation of turbines in Nantes and mooring chains in Lorient"*.

### INTERNATIONAL OBJECTIVES

*"Brest is the most advanced port in this area. It is providing services for the developers of the Saint-Brieuc wind farm and other requests are flooding in. We are reaching a turning point. The challenge for Europe in offshore wind is to scale up production very significantly. At present, the other ports don't have the capacity to serve this industry. So Brest has an essential role to play"*, asserts **Christophe Chabert**. **Daniel Cueff** expands on the point. *"We've had a visit from an Irish delegation, for instance. Ireland is looking for a site for offshore wind turbine construction and assembly. There is huge French and European demand, so we hope Brest will become a base for the whole of Europe"*.

**THE MRE TERMINAL AT THE PORT OF BREST WILL BE COMPLETED IN 2025-2026.** THE OPERATORS ARE ALREADY THINKING ABOUT FURTHER DEVELOPMENTS AND ADDITIONAL FACILITIES AND EQUIPMENT FOR THE SERIAL PRODUCTION OF FLOATING WIND TURBINES.



©France Energies Marines

## FRANCE ENERGIES MARINES SUPPORTS THE MRE INDUSTRY

FOR OVER A DECADE, **FRANCE ENERGIES MARINES** HAS BEEN SUPPORTING R&D PROJECTS IN THE MARINE RENEWABLE ENERGY (MRE) SECTOR. THROUGH ITS WORK THE INSTITUTE IS PLAYING AN IMPORTANT ROLE IN DEVELOPING THE TECHNOLOGIES OF TOMORROW TO SECURE A LOW-CARBON AND RENEWABLE ENERGY MIX.

A tidal turbine immersed in the Etel estuary in Morbihan, equipped with an artificial intelligence monitoring system to improve performance - this is the pitch for the Element project. The project brings together Scottish and French partners including **France Energies Marines**. "We are recognised as the institute for energy transition", notes **Herveline Gaborieau, Executive Director of France Energies Marines**. The institute now has 75 staff, 27 member organisations, a headquarters in Brest and three regional offices on the Mediterranean, Channel and Atlantic coasts, and is involved in European-scale projects. "We support collaborative projects with manufacturers, SMEs and research centres.

*Our aim is to bring together a range of parties to pool academic resources, find funding and, ultimately, to facilitate the transition into the renewable energy sector."*

### WIND POWER AT THE FOREFRONT

The principal focus of the marine renewable energy sector is on offshore wind, with the stated objective of 50 wind farms by 2050. "Things are moving, France is establishing itself in this area", says **Herveline Gaborieau**. She does not seek to sidestep the fact that France is lagging behind on fixed wind power, although she highlights significant acceleration in relation to the future development of floating wind turbines: "France has three pilot sites under construction and is one of the first countries to launch a commercial tendering process. The sector is very active." Since it was set up in 2012, **France Energies Marines** has supported around ten R&D projects each year, worth €20 million: "We need to speed things up further and provide opportunities for more structural projects to test technologies at sea. More important investment will be needed, but we have to achieve the European objective of 300 GW by 2050."

INFO + [www.france-energies-marines.org](http://www.france-energies-marines.org)

## IFREMER TRANSFORMING TESTING

WITH A WAVE BASIN ON ITS BREST SITE WHICH IS ALSO THE HEADQUARTERS OF THE INSTITUTE, AND A MARINE TESTING SITE IN THE BREST HARBOUR, **IFREMER** PROVIDES TESTING FACILITIES AND SUPPORT FOR NEW MARINE RENEWABLE ENERGY TECHNOLOGIES.

In the past **Ifremer's** testing facilities were used for the oil and gas industry but for over a decade they have been benefiting the marine renewable energy sector. **Jean-Marc Daniel, Head of the Department of Physical Resources and Deep-Sea Ecosystems at Ifremer and the Institut Carnot-MERS\***, explains: "The basin at Brest is used to test wave and wind energy systems. At the same time we've developed a marine testing site at Sainte-Anne du Portzic in the harbour of Brest which offers the advantage of being close to the laboratory while providing access to real sea conditions." This is where testing was conducted, for example, on the turbines for the Eolink and Windquest projects and the wave power system developed by **Legendre** and **GEPS Techno**.

### INSTITUT CARNOT MERS

These **Ifremer** testing facilities are grouped under the umbrella of the Institut **Carnot MERS** which includes **Ifremer** and the **École Centrale de Nantes (ECN)** engineering college. "The aim of the Institut

*Carnot is to promote collaboration between public research and private companies."* The Institute supports a range of projects from a manufacturer funding doctoral research to full-scale demonstrators. One example is the project run with **GEPS Techno** on autonomous wave power buoys, which involved "seven years of support from a model in the testing basin to a full-scale version at **SEM-REV™**". **Carnot-MERS** is also supporting the **Dikwe** project, a wave power system due to be installed in Brittany (see also p. 9). "We provide entrepreneurs with our knowledge of the marine environment and our expertise with conducting tests and how materials behave at sea... We can design the necessary experiments to test and validate their ideas".

\*\* Offshore testing site run by the École Centrale Nantes, off the coast of Le Croisic

### KEY FIGURES SAINTE-ANNE DU PORTZIC:

20

**20 M** deep for equipment immersion

7

**7 M** tidal range at high tide

1,7

**1,7 M/S** maximum tidal flow

2

**2 M** maximum significant wave height (crest to trough)

INFO + [carnot-mers.com](http://carnot-mers.com)

\* Carnot MERS (Marine Engineering Research for Smart, Sustainable and Safe Seas)

## OFFSHORE WIND: IBERDROLA INVESTS IN FRANCE

THE SAINT-BRIEUC WIND FARM IS DUE TO BE COMPLETED IN LATE 2023 AND WILL BOAST 496 MW AND 62 WIND TURBINES OVER AN AREA OF 75 KM<sup>2</sup>, WITH AN EXPECTED PRODUCTION OF 1,850 GWH. THE BUILDER AND OPERATOR IS **AILES MARINES**, A SUBSIDIARY OF **IBERDROLA** WHICH IS ALREADY LOOKING AT OTHER PROJECTS IN FRANCE.

"This will be the first Breton wind farm." **Stéphane Alain Riou**, **Offshore Director at Iberdrola France**, is excited about the prospect of completing this 12-year project, "which will be able to produce green electricity for 835,000 people", he says. **Ailes Marines** is a fully-owned subsidiary of **Iberdrola** and was set up especially for the Saint-Brieuc wind farm. By now, **Iberdrola**, the largest European energy company and leader in onshore wind, is currently seeking to capitalise on its offshore expertise to gain additional French offshore projects.

### LOCAL SKILLS

**Ailes Marines** is taking advantage of the recent marine renewable energy terminal construction at the Port of Brest, which **Riou** says has facilitated "the construction of foundations using 15 Breton

subcontractors, followed by the installation of the **Haizea Breizh** assembly plant bringing 40 jobs". Before putting the shipbuilding companies to work, **Ailes Marines** enlisted the services of research facilities and laboratories: "Ten years of consultation, over 1,500 meetings, collaboration with the fishers to preserve the Saint-Jacques scallop beds and to support all types of fishing activity, and joint publications with the **French National Centre for Scientific Research (CNRS)**, the **University of Brest**, etc." **Ailes Marines** prioritises the skills and expertise of local Breton partners.

### AN ATTRACTIVE FRENCH MARKET

**Stéphane Alain Riou** would like to see the creation of an industrial cluster in France: "Wind turbine manufacturers, maritime and port services, maintenance etc. After Saint-Nazaire and Saint-Brieuc, France should continue its efforts and seek to ensure there are no missing links in the production chain." **Iberdrola** is taking part in several tendering processes, including for a fixed offshore wind farm in Normandy and floating wind turbines off southern Brittany and in the Mediterranean. "There are plenty of challenges for the ports which will have to respond to the needs of industry. And Brest can look forward to reaching out and attracting European industrial projects."

INFO → [ailes-marines.bzh](https://ailes-marines.bzh)

## BRITTANY SECURES SUCCESS

BRITTANY IS ALREADY HOME TO FIXED OFFSHORE WIND FARMS AND TEST SITES FOR OTHER TECHNOLOGIES, BUT PROGRESS ON FLOATING WIND POWER IS ALSO ACCELERATING. THE REGION HAS A LONG HISTORY WITH MARINE RENEWABLE ENERGY AND IS LOOKING TO EXPLOIT ITS STRATEGIC LOCATION TO MAKE ITS MARK IN EUROPE.

Wind, wave and tidal power - how are things looking in the sector in Brittany? "With wave energy, we're less technically advanced", explains **Philippe Thieffry**, **Head Officer at Bretagne Ocean Power** (see also p. 11). "But when it comes tidal power, we've taken two major steps forward with the technology used by **Hydroquest** at Paimpol-Bréhat and by **Sabella** at Ouessant. Now we're looking at the commercial prospects under the next PPE". With regard to wind power, Brittany is already up and running with the Saint-Brieuc wind farm operated by **Ailes Marines**. "We supported them to ensure they could rely on Breton

companies for their supply chain. The next step for us is to help these companies get involved with the operation and maintenance side."

### FLOATING WIND - THE NEXT OBJECTIVE

On the back of the expertise gained with fixed wind turbines, the next challenge for the sector is floating wind power: "We were pioneers in Brittany," **Philippe Thieffry** says, "what with the investments made over the last decade, the marine renewable energy terminal in Brest and the establishment of the **Regional Commission for Maritime Affairs (CRML)** to designate the first floating wind turbine zones. Now the government is pressing ahead with the plan for 50 wind farms by 2050." And the region is gearing up: "We need to play our part in the 40 GW planned for 2050. We need to get ready for the planning process, in consultation with all the stakeholders, and identify the constraints. In addition, we're supporting manufacturers to maximise local benefits." Due to their experience with fixed wind turbines, plenty of companies are already prepared. "It's also in our interest to collaborate so that we can be ready to take up projects in France and internationally".

\* Multiannual Energy Plan (Programmation pluriannuelle de l'énergie)



# DIKWE: THE WAVE-POWER BREAKWATER

THE **DIKWE** PROJECT, DEVELOPED BY THE **LEGENDRÉ** GROUP WORKING IN PARTNERSHIP WITH GEPS TECHNO AND **IFREMER**, HAS PRODUCED AN INTEGRATED DOCKSIDE WAVE POWER SYSTEM USING EXISTING INFRASTRUCTURE - A POSITIVE INNOVATION TO ENHANCE PORT PROTECTION WHILE AVOIDING OFFSHORE CONSTRAINTS.

A "positive energy breakwater" is coming to Brittany: the **Dike Wave Energy** or **Dikwe** project, with support from the Brittany and **Pays de la Loire** Regions and the French Agency for the Environment and **Energy Management (ADEME)**. As **Dikwe's** project manager **Quentin Henry** explains, "We are seeking to integrate our quayside wave energy

system into the market for breakwater repair and construction. **Dikes** are designed to curb the energy of the waves, but we have found a way to exploit and optimise this natural energy." With no concerns about offshore mooring, and taking advantage of the **Legendre** Group's core market activities, **Dikwe** is uniquely positioned to provide "a port protection function plus production of renewable energy that's immediately available on shore." **Dikwe** is using the innovative technology of oscillating flaps to capture the wave energy, which undergoes a controlled conversion into electricity. The hydraulic functioning of each type of structure is then assessed, ensuring the system's optimum cost-effectiveness and adaptability. Following positive initial tests, both in test tanks and at sea, a demonstrator is planned for Brittany in 2024. "We are confident, and the project is starting to attract interest."

INFO+ [www.dikwe.fr](http://www.dikwe.fr)



Houlomoteur DIKWE du groupe Legendre ©Dugornay Olivier IFREMER

# AN MRE MASTERS AT BREST TO PUT WIND IN YOUR SAILS

THIS SPECIALIST MASTERS DEGREE COURSE IN MARINE RENEWABLE ENERGY WAS PIONEERING WHEN IT WAS FIRST DEVISED IN 2010, AND NOW SERVES AS A BENCHMARK. THIS SECTOR, EXPANDING IN FRANCE AND THROUGHOUT EUROPE, NEEDS EXPERTISE FOR A RANGE OF PROJECTS NOW MORE THAN EVER.

The specialist Masters in marine renewable energy is provided by **ENSTA Bretagne** in cooperation with the **École Navale** (French naval academy), **IMT Atlantique**, the **University of Brest** and **Ifremer**. Now into its 14th year, it boasts some 150 graduates. "Our students already have engineering or other masters degrees after five years of higher education. At that level, we get highly motivated students - both younger post-grads and mature students returning to education," explains the course leader, **Jean-Yves Pradillon**. They learn more about the specifics of energy resources, the design and management of energy extraction systems, the coastal environment and impacts on it, the law, economics and societal factors: "It's a comprehensive education programme covering highly technical aspects as well as financing and profitability. Our students will eventually become MRE project managers or programme directors." Some 90% of those who complete the course find a job in the sector. The success of the programme is demonstrated by how little the expertly targeted content has had to change over the years. Indeed, competing courses are now starting to open up.

INFO+ [www.ensta-bretagne.fr](http://www.ensta-bretagne.fr)



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## JULIEN BONNEL, A FRENCH SCIENTIST ABROAD

### AN EAR UNDER THE WATER - FROM BREST TO AMERICA

INCREASINGLY STUDIED BUT STILL FREQUENTLY MISUNDERSTOOD, UNDERWATER NOISE POLLUTION IS VERY MUCH A LIVE ISSUE. **JULIEN BONNEL FROM THE WOODS HOLE OCEANOGRAPHIC INSTITUTION (WHOI)** IN THE UNITED STATES IS CURRENTLY GROUP MANAGER FOR THE OCEAN ACOUSTICS AND SIGNAL PROCESSING LABORATORY. AFTER A FEW YEARS WORKING IN BREST, BONNEL CROSSED THE ATLANTIC TO STUDY UNDERSEA ACOUSTICS.

#### PLEASE DESCRIBE YOUR CAREER PATH.

I grew up in Paris, where I did a preparatory maths and physics course. I then joined an engineering college in Grenoble now called Ense<sup>3</sup>, the **National Graduate School of Energy, Water and the Environment**. I did a thesis at the end of engineering school, committing myself for a further three years. I have an electrical engineering degree, specialising in signal and image processing, and I did signal processing applied to underwater acoustics while preparing my thesis.

You need an ocean to do underwater acoustics, and Grenoble had mountains, but no sea. So I came to Finistère. After getting my PhD I took up a post as a teacher and researcher at **ENSTA Bretagne**, a French engineering school. I worked at **Lab-STICC** (a research lab for information and communication science and technology) and was in charge of the small passive acoustics team there. The main goal of our work was to improve our understanding of the marine environment by listening to the cacophony of noise it produces. I stayed at **ENSTA Bretagne** for seven years, and then in 2017 I took the opportunity to come to Woods Hole in the United States, **WHOI** being one of the top two oceanographic institutions in North America.

#### WHY THE US?

**WHOI** opened up a post in undersea signal and acoustics processing, and I said, "That's for me!" That opportunity had not been available for seven years, so I reckoned I'd give it a try. My career therefore gradually shifted from electrical engineering to acoustical oceanography as I pursued the post. I'm now manager of the **Ocean Acoustics and Signal Processing Laboratory**, which is the equivalent of being in charge of a **CNRS** lab team in France. There are six of us working as permanent staff.

#### WHAT DOES YOUR RESEARCH INVOLVE?

**WHOI** is a strange beast, even in the American system. It's a private not-for-profit institute, not a university. For researchers like me, the government doesn't cover our salary, even once we've become permanent staff, so we're under constant pressure to generate income from external sources. My own research is split between defence-related work (for both the American and French defence sectors) and environmental activities, in particular working with colleagues in Brest on ecoacoustics and issues around the impact of noise on marine creatures. These are important concerns in Brittany, with the development of wind power. Together with the teams based in Brest, we've shown that this noise pollution is having an effect on the marine ecosystem, although not in a straightforward, linear way, so further research work would be useful.

What I love about my work is the constant switching between the two worlds of defence and environment. There's no doubt that, in underwater acoustics, it's the defence sector that's driving innovation forwards, because it has the resources and the most advanced equipment. But at the same time, there are huge societal and environmental needs. Military experts and marine biologists might not use the same vocabulary, but they actually have the same scientific needs and are asking the same fundamental questions. Put simply, there's not a huge difference between detecting a submarine and finding a whale. By linking these two communities, we can speed up knowledge transfer, ensuring that scientific discoveries bring about rapid social impact. There's a genuine interest in defence and ecology working hand in hand.



Bretagne Ocean Power - Port de Brest ©Fly HD - Région Bretagne



## BRETAGNE OCEAN POWER: FOCUSING ON BRITTANY'S EXPORT POTENTIAL

BRETAGNE OCEAN POWER'S GOAL IS TO BRING STAKEHOLDERS TOGETHER TO ENHANCE THE REGION'S INTERNATIONAL VISIBILITY. HEAD OFFICER PHILIPPE THIEFFRY EXPLAINS HOW THE ASSOCIATION IS STRIVING TO PROMOTE AND EXPORT BRETON TALENT IN MARINE RENEWABLE ENERGY.

### WHAT IS BRETAGNE OCEAN POWER AND WHAT ARE ITS AIMS?

**Philippe Thieffry:** Bretagne Ocean Power (BOP) has been around for four years now. It's a regional association, chaired by Daniel Cueff (Vice-President of the Brittany Region in charge of maritime affairs), which brings together various stakeholders and organisations in the marine energy sector, including Bretagne Développement Innovation, Bretagne Commerce International, the Bretagne Pôle Naval and Breizh EMR clusters, Pôle Mer Bretagne Atlantique, the 7 Technopoles of Brittany and the Brittany Chamber of Commerce and Industry. BOP fights Brittany's corner, providing a single coordinating structure and a preferred point of contact for the top offshore wind developers - the international clients we are seeking to direct towards our ports and firms based in the region.

### WHERE DOES BRITTANY RANK IN MARINE ENERGY AND WHAT ARE THE REGION'S AMBITIONS?

The main focus for 2023 is to develop our companies on an international scale. Some already have recognition abroad, including those working in oceanography, while others are starting up in France at test sites or on their first wind farms. During this tendering phase for southern Brittany we are taking the time to engage with the energy sector, which needs to identify suitable companies and skills in the region. Several foreign firms have been attracted to France to develop floating wind turbines, including Equinor of Norway, BlueFloat Energy of Spain and RWE of Germany. Each of those companies has other ongoing projects around northern Europe, and these connections will open up opportunities for export projects in Brittany. To help diversify our supply chains, we have developed strong relationships with companies from Scotland, Wales and Norway.

### WHAT ARE BRITTANY'S STRENGTHS ON THE INTERNATIONAL STAGE?

The region has several advantages. Its ports are equipped for marine energy, there is a complementarity of different stakeholders, and there is political will. Brittany has a very high level of wind and wave resources, as well as its strategic Atlantic-facing position, which is sui-

table for projects in the Celtic Sea. Some people talk about a "Breton pack," and there is certainly a natural linkage between all the different stakeholders in Brittany - in R&D, industry, services and policy.

### CAN YOU GIVE US AN OVERVIEW OF THE VARIOUS PLAYERS IN BRITTANY?

There are specialists in environmental research and measurement, and there are high levels of knowledge on the marine environment, modelling, forecasting, undersea monitoring, using drones and robots for taking measurements, and analysis. Breton firms are already active in the offshore wind export markets. Then there is the shipbuilding and ship repair industry, with firms specialising in metalwork, boiler making, electronics, welding and hydraulics - all of which can make a contribution to the development of floating wind. The maritime services sector (which includes the chartering and deployment of vessels, as well as marine and port logistics) can use partnerships to gear up for the export market. For example, TSM Iroise Mer has teamed up with Windcat Workboats, a Dutch firm, to access bigger markets. In Saint-Brieuc, they launched the first French crew transfer vessel to be specially designed for the offshore wind sector.

### WHAT IS YOUR VISION FOR CAMPUS MONDIAL DE LA MER ?

Initiatives like the Campus offer an alternative approach for grouping together different actors in marine science and innovation and for promoting Brittany internationally. Working to support Campus mondial de la mer and acting as a focal point for Brittany's seven technopoles as part of Bretagne Ocean Power, Technopôle Brest-Iroise is assisting our association by supporting the creation and development of innovative marine renewable energy firms, including Eolink, Cervval, Hytech-imaging and MAPPEM Geophysics.

INFO + [bretagneoceanpower.fr/en](http://bretagneoceanpower.fr/en)



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FORESIGHT

## THE INFRASTRUCTURES PORTAL: POOLING RESOURCES FOR INSPIRATION AND INNOVATION

FOR CAMPUS MONDIAL DE LA MER, THE GOAL WAS TO DEVELOP A TOOL FOR USING ITS BROAD SUITE OF RESEARCH INFRASTRUCTURE, TECHNOLOGY PLATFORMS AND EQUIPMENT IN A CONCERTED WAY, OPENING UP THESE RESOURCES TO THE WIDER ECONOMY.

The Marine Research Infrastructures and Facilities Portal is "a bilingual portal that allows any visitor, whether from France or elsewhere, to view all the research equipment available within the Campus mondial de la mer community in western Brittany and to find out how to access this equipment," explains Alice de Joux, project coordinator at Technopôle Brest-Iroise within the Campus team. Online since 2018, the portal provides an inventory of equipment and infrastructure listed by around 60 public research bodies and teams and 20 or so companies developing research collaborations. These tools span a varied range of activities, from underwater robots for shipping to observation and experimental systems and lab equipment, as well as databases and cutting-edge computer technology. Alice de Joux says that, for Campus mondial de la mer, the goal is to "catalogue this whole wealth of infrastructure to foster innovation in the area and to let companies know how they can get access to items that will facilitate their projects."

### 427 ITEMS TO CHOOSE FROM

The web portal (at [www.infras-campusmer.fr](http://www.infras-campusmer.fr)) brings together five nationally certified research infrastructures. "Our infrastructures really are at the cutting edge," points out Alice de Joux, "especially for MRE tests and prototypes, which have required huge investment" - resulting in 93 science and technology platforms and 427 different pieces of equipment. The portal has been operating successfully since 2018, even if the returns on investment can be "hard to quantify". There is a positive synergy around the portal, with "many projects" born from this pooling of resources. "One can quote the Brest-based company Gwilen, supported by Technopôle Brest-Iroise, as an example," the project coordinator notes, "where the portal gave a boost to the company's innovative project to use harbour sediment to mitigate impacts from the construction industry. The company used the portal to identify the right platforms and expertise to develop its project."

INFO+ [www.infras-campusmer.fr](http://www.infras-campusmer.fr)

SAVE THE DATE



### Ocean Hackathon® 8

17-19 November 2023 in 16 cities around the world

Ocean Hackathon® is 48 hours non-stop to develop a prototype as a team and to think about its use, based on various digital data related to the ocean. A call for challenges is launched from May 3rd to June 30th to identify the projects on which the teams will position themselves in each of the 16 participating cities, including Brest. At the end of the week-end, one team will be elected to take part in the Grand finale, to be held in December 2023 in Brest.

More information on [www.ocean-hackathon.fr](http://www.ocean-hackathon.fr)



### Sea Tech Week® 2024 - Maritime safety and security

15-17 October 2024 in Brest

La Sea Tech Week® is the Campus mondial de la mer flagship event dedicated to marine science and technology. Every two years, it brings together 1,200 leading national and international participants in Brest. Sea Tech Week® includes 3 plenary sessions, numerous workshops, a trade fair, BtoB meetings, a gala evening, etc. In 2024, Ireland will be the country of honour.

More information on [www.seatechweek.eu](http://www.seatechweek.eu)

### SONAR #8

Date of publication: May 2023

**Publication manager:** Jérémie Bazin & Juliette Rimetz-Planchon

**Editorial board:** Olivier David, Michel Gourtay, Frédéric Jean, Bertrand Thollas, Patrice Le Lourec, Rivacom.

**Writing:** Rivacom

**Graphic design:** severinechaussy.com

[www.campusmer.fr](http://www.campusmer.fr)  
[contact@campusmer.fr](mailto:contact@campusmer.fr)

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