BRETAGNE

Offshore and marine renewable energies

PRESS KIT

Seanergy | March, 22-23, 2017

Le Havre | Normandy, France

#Seanergy2017

/Table of contents

/Editorial

Marine renewable energy represents a significant opportunity for Brittany, in terms of both power and industry. From maritime planning through to assistance for companies and employees, and from support for projects through to investment in ports, the Bretagne Region is actively engaged in work alongside this emerging sector.

Since July 2016, our commitment has been set out in a roadmap for the development of marine energy. This document includes a clear goal, in line with the French government's framework policy objectives: planning and installing 2000 MW of additional capacity by 2030. Floating wind power is our priority in this respect.

Demonstrations and pilot projects are a vital step on the way to achieving this goal. Both the OpenHydro-DCNS underwater tidal stream generators installed by EDF and Sabella's D10 tidal turbine have blazed a trail for Brittany – and for France as a whole. As to floating wind power, we are already providing assistance for the project being undertaken by Eolfi Offshore France, the winner of the national request for proposals for the construction of a pilot array of four turbines between Groix and Belle-Île.

Anticipation is required if we are to see commercial tidal power and floating wind farms come on stream – and that is why we are losing no time in preparing for them. A few days ago, the Regional Sea and Coast Conference, which brings together stakeholders from across Brittany under the chairmanship of the French State and the Region, approved the selection of five broad areas in which future arrays could be located. This consultative work is ongoing to ensure that by the end of 2017, more clearly defined areas have been determined for the purposes of future national calls for tender. We see this regular, constructive dialogue with all stakeholders as the best way to guarantee the success of future projects.

Alongside planning in the fields of maritime affairs and energy, the Bretagne Region works on a daily basis with stakeholders in the industry, addressing their needs and making sure that marine energy also serves as a local stimulus. Working with its partners, the Region Council has put together a full-service offering for companies working in this international sector, spanning everything from support for R&D and employee training through to promoting the skills of Brittany's local companies.

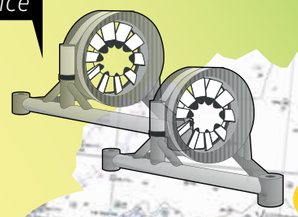
At the Port of Brest, the Region Council is anticipating the installation of new businesses, investing €220 million to provide dedicated infrastructure for a 40-hectare marine renewable energy terminal. The first phase of works will be completed by 2019.

All of these projects are helping to prepare Brittany's energy model for the future: lower-carbon, more decentralised, and with local production linked to local energy use. They are the outworking of the Bretagne Region's clear commitment to addressing climate challenges – and play to our industrial and maritime strengths.

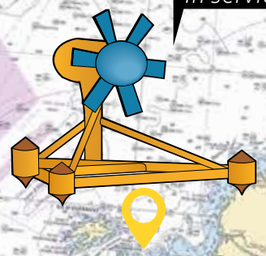
Jean-Yves Le Drian
President of the Bretagne regional Council

/ OFFSHORE MARINE RENEWABLE ENERGIES IN BRETAGNE

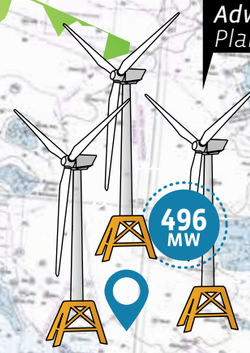
TIDAL STREAM TURBINE
(EDF, DCNS/OpenHydro)
In service



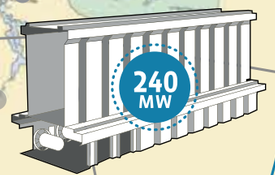
TIDAL STREAM TURBINE
Sabella D10 (Sabella, AKUO Energy)
In service



OFFSHORE FIXED WINE TURBINE
Ailes Marines (Iberdrola, Eole RES, Adwen, Caisse des dépôts)
Planned

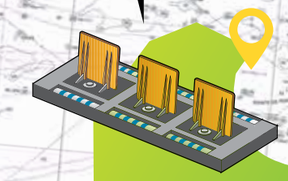


TIDAL POWER PLANT
Barrage de la Rance (EDF)
In service



TIDAL STREAM TURBINE
(Sabella D03)
Tested

WAVE ENERGY
Wattmor (Fortum - DCNS)
Planned



TIDAL STREAM TURBINE
MegaWattBlue
Planned

FLOATING WIND TURBINE
(Eolfi Offshore France / DCNS / CGN Europe Energy, GE, Vinci, Valemo)
Planned

Flamanville
Paimpol
Lannion
Morlaix
Guingamp
Brest
Saint-Brieuc
Saint-Malo
Fougères
Quimper
Rennes
L'orient
Redon
Vannes
Nantes

/ Sites

- Pilot farm
- Production site
- Demonstrator

/ Skills base

Research instutes
France Energies Marines • Brest
Ifremer • Brest
Worldwide Ocean Campus • Brest
ENSTA Bretagne • Brest

Maritime Inovation cluster
Pôle Mer Bretagne-Atlantique • Brest

Industrial cluster
Bretagne Pôle Naval • Lorient
Breizh EMR • Saint-Brieuc

/ Infrastructures

- Secondary port
- Maintenance port
- Port of Brest MRE Terminal *(40 ha)*

/ Electricity grid

- 400 kV — 225 kV
- 25kV grid by 2017
- 240 MW — Generation site *Electrical output*

/ Geographical scale

0 10 20 30

/ LCOE (Levelized cost of energy)

Plus bas coût — Plus haut coût

/ MORE INFORMATION

www.bdi.fr/EMR

/GROIX & BELLE-ÎLE PILOT FLOATING WIND FARM

The Groix & Belle-Île floating wind farm won French research agency ADEME's EOLFLO request for proposals in July 2016. The project calls for 4 floating wind turbines with a total capacity of 24 MW to be located between the islands of Groix and Belle-Île.

EOLFI has joined forces with leading Chinese energy firm CGN EE to develop, build, and operate the Groix & Belle-Île floating wind turbine project. To do so, they have brought together key stakeholders from the sector in France with expertise in marine renewable energy: DCNS Energies, VINCI Construction France, General Electric, RTE, and VALEMO. The Bretagne Region has supported the project throughout every stage of its development.

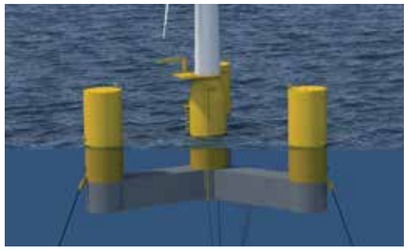
The four 6 MW General Electric Haliade™ turbines will be installed on semi-submersible floating structures built in Brest by DCNS Energies and VINCI Construction. With total capacity of 24 MW, the wind farm will produce enough electricity to power 20,000 homes. VALEMO will be responsible for supervision and maintenance operations.

After consultation with all the relevant stakeholders, the Groix & Belle-Île floating wind turbine site was adopted by Brittany's Regional Sea and Coast Conference in 2014, with ADEME following suit in 2015. The area is typical of the sea conditions for floating wind power prevalent in many other places worldwide; as such, it is suitable for demonstrating the reliability of the technology used, as well as for showcasing the project partners' expertise, enabling them to conquer export markets.

Floating wind power offers a twofold opportunity to the Region: it provides a source of energy to boost electricity production, and a source of industrial growth, with the expansion of the Port of Brest.

The Groix & Belle-Île floating wind power project marks a significant contribution to the emergence of this new sector in Western France.

www.eoliennes-groix-belle-ile.com



CONSORTIUM PARTNERS

- EOLFI
- CGN EE
- RTE
- GENERAL ELECTRIC
- DCNS Energies
- VINCI Construction France
- VALEMO

LES EOLIENNES FLOTTANTES DE GROIX & BELLE-ILE

PROJECT TIMELINE

2020 / Commissioning

/OFFSHORE WIND FARM PROJECT SAINT-BRIEUC BAY

Construction of a 62-turbine offshore wind farm, generating enough electricity to cover the needs of 850,000 consumers.

Ailes Marines is developing a 62-turbine offshore wind farm just beyond Saint-Brieuc Bay, Côtes-d'Armor. Each turbine has installed capacity of 8 megawatts (MW); the wind farm as a whole will have total installed capacity of 496 MW, producing 1850 GWh per year – equivalent to the annual energy needs of 850,000 people.

The wind farm covers a total area of 75 km².

The turbine nearest the coast will be at a distance of 16.3 km.

The project is a clear sign of the ongoing development of the French offshore wind power industry.

It will involve 2,000 jobs, mostly in Western France, with the potential for 1,000 of these to be in Brittany.

The wind turbines will be manufactured in Le Havre by Adwen.

The jacket foundations will be partly manufactured, and assembled, in Brest.

Companies based in the region will make up a significant part of the supply chain.

The wind farm's maintenance facility will be located at Saint-Quay-Portrieux in Côtes-d'Armor.

SCHEDULE

2017 / Completion of the project inquiry
2018 / Provisional start of works
2020 / Full commissioning.

PARTNERS (CONSORTIUM):

The contract to build the Saint-Brieuc Bay offshore wind farm was won in 2012 by simplified joint stock company Ailes Marines SAS, 70% owned by Iberdrola and 30% owned by AVEL VOR. RES owns a 22.5% stake in AVEL VOR, while the Caisse de Dépôts group owns a further 7.5% share.
Ailes Marines is responsible for the development, construction, installation, and operation of the wind farm.
Ailes Marines is working with Adwen for the supply of wind turbines.
The wind farm's access to the French electricity grid from the offshore substation is being provided by RTE.

/ Total budget

- the total budget for the project is €2.5 billion

/ Funding

- The project is being 100% funded by Ailes Marines shareholders

/EDF TIDAL STREAM GENERATOR PAIMPOL-BRÉHAT

The purpose of this demonstration project is to validate the technical, administrative, and environmental feasibility of tidal stream generator systems.

After spending several months underwater in 2016, the two generators were brought ashore in 2017 for maintenance and technical upgrading.

Originally launched in 2008, EDF's Paimpol-Bréhat tidal stream generator project is continuing to progress.

The OpenHydro technology was validated following a series of tests on the prototype 16-metre-diameter turbine, "L'Arcouest", over the course of two 3-month periods of immersion at the Paimpol-Bréhat site.

In 2014, EDF and its industrial partners DCNS/OpenHydro made the decision to commit to the pilot production of 2 new turbines. These two turbines benefit from a more advanced design than L'Arcouest, delivering improved mechanical and electrical reliability. The technical architecture has been altered: in particular, the submerged converter, supplied by General Electric, is now mounted directly on the turbine foundation. The various components will be linked by underwater connectors supplied by Siemens.

The two tidal stream generators were lowered into the sea in January and May 2016 at the Paimpol-Bréhat site.

Over the subsequent months, operations were carried out to connect the two generators, followed by a whole raft of operating tests. Environmental monitoring also continued along the length of the submarine cable; after four winters, examination of its condition both at sea and onshore has confirmed that both the cable and the stabilisation system used are robust.

At the end of winter in 2017, the two generators will be brought back to dock for maintenance operations and further technical upgrading.

This EDF demonstration project has a twofold aim: proving the technological feasibility and environmental acceptability of a generator farm, and opening up the way for design work to commence on much larger projects at sites with far more significant energy potential.

Hydrolienne OpenHydro-DCNS

PARTNERS (CONSORTIUM):

- EDF (project sponsor)
- DCNS/OpenHydro
- General Electric
- Siemens

/ Total budget

- €40 million

/ Funding

- EDF
- Bretagne Region
- French State (ADEME)
- Europe (ERDF)

/SABELLA D10

- ***1 MW demonstrator tidal stream generator – Fromveur Passage, Finistère***
- ***The first industrial tidal stream generator to be connected to the French national grid (November 2015)***

The Sabella D10 project won French research agency ADEME's call for expressions of interest for marine energy demonstrations in 2011. It consisted in the construction and 12-month deployment of an industrial tidal stream generator in Fromveur Passage (also known as St Vincent's Channel). In November 2015, the tidal stream generator was connected to the isolated grid on the island of Ouessant (Ushant), 2 km away.

The generator is 17 m high and has a footprint of 20 x 20 m; its 10-metre rotor can generate 1 MW from the currents in the Fromveur Passage.

The project – a national first – required three years' worth of engineering, tests, and construction.

During slack water periods in May 2015, the cable to export the electricity produced was installed between the generator site and the coast of Ouessant. In June 2015, D10 was lowered into the Fromveur Passage; in September, it was connected to the island network via the previously installed cable. It thus became the first – and to date, the only – industrial tidal stream generator to be connected to the French national grid.

Initial results for the project have been promising and in line with expectations; they have also opened up future avenues for improvement.

In July 2016, at the end of the period for which on-site installation was authorised, the turbine was raised to the surface for technical inspection and expert appraisal. It will be reinstalled in spring 2017 as part of the EU's ICE project.

The project is noteworthy in a number of respects:

- widespread social acceptance
- 100% French construction
- structural industrial partnerships
- output dispatched to Ouessant under the control of EDF SEI and ENEDIS
- environmental considerations supervised by the Iroise Marine Natural Park.

SCHEDULE : 2011 - 2016

PARTNERS (CONSORTIUM):

- SABELLA
  - Project management
  - Tidal stream generator engineering and construction
  - Installation and operation at sea for 12 months
  - Dismantling
- IFREMER
  - Ageing of materials in a marine environment
  - Mechanical testing on a test bed
  - Underwater acoustics
- BUREAU VERITAS
  - Approval of mechanical design calculations
  - Assistance with a typical certification process

/ Total budget

- €13.5 million (30% state subsidies)

/ Funding

- State subsidies: PIA "future investment programme", Bretagne ERDF, local authorities

/PHARES

- ***Connected tidal power array***
- ***Fromveur Passage, Finistère***
- ***Deploying an energy model for isolated grids***

PHARES is a pilot project for a tidal array off Ouessant (Ushant), designed to serve as an illustration of the insular energy model promoted by SABELLA, and to showcase perspectives for low-carbon development that could be applied to islands and coastal areas worldwide.

PHARES aims to supply the electricity grid on Ouessant with green energy. The innovative aspect of this project resides in the deployment of two D12 tidal stream generators in Fromveur Passage (also known as St Vincent's Channel), linked to Ouessant's electricity grid (which has no interconnections), and combined with onshore solar and wind power production capacity, backed by storage facilities on the island.

The energy storage system serves as a way of smoothing peaks and troughs in output, particularly at times of slack water.

At the same time, there are also plans for energy use monitoring, peak load reduction, and deferrable demand management, enabling the best possible use of the marine energy generated by the tidal array.

Renewable solar and wind energy production is the last chapter of the "Phares" project which offers an exemplary solution for autonomous non-connected networks. Over 80% of the electricity on Ouessant will come from renewable sources.

In the medium term, the development of low-carbon mobility, local agricultural production, and green tourism will further enhance the appeal of the island and encourage the creation of more secure local jobs.

Ouessant will serve as a showcase for island-based expertise that can also be used to promote other projects, both in France and internationally.

SCHEDULE: 2017 - 2020

PROSPECTIVE PARTNERS

- SABELLA
  - Tidal array engineering
  - Construction and commissioning of tidal stream generators
  - Assistance with the deployment of the insular energy model
- AKUO ENERGY
  - Project management
  - Site characterisation
  - Deployment of other forms of renewable energy on the island
  - Operation of the pilot array
  - Deployment of the insular energy model
- BRETAGNE REGION
  - Smart grid and local energy loop integration
  - Local development initiatives

/ Funding

- State aid: PIA "future investment programme", regional investment fund

/WATTMOR PILOT WAVE FARM PROJECT

Finnish energy firm Fortum is working with DCNS and AW-Energy to locate a pilot installation to harness wave energy in Brittany, more specifically in Audierne Bay, Finistère.

The project involves the design, manufacture, and installation in Audierne Bay of a pilot array to generate electricity using waves. "Wattmor" is a combination of the unit of power, the watt, and mor, a Breton word used to denote the sea.

Wattmor is a partnership between energy firm Fortum, the Finnish company AW-Energy, which is developing the WaverRoller® technology, DCNS, and the Bretagne Region; the latter is providing local and financial support as part of its policy to encourage the development of marine energy.

WaverRoller® technology is based on a panel that moves back and forth with the waves. Each unit can operate in coastal waters up to 2 km from the shore, at depths of up to 20 m.

The project is designed to provide a demonstration of a 1-MW pilot array consisting of three industrial-scale 350 kW machines, the very first of which is due to be deployed in Portugal in 2017.

The project is being conducted in several stages.

Project feasibility was determined following studies of the site, the suitability of WaverRoller® technology, the architecture of the array, and the broader environment.

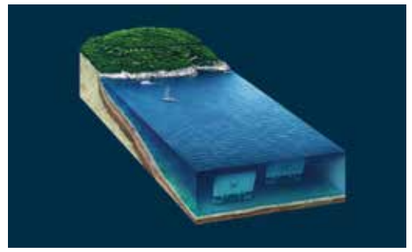
Local consultation with stakeholders has been ongoing since the origins of the project.

The next phase involves the detailed design of the array equipment and the construction of the machines prior to on-site installation.

The consortium is currently seeking the funding required for this fully-fledged investment phase before continuing with more detailed preliminary design work.

SCHEDULE

2013 – 2016 / Studies relating to the site, the suitability of the technology, and the array architecture
2015 – 2016 / Environmental studies
2013 jusqu'à aujourd'hui / Local consultation
Aujourd'hui / Seeking funding for the investment phase



PARTNERS (CONSORTIUM):

- Fortum
- AW-Energy
- Bretagne Region
- DCNS

/ Total budget

- €10-15 million for the investment phase

THE BRETAGNE REGION: COMMITTED TO DEVELOPING MARINE RENEWABLE ENERGY

A STRATEGY FOR THE SEA AND COAST ECONOMY

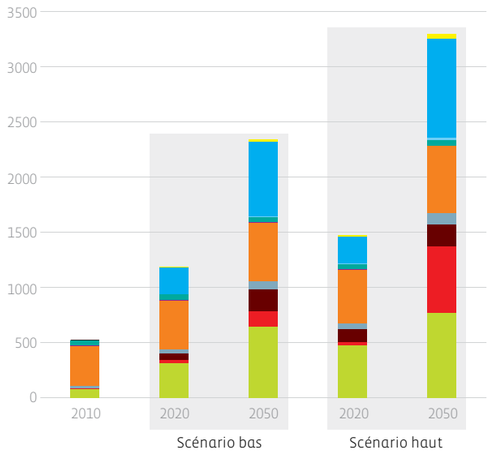
Ever since it signed up to the Breton Electricity Pact in 2010, the Bretagne Region Council has been at the forefront of a highly proactive policy promoting Marine Renewable Energy (MRE), characterised by a consultative emphasis that brings together all the stakeholders in the industry, notably in the Regional Sea and Coast Conference (Conférence Régionale Mer et Littoral, CRML).

This broad-based local government policy has a twofold aim: bringing down the region's energy dependence – and establishing an industrial showcase worthy of the international scene.

One key aspect of the Bretagne Region's energy policy is a long-term commitment to the production of renewable energy, with the goal of increasing output threefold by 2050. The various forms of marine renewable energy are an essential building block in this low-carbon energy mix.

Marine renewable energy is also one of the "industries of the future" featuring in the Region's economic development strategy, known as "Glaz Economie". Support to firms engaged in development projects, innovation, and internationalisation lie at the heart of the Region Council's priorities. In-depth coordination with economic stakeholders allows the Region to assist local firms in identifying outlets in major infrastructure projects, within Brittany and beyond, building momentum for international expansion.

/ Development of renewable energies production



Source : schéma Régional Climat Air Energie de Bretagne 2013 - 2018

When it comes to marine renewable energy, in June 2016 the Bretagne Region Council adopted a roadmap to address five key issues:

› Organising MRE coordination and planning for energy and maritime affairs

› Supporting projects off the coast of Brittany

› Supporting the sector's economic and industrial dynamic

› Investing in the infrastructure required to cater for MRE, particularly in ports

› Raising the profile of the region's MRE offering internationally

©Sara Minisini / BDI

©Sabella

EU PROJECTS TO BOOST REGIONAL ENERGY POLICY

To address those aspects of the marine renewable energy roadmap designed to help stimulate industry, the Bretagne Region has been involved in a number of EU projects: SET UP, ICE, Era-net Ocean Energy, and EEN.

/ SET-UP (International Cooperation)

Coordinated by Bretagne Développement Innovation and the Bretagne Region Council, the SET-UP project involves 6 European regions* exchanging best practices with a view to improving public policies aimed at promoting the development of smart grids. It places a special focus on solutions addressing three of the major challenges inherent in energy transition:

- Acceptance by consumers
- Definition of new business models
- Development of efficient financial engineering.

www.interregeurope.eu/set-up

SET-UP
Interreg Europe

/ ICE - Intelligent Community Energy (Security of supply)

ICE aims to design and implement innovative, smart energy solutions for isolated Channel territories.

Coordinated by Bretagne Développement Innovation, 9 partners in the Channel zone have joined forces to take up the challenge of energy vulnerability faced by island communities and other remote areas.

Different solutions drawing on smart grid technology will be trialled at two pilot sites, in France and the UK (the island of Ouessant and the University of East Anglia campus), developing systems that can address issues relating to the energy mix (particularly for renewable energy), demand management, and storage. For Ouessant (Ushant), which has no connection to the mainland, the aim will be to incorporate tidal energy harvested from the Fromveur current, and validate autonomous and insular energy models.

At the end of the project, these low-carbon solutions will be incorporated into a full-orbed commercial offering that can then be made available to islands and other outlying areas by a consortium of companies from the Channel zone.

/ ERA NET Ocean Energy COFUND (Technology building blocks)

Co-funded by the EU research programme Horizon 2020, the Ocean Energy ERA NET Cofund brings together seven national and regional partners from across Europe: Scotland (project coordinator), Spain, the Southern Basque Country, Ireland, Sweden, Bretagne, and Pays de la Loire.

€18 million has been earmarked for this project to fund demonstration work to test and validate ocean energy technologies: wave power, marine current power, tidal power, ocean thermal energy conversion, and osmotic power.

On March 20, 2017, the partners launched a transnational request for proposals, directed at academic and industrial stakeholders in their respective regions. More specifically, the RFP concerned the following areas of research: full systems; components and subsystems; foundations; anchoring; electrical systems; installation; operations; and maintenance at sea.

Worth €18 million, and co-funded by the European Union, the RFP will provide support for R&D conducted by laboratories and companies in eight EU regions, as well as encouraging cooperation across Europe in this field.

The Bretagne and Pays de la Loire Regions will each be putting up €1 million to support their respective local stakeholders.

www.oceancofund.eu

OCEAN ENERGY
ERA-NET COFUND

/ EEN – Entreprise Europe Network (International cooperation)

Innovation projects may call for skills from outside a company, or indeed from outside the country. EEN helps companies define needs, identify a suitable partner, and link up with the appropriate people, drawing on its network of 600 contacts located in over 60 countries worldwide.

www.een-france.fr

enterprise europe network

L'Europe à la portée de votre entreprise.

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PORT OF BREST

/ Infrastructure: Port of Brest

Brest is Brittany's leading port, and is now the focus of an ambitious development programme commensurate with the city's economic, energy, and industrial potential.

Development works are underway (see below) to allow the port to cater for industrial activity relating to MRE and provide ideal conditions for industrial firms to set up at the port in the future, for production, storage, loading/unloading, and the handling of outsize and/or heavy structures.

The development initiative has a twofold aim:

- Expanding the commercial port's historic business by improving shipping access to the bulk and multimodal terminals
- Developing new industrial activities at the commercial port by creating a new port terminal suitable for heavy consignments, in particular those involved in the Marine Renewable Energy industry.

/ Port of Brest development works progress report:

The Region has selected the contractors who will be responsible for the future MRE terminal's breakwater and dock. Work on the future terminal commenced at the start of January 2017, and in early March, the Bretagne Region announced that following a call for tender process, the first two workpackages for the maritime works had been awarded.

› THE TENDER FOR THE DOCK AND ITS WHARF (LOT M01) (SUCCESSFUL BIDDER: THE EMCC CONSORTIUM*):

Scheduled for 2017-2019, the works involve the construction of a 380-metre dock strong enough to cope with extremely heavy consignments (10 t/m²), together with a 4-hectare handling area, directly linked to the port storage yards.

** VINCI Construction, MENARD Agence Ouest, SOCIETE DE DRAGAGE INTERNATIONAL, IDRA Environnement and GTM Ouest.*

› THE CONTRACT FOR THE BREAKWATER (LOT M02) TO BE BUILT TO EXTEND THE EXISTING POLDER (SUCCESSFUL BIDDER: BOUYGUES TP RF SAS CONSORTIUM*):

To be built between 2017 and 2019, this 860-metre breakwater will be connected to the dock and create an enclosure in which all the marine sediment dredged from the port will be stored – a total of 1.25 million cubic metres. Once consolidated, these freshly-reclaimed areas of land will constitute a new 14-hectare polder, to be developed from 2020 onwards, during a second phase of works.

** DTP, LIZIARD, PIGEON Bretagne Sud, STPA SAS, SODRACO International and KELLER Fondations profondes.*

Other onshore and maritime contracts will follow later.

www.portbrest.bretagne.bzh

COLLECTIVE PLANNING

The Regional Sea and Coast Conference (Conférence régionale de la mer et du littoral, CRML) is co-chaired by the French State and the Region. It plays a vital, ongoing role in facilitating consultation on maritime planning for marine energy. The process began in 2011 with the identification of an appropriate area for an offshore wind farm in Saint-Brieuc Bay, before going on to identify each of the pilot sites in Brittany, and in 2016, anticipating the identification of new zones for future commercial arrays.

March 3, 2017 marked a major milestone, with the validation by the Regional Sea and Coast Conference of three favourable areas for tidal stream generators and 2 macro-zones for floating wind power (see also the map of MRE projects at the start of this documentation).

The proposal comes in response to instructions, issued by French ministers to the Préfecture authorities ahead of future calls for tender, to identify potentially suitable areas for hosting projected tidal stream generator arrays and floating wind farms for future commercial operations.

• **The potential of the Fromveur Passage (also known as St Vincent's Channel) in the Iroise Marine Natural Park for tidal current energy was also highlighted.** Provided that the specific environmental considerations and uses of this area can be properly taken into account, it is the most suitable site in the short term for the commercial development of this technology. The potential of the **Héaux de Bréhat** and **Gulf of Morbihan** sites was also highlighted (although exploitation of the former will require further technological development); while these areas are smaller and offer less energy potential, they are nonetheless strategic for the region.

• **For floating wind power**, two macro-zones off the coast of Brittany have significant potential. They are compatible with the technical and economic considerations inherent in this innovative technology, and also fulfil the main regulatory constraints that have been identified. However, for them to be eligible to host commercial projects in the future, further research and consultation will be required in 2017, in particular with the fishing industry, in order to take into account the historic activity of fishing fleets in the areas in question. Dedicated discussions bringing together the government, the Bretagne Region maritime fisheries and marine fish farms committee, and the Bretagne Region Council are being planned for this purpose.

The aim is to put forward concrete proposals by the end of 2017, enabling Brittany to make a far-reaching contribution to this national undertaking.

The Regional Sea and Coast Conference (Conférence régionale de la mer et du littoral, CRML) was convened for the first time in 2009, and officially recognised by the French Decree of February 16, 2012 as one of the official bodies to be consulted when devising action plans for marine environments. Co-chaired by the president of the Region Council, the Atlantique Maritime Préfet and the Region Préfet, it meets between two and three times a year. Its 5 colleges consist of representatives of local authorities in Brittany; government departments and public institutions whose remit includes maritime affairs; professional organisations for fishing, shellfish farming, port activities, shipbuilding and repair, farming, and tourism; and non-profit associations devoted to the protection of nature and heritage, the interests of users, local residents, and so on.

THE POWER OF AN ECOSYSTEM TO CREATE WIN-WIN PARTNERSHI PS

/ 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.

2900 *private and public-sector researchers*
in marine science and technology

2 *industry clusters:*
Bretagne Pôle Naval, BreizhEMR

2 postgraduate engineering degrees
6 Masters degrees
4 specialised Masters degrees

19 *training establishments*
for **maritime and industrial careers**

150 *qualifications*
in industry, ranging from NVQs to postgraduate Engineering degrees, in maritime-related sectors.

1 *energy transition institute for MRE:*
France Energies Marines

Headquarters
and main site of oceanographic institution **Ifremer**

1 *dedicated competitiveness cluster:*
Pôle Mer Bretagne Atlantique

180 *companies*
involved in the MRE market

5 *higher education institutions:*
ENSTA Bretagne, Naval Academy, ISEN, Campus Mondial de la Mer, Telecom Bretagne

THE BRETON DELEGATION

/ BRETAGNE (BRITTANY, FRANCE) - STAND D7

/ Breizh EMR
/ Bretagne Pôle Nava
/ ENSTA Bretagne
/ Eolfi
/ Guinard Energies
/ Iroise Mer)
/ Mappem Geophysics
/ Pôle Mer Bretagne Atlantique
/ Port de Brest
/ Sabella
/ Bretagne Développement Innovation

/ BREIZH EMR

Bretain COMPANIES AROUND THE INDUSTRY OF RENEWABLE MARINE ENERGIES

The objective of Breizh' EMR is to create a regional dynamics around the industry of renewable marine energies, by facilitating the relationships between its members, creating commercial and industrial synergies, ultimo resulting into the establishment of a "Breton" industrial sector of renewable marine energies.

Added values:

- Network of key business leaders dedicated contact person to provide access to this Industrial Competence Network.
- Assistance in optimizing supply chain.
- Support for co-development business projects to help you increase your competitiveness.
- Transfer of the best technology solutions from the multi-market expertise of the member firms

Technical skills : Quality Health Safety Environment (QHSE) engineering, steel construction, sheet metal work, precision engineering, surface treatment, composite materials, electricity automation / industrial electricity, hydraulic power unit, ship repair, logistics.

Key figures:

- 15 companies.
- 1.575 employees.
- 226 M€ inturnover.

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/ BRETAGNE PÔLE NAVAL

At Seanergy 2017, the MRE cluster of BPN, will bring the dynamics of its companies into tidal, offshore wind (seabed mounted & floating), highlighting the high technical level of achievements and projects.

Last year, BPN produced an industrial model for a typical floating off-shore wind turbines project. This one validated the capacity of the Brittany companies to realize a complete float. In 2017, the operational working group of the MRE cluster will drive the production of new scheme for other MRE technologies.

BPN enters more than ever into an operational phase by being strength of proposals.

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/ ENSTA BRETAGNE

ENGINEERING INSTITUTE

Based in Brest, ENSTA Bretagne is actively engaged in and committed to Maritime Engineering and Renewable Marine Energies.

ENSTA Bretagne offers specialized courses in renewable marine energies, naval architecture, hydrography, IT, robotics...

With Ecole navale, IMT Atlantique and UBO, ENSTA Bretagne conducts in Brest a post Master's Degree. Pedagogical objective is to train project or program managers dedicated to the development of energy product ion systems and farms at sea: Assessment of Energy Resources, Engineering Science and Technology, Coastal Environment and Impact, Marine Energy and Society.

RESEARCH

In Mechanics, its aims to improve knowledge of the mechanical behavior of the materials and the structures in the naval, automotive and aeronautical fields.

IT Department is organized into 4 theme-based teams: Robotics / Ocean Sensing & Mapping, Passive Acoustics, Radar and Electro-Magnetic Sensing, Model-Driven Engineering.

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/ EOLFI

Headquartered in Paris with offices in Marseille, Lorient and Taipei, and with a team of around 40 experts, EOLFI is an independent wind power specialist with more than 12 years of international experience. Its operations span from onshore wind and solar to floating offshore wind projects in Europe and Asia.

In July 2016, EOLFI was awarded **the first oceanic floating project of in France**. This project consists of the development of a 24 MW floating pilot wind farm, 15km off the coast of Groix island, which is located in Brittany. EOLFI, via EOLFI Offshore France (a joint venture with CGNEE), is the project owner and will develop the project along with four industrial partners: DCNS Energies, Vinci, GE Renewable Energy and Valemo.

/ Products & Services presented at Seanergy 2017

Besides, EOLFI has pioneered several technologies related to offshore floating energy: Blidar, Stationis (decision support software program dedicated to the pre-engineering design of the subsea architecture of a floating wind farm), Spinfloat (novel concept of vertical axis floating wind turbine technology), Agnes, and is actively researching new developments.

EOLFI is an active member of a number of important industry organizations: France Energie Eolienne, Syndicat des Energies Renouvelables, Pôle Mer Méditerranée, Cluster Maritime Français and Capenergies in France, as well as Taiwan Wind Turbine Industry Association and Taiwan Wind Energy Association.

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/ GUINARD ENERGIES

A Brest-based French start-up, Guinard Energies has developed a new technology of ducted turbine dedicated to hydrokinetic power, which doubles the recoverable energy. It has been validated by DGA (Defense authorities).

The first demonstrator of 4 m diameter, 250 kW nominal power at 3.5m/s will be deployed in Brittany in 2017.

A small 4 kW hydrokinetic floating turbine is being developed in order to start industrialization.

The technology is first utilized by Guinard Energies to offer a Power Assessment Service for hydrokinetic energy projects. It provides on-site hydrokinetic power measurements and current speed measurements. This unique worldwide service takes implicit eddies and site characteristics into account to ensure project credibility. The service is available for all hydrokinetic project developers, in marine or river environments.

Power assessments were being conducted in Brittany and now Overseas.

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/ IROISE MER

Iroise Mer is a shipowner and offers **maritime solutions and specific services in the Marine Renewable Energy sector.**

Founded in 2002, IROISE MER is now part of the Thomas Services Maritimes (TSM) group since 2013. As a shipowner, we are able to provide to our clients the best of our vessels capabilities to fulfill their technical and HSE requirements. IROISE MER offers maritime solutions and services in particular in the Renewable Marine Energies (MRE) sector and can work as a partner for:

- Management of your maritime projects from engineering to works on sites
- Offshore and nearshore marine works
- Nearshore – Offshore towing
- Identification and recovery of U.X.O. and salvage operations
- Diving or ROV support vessels

/ Products & Services presented at Seanergy 2017

Thanks to our strong experience in French Brittany and English Channel in tidal area sites and on Offshore Wind Park, we have design a newbuilt Light Work Class and Very Shallow Draft DP1 vessel.

She will be present at Seanergy show in Le Havre for visits and sea trials at sea.

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/ MAPPEM GEOPHYSICS

MAPPEM Geophysics is **leader in marine resistivity imaging and electromagnetic measurements.**

Marine geophysics and site investigation are often limited by the performances of standard investigation methods. The presence of hard materials (chalk, calcarenite, boulders, granite, etc.), cavities (karsts), shallow gas, etc. can prevent these methods to give valuable information. MAPPEM techniques can provide geological information where others can't. MAPPEM technologies can also be used to detect and localize buried objects, even if non-ferrous (such as aluminium UXO).

/ Products & Services presented at Seanergy 2017

The MAPPEM system is an innovative towed fish dedicated to electrical resistivity imaging of the marine sub-bottom structures, using electromagnetic techniques. An electrical current, harmless for the environment, is injected in the substratum. This current "enlightens" the substratum and the MAPPEM system records the electromagnetic effects of the different materials. This leads to colourful images of the geological structures, but also allows to localize eventual buried objects.

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/ PÔLE MER BRETAGNE ATLANTIQUE

Pôle Mer Bretagne Atlantique Current Profile:

- 350 members
- 1 regional centre of maritime excellence: Brittany-Pays de la Loire
- 273 recognised projects with 831 million euros of investment in R&D
- 240 million euros of public funding secured over ten years
- 6 major fields of activity: Maritime safety and security, shipbuilding and leisure boatbuilding, marine energy and mining resources, marine biological resources (fishing/ aquaculture and blue biotech), environmental and coastal planning and development and maritime ports, infrastructure and transport.

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/ PORT OF BREST

Brest port is currently at works to improve nautical access and to create a new terminal dedicated to Marine Renewable Energies. The project includes the creation of a heavy load wharf of 380m long and 12m depth. Large areas will be available next to the quay to accommodate new industrial activities, connected to the quay by heavy load roads. This large investment reveals the strong will to welcome new stakeholders in Bretagne to take advantage of the great potential of this part of France as regards MRE.

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/ SABELLA

SABELLA : innovative and market-ready solution for energy transition in remote communities and electricity production using marine currents

Innovative company founded in 2008, SABELLA establish itself among the tidal energy industry major players.

After the success of the D03 project in 2008, SABELLA stands out with the completion of its 1 MW project in Ushant, Sabella D10 being the first and only tidal turbine immersed and grid-connected in France (cf. Sabella D10 project report).

With a differentiated and economically-optimized range of technologies, SABELLA endeavors **to promote an energetic model tailored for remote grids on islands and shore communities.**

Based on a clean and reliable resource, the model offers a sustainable alternative to costly and polluting fuel-based power generation.

Given tangible results and promising performances, D10 tidal turbine will be kept on site until 2019, as part of the European project “ICE”, led by the regional economical agency Bretagne Développement Innovation (BDI). At the end of this project, the pilot farm Eussabella will be deployed (cf. Eussabella project report).

In parallel, SABELLA pursues its international development, targeting countries with significant tidal stream potential and needs for reliable and secure energy supply.

A demonstration project is currently under development in Indonesia, together with the Ministry of Energy. It will consist in installing a first tidal turbine in the biggest archipelago in the world. This will allow knowledge acquisition before the publication of ambitious calls for tenders planned in 2018, following the TEPI project held by French Development Agency.

In the Philippines, SABELLA is developing a project together with H&WB in order to harness the tidal energy potential of the San Bernardino Strait, estimated to be higher than 500 MW. The first phase, in association with PNOC RC, the renewable energy division of the national oil company of the Philippines, will see the deployment in 2019 of three D15 tidal turbines to supply the isolated island Capul.

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www.sabella-d10.bzh

/ BRETAGNE DÉVELOPPEMENT INNOVATION

BRETAGNE DÉVELOPPEMENT INNOVATION

Established and funded by the Region Council, Bretagne Développement Innovation (BDI) is a non-profit agency devoted to Brittany's economy*. BDI's mission focuses on the emergence and structuring of high-potential sectors for the Bretagne region:

- Offshore and marine renewable energy (MRE)
- Smart electricity grids (SMILE programme)
- Defence and security
- Cyber security and cyber defence
- Electronics / Digital & Industry
- Ocean racing

Acting as lead partner to coordinate the MRE dynamic
The Bretagne Region Council largely relies on BDI to head up **regional coordination between stakeholders in the MRE industrial ecosystem**: clusters, Chambers of Commerce and Industry, technology innovation centres, and other players. BDI also implements regional **promotion strategy** for the sector, now firmly established in the Bretagne region's economic and industrial landscape.

The goals of this mission are as follows:

- Stimulating industrial activity in the field of marine renewable energy through initiatives directed at contracting entities, subcontractors, and international investors
- Helping to direct hinterland businesses towards MRE (particularly for the Port of Brest)
- Establishing Brittany's reputation in the field of marine renewable energy
- Ensuring the region is represented in MRE networks across Europe.

** BDI's work forms part of the Regional Strategy for Economic Development, Innovation, and Internationalisation (Stratégie régionale de développement économique, innovation et d'internationalisation, SRDEII), known as Glaz économie, together with the territory's many economic stakeholders.*

http://www.bdi.fr

THE OTHER COMPANIES

/ On their booth:

- **EVALTECH MARINE**
- **NASS&WIND SMART SERVICES /** nassetwind.com
- **NEOTEK /** neotek-web.com
- **DYNAMOCEAN /** dynamocean.com
- **SETEC - IN VIVO /** setec.fr/societe/setec_in_vivo.html
- **ORANGE MARINE /** marine.orange.com
- **DAMEN SHIPREPAIR BREST SAS /** damenshiprepairbrest.com
- **OPEN OCEAN /** openocean.fr
- **FRANCE ENERGIES MARINES /** france-energies-marines.org
- **IFREMER /** wwz.ifremer.fr/brest

/ In the B2B meetings

- Actimar
- Blue Watter Shipping
- Brest Expertise Maritime
- Dekra Industrial
- Eolink
- ETT
- Gsea Design
- Hyd et au Fluid
- Kenta
- Le Béon Manufacturing
- Ouest Valorisation
- Piriou
- Prestia
- Quiet Oceans
- Richard Marine Consulting
- Serenmar
- Shom

THANK YOU !
TO ALL THE PRESENT ACTORS

Exhibiting partners

EOLFI

GUINARD ENERGIES

iroisemer

MAPPEM GEOPHYSICS
Marine Electromagnetic Investigation

Sabella SAS

PORT OF BREST
MRE Terminal

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BRETAGNE (BRITTANY, FRANCE) - BOOTH D7
SEANERGY 2017
Le Havre, Normandy (France)

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BRETAGNE DÉVELOPPEMENT INNOVATION

avec le soutien de Région Bretagne