



PRESS KIT



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"Floatgen marks a crucial milestone in Ideol's history and confirms our position as an international leader. But it is also an important moment for this new, emerging sector which is currently entering the phase of commercial deployment."



Paul de la Guérvivière
CEO, Ideol



Benoît Lange, Head of Sales and Marketing, Bouygues Travaux Publics

"Our investment in the Floatgen project demonstrates Bouygues Travaux Publics' desire to highlight, within the sector of Renewable Marine Energies, our vast experience in the construction of port and marine infrastructure internationally and within France. Concrete floats, produced on an industrial scale, will offer a competitive solution for offshore wind power."

Arnaud Poitou
Director, Centrale Nantes

"Floatgen is a landmark event for our school. The offshore SEM-REV test site and its innovative electric network, which was truly visionary in 2007, has become a research tool with global reach and is now absolutely crucial to the development of this new industrial sector in France"



Bruno Retailleau, Former President of the Pays de la Loire Regional Council

"Floatgen is simply remarkable from a technological point of view and perfectly illustrates the Pays de la Loire region's ambitions within the maritime sector. The project, based within the Loire region and a world first, solidifies our position as the leading region for the new maritime economy and the first industrial hub for renewable marine energy in France."

"The State supports this particularly innovative floating wind project, as it symbolizes the priority afforded to the deployment of offshore renewable energies to meet the objectives of the energy transition, maritime ambition and industrial and commercial policy, and will strengthen the particularly strong collective dynamic observed in the Pays de la Loire around these objectives."



Nicole Klein, Préfète, Pays de la Loire Region

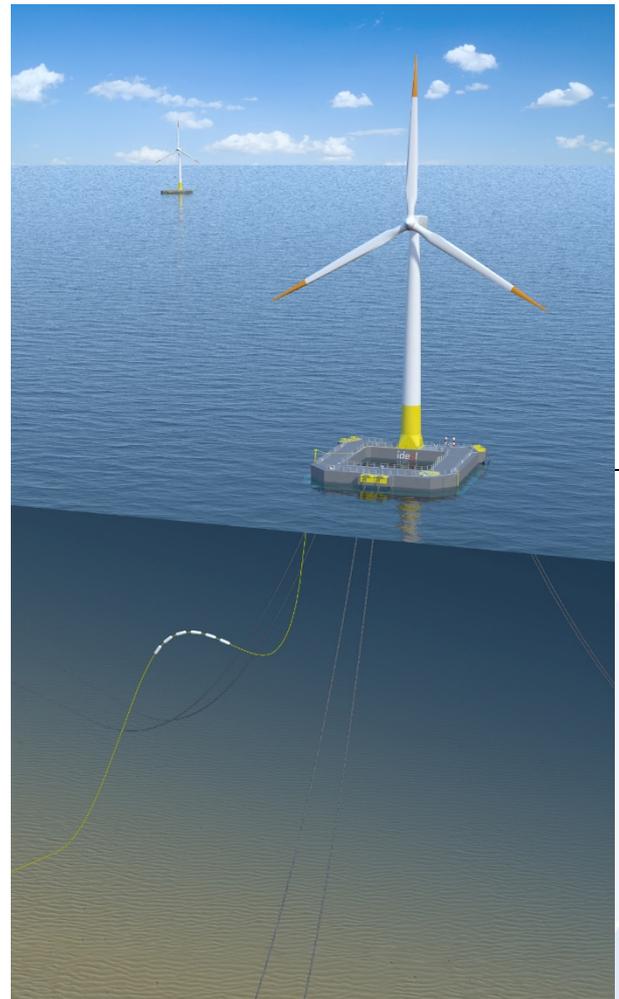
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Floatgen, a landmark undertaking for the future of offshore wind power

Floatgen: A new generation is here. The Floatgen project marks a new first for offshore wind power: the floating wind turbine, capable of generating 2MW of energy and currently being prepared for deployment off the coast of Croisic at the Centrale Nantes SEM-REV test site. This turbine will be deployed for an initial period of two years, and the electricity produced sent directly to the electrical grid for this entire duration. The turbine will produce the equivalent of the annual consumption of 5,000 inhabitants.

An opportunity to confirm the performance of floating wind turbines. The Floatgen project was designed as a starting point for the development of commercial floating wind farms. Its objectives: to confirm the technical feasibility and the economic viability of floating wind turbines, and to prove that Ideol's technological solution is the most competitive on the market. As the first demonstration unit for Ideol's floating base technology, it has provided, and will continue to provide, the consortium partners with an unparalleled experience, particularly in terms of construction methods, deployment and operation, in addition to its value as a showcase model for future export.



Key project data



Ideol's singular, patented float technology. Fitted with the Damping Pool® system and built using reinforced and prestressed concrete by Bouygues TP, the Floatgen wind turbine float measures 36 metres wide and 9.5 metres in height (with a 7.5 metre draught). Floatgen is the first demonstration unit of this particular technology.



A 2MW wind turbine (Vestas V80) with a rotor diameter of 80 metres (with 40 metre long blades). The turbine tower is attached to the float using an adapter and measures 60 metres in height, including the adapter.



A world first in anchoring. Floatgen's semi-slack anchoring system (to keep the turbine in the correct position) is innovative in its use of synthetic fibres (nylon) as opposed to chains. A world first for permanent anchoring at this scale (6 anchoring lines).



An innovative electrical network linked with a research base
The wind turbine is installed on SEM-REV, the first multi-technology offshore test site for marine renewable energy, which is connected to the grid. The site is run by Centrale Nantes with CNRS support. It is located 22 km off the coast from Le Croisic at an ocean depth of 33 metres.



Putting Ideol's floating base to the test under strenuous ocean and climate conditions. The ocean and climate conditions at the SEM-REV site, with their maximum wave height (Hmax) of 16 metres and very shallow dispersion, are particularly treacherous, thereby acting as the perfect proving ground for the deployment of the system under the most demanding environmental conditions.

Floatgen has brought together the biggest names in industry and academia. 7 partners from across Europe, including 3 from France companies - Ideol, Bouygues Travaux Publics, and Centrale Nantes - have joined forces to provide their respective areas of expertise. The floating base technology (also known by its patented name Damping Pool® – see the attached data sheet) developed by Ideol, lead partner in the consortium, has been at the core of the project since 2013.



IDEOL (Coordinator – France)

Responsible for engineering the overall floating system (anchoring, float, export cable), providing the wind turbine and offshore deployment



CENTRALE NANTES (France)

Contributed its expertise in ocean engineering and use of the SEM-REV test site off the coast of Le Croisic, in addition to providing and implementing the anchoring system



BOUYGUES TRAVAUX PUBLICS (France)

Responsible for the manufacturing engineering, construction, and floating of the base from the Saint-Nazaire port



RSK GROUP (United Kingdom)

Contributed the environmental impact analysis for the float system



ZABALA (Spain)

Responsible for managing the consortium as well as ensuring internal communication for the project



STUTTGART UNIVERSITY (Germany)

Contributed interlinked digital simulations and assessed the measurement campaign

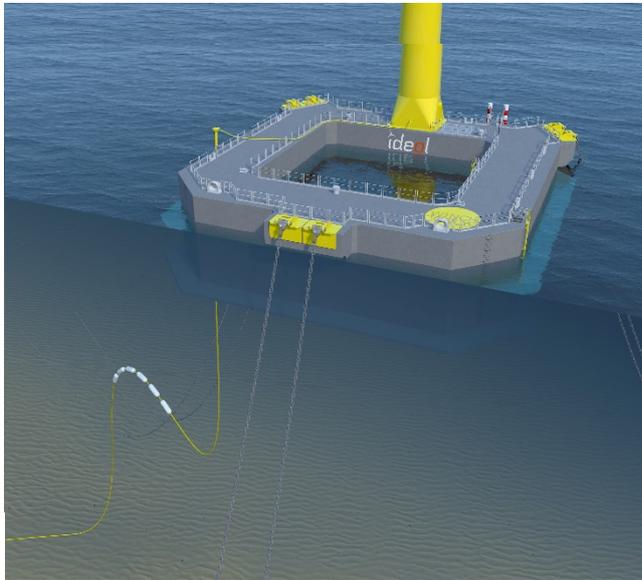


FRAUNHOFER-IWES (Germany)

Provided the benchmark between the Floatgen floating system and other comparable floating solutions

Project funding: The state is contributing €9.1 million in PIA (Investments for the Future) funding: €5.7 million via the ADEME (French Environment & Energy Management Agency) call for projects and €3.4 million via PIA-SEMREV for the anchoring system installed by Centrale Nantes. The Interreg programme “FORESEA” is supporting further Floatgen testing with funding of between €700K and €1,000K.

Innovative in every way



Compact and competitive, Ideol's floating base is at the heart of the innovation involved in the Floatgen project. Designed around Ideol's patented Damping Pool technology, the floating base system features a ring-shaped central opening for optimal stability at a lower cost owing to its particular hydrodynamic properties.

The Ideol solution used is founded in its proven expertise in both the offshore oil sector (meeting offshore standards and regulations) as well as offshore wind energy (the use of standard wind turbines with no major modifications required).

This means that the floating wind turbine can be deployed from a depth of 30 metres, and thanks to its compactness, is completely aligned with the new generation of large-scale turbines (12-15 MW) available on the market.

The whole of the design used has been assessed and certified by an independent third-party certification company.

Ideol's solution is the simplest and the most compact, designed to be the most competitive on the market.

Floatgen is the first offshore wind turbine to be deployed using Ideol technology, prior to the deployment of an additional unit in Japan during the summer of 2018 (for more information see Ideol's dedicated literature on this subject).

Bouygues Travaux Publics has contributed to the project with its innovative use of lightweight concrete and original construction methods. Using concrete as the main material for the construction of the Ideol floating base is a remarkable fact, and makes it stand out from all other floating solutions on the market, which use steel. Bouygues Travaux Publics, which was responsible for construction of the base, developed a bespoke lightweight self-compacting concrete formula for this purpose.

The innovative qualities can be seen in the construction methods of the demonstration unit developed by Bouygues. To better adapt to existing port infrastructure, the chosen solution consisted of building the floating base on top of three reinforced barges moored next to the quay. The base and barges were then towed to the Joubert lock located next to the entrance to the port where the base was finally floated.

Semi-slack nylon cables, a world first in permanent anchorage. Experience gained from the offshore industry helped Centrale Nantes and Ideol develop the specific features required to create such an innovative anchoring system. Rather than use the traditional chains to manufacture the anchoring lines, Ideol, as the designer of the system, and Centrale Nantes, as the supplier of the system, opted for nylon, a synthetic fibre, with its excellent resistance. LeBéon Manufacturing was selected to provide this innovative system alongside two industrial partners from the offshore sector: Bexco, a Belgian company specialising in synthetic fibres and Dai-Han, a South Korean company specialising in chains.

This innovative use of nylon lines has generated significant cost savings for the anchoring system.

The SEM-REV is the first offshore multi-technology test site in the world for marine renewable energy.

The SEM-REV platform, designed to be a global standard, is a cooperative research tool which allows demonstration units, pilot units, and offshore energy recovery (wind energy, wave energy) units to be tested up to full-scale in real conditions.

SEM-REV, includes an onshore research base station and an electric network connected to the grid via an export cable with an 8MW capacity and an electric sub-station. An innovative subsea hub and a dynamic cable, which have been designed specifically to connect a high-power floating demonstrator, will allow for the simultaneous connection of three prototypes.

This test site has all the authorizations and all the equipment and means of measurement allowing for the development, in operational conditions, of marine energy recovery systems (mainly offshore swell and wind).

The site is operated by Centrale Nantes and the CNRS, and is fitted with all relevant equipment required to implement marine renewable energy systems (floating wind turbines, wave energy) offshore under real conditions. Originally launched in 2007 under the 2007-2013 State-Region project contract, this visionary project has an overall budget of around EUR 20 million. A number of leading partners such as the Pays de la Loire Region (€9.9 million), the French Government, and the *Loire-Atlantique* have contributed to date a total of €17 million to the project. The project is a key element in the Pays de la Loire's marine renewable energy strategy and a decisive asset in the development of this new national industry. SEMREV will also provide initial and on-going training in the sector of marine renewable energy, particularly in deployment, maintenance, and dismantling operations.

Floatgen: the floating wind turbine firmly anchored in its region

70 jobs in Saint-Nazaire were directly secured by the construction of the floating base. In comparison to other steel floating bases, which are imported from abroad, **the concrete base selected by Ideol has meant construction has stayed as close as possible to the deployment site.** **The construction techniques developed and implemented by Bouygues Travaux Publics were firmly entrenched in the local economy,** with adaptation to the host port made easier.

Construction at Saint-Nazaire port, which is located a few dozen kilometres from the deployment site, was therefore a natural and optimal solution from an infrastructure and logistics standpoint. Saint-Nazaire is particularly renowned for its dynamic industry and, from a socio-economic standpoint, constructing the project in this location would bring a number of benefits to the community.



©Région Pays de la Loire



LeBéon Manufacturing in Morbihan manufactured the anchoring system

Following a call to tender, Centrale Nantes alongside Ideol, designer of the anchoring system, awarded the contract for the manufacture of system elements to LeBéon Manufacturing (a consortium involving Bexco as supplier of the nylon anchoring lines). The majority of forged workpieces was produced in their Plouay plant in Morbihan.

Using local suppliers for all other components. For the majority of all other components or logistical activities, the Floatgen Partners opted for suppliers within the Saint-Nazaire region, such as Artelia (project management), Ceteal (technical studies), Point P - Trouillard (concrete), Shipelec (electrical works), Tissot (logistics), TGO (logistics and storage), Mécasoud (anchorage base), SNEF (electrical works), and Oetra (rental of construction barges). This local focus was applied to all of the project’s purchases, from communications (the communications agency is based in Nantes, with its events agency located in Saint-Nazaire) to insurance (Bessé in Nantes).

Richard Lalaite, head of SNEF (in charge of electrical work and installation for Floatgen)

“This project has helped us expand the skills of our teams within the marine renewable energy sector owing to the collaborative effort involved between ourselves and Ideol’s teams. It is a testament to our ambition to develop our capacity for marine renewable energy in our region and demonstrates our company’s focus on the future.”



Laurent Vatey, account manager for Bessé (Floatgen insurer) “Insuring innovative projects is always a challenge from our side, in terms of advising customers in regards to which policies they should take out, as well as on the market side. Floatgen is therefore a crucial element for driving the implementation and continuity of a new branch of insurance, particularly at the national level, which is dedicated to marine renewable technology more generally and floating wind turbines specifically.”



80% of leading suppliers are French

Over €20 million in orders have been placed with French suppliers

Timeline of this extraordinary project

January 2013	Project launch
2013 – 2015	Design and engineering phase for the float system (the float itself, anchoring system, export cable), development phase for the test site
2015	Partial certification of the design used for the floating base by Lloyds' Register
Summer 2015	Electricity export cable installed on the Centrale Nantes SEM-REV test site
1 June 2016	Official construction launch
Summer 2017	Float construction complete and floated Mounting of the adapter and wind turbine (performed quayside)
Autumn 2017	Official inauguration ceremony. Turbine tests quayside.
Spring / Summer 2018	Turbine towed and deployed on site followed by connection to the power grid
2019 – 2020	Offshore operation of the wind turbine (demonstration period takes place over a minimum period of two years)

The floating base was built across three construction barges joined together and moored at the Charbonniers quay in Saint-Nazaire.

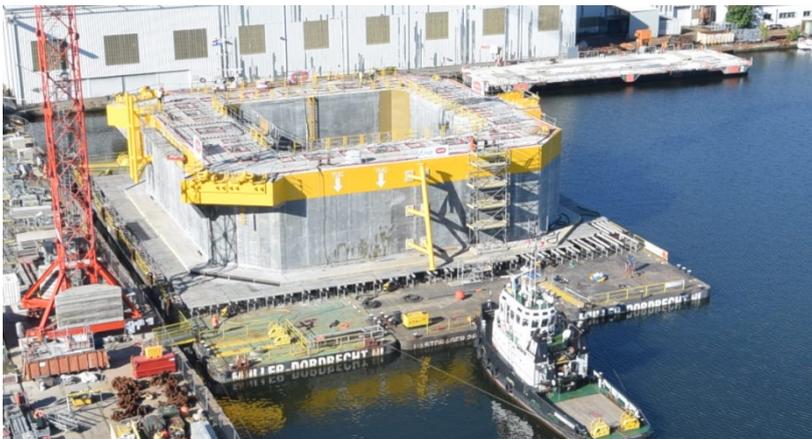


September 2016: construction barges moored

©Devisubox

March 2017: 60% of the float completed

©Devisubox



August 2017: float completed, ready for launch.

©Devisubox



Platform floating successfully

©Devisubox



August 2017: adapter installed along with one section of the tower.

©Centrale Nantes / Above All



A section of the tower

©Centrale Nantes

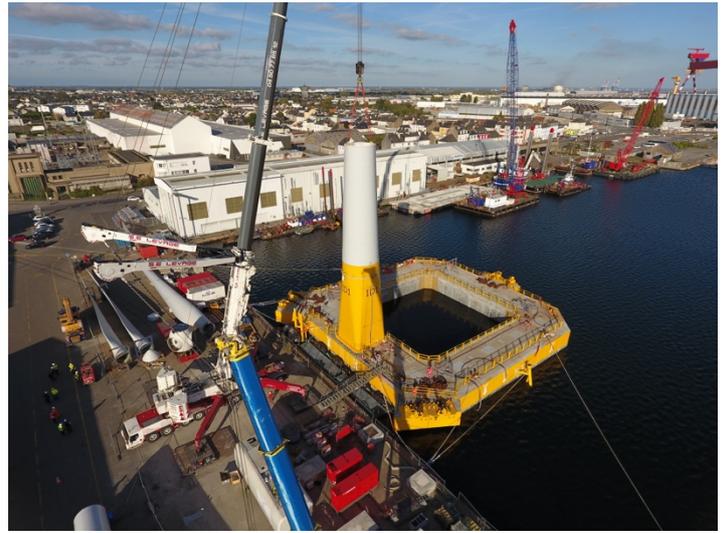


One of the three 40 m-long blades for the rotor.

©Centrale Nantes

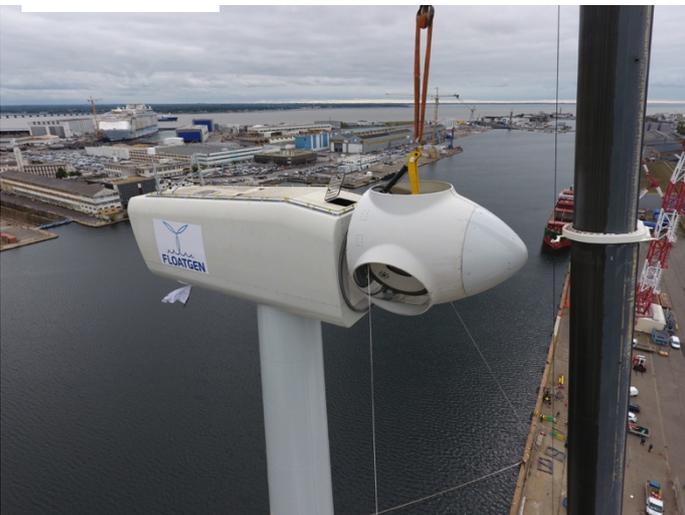
The Vestas V80 2 MW turbine used by Floatgen was delivered to Saint-Nazaire port in June 2016, with some minor modifications made prior to installation.

Quayside installation of the wind turbine



©Centrale Nantes / Above All

©Centrale Nantes / Above All



©Centrale Nantes / Above All

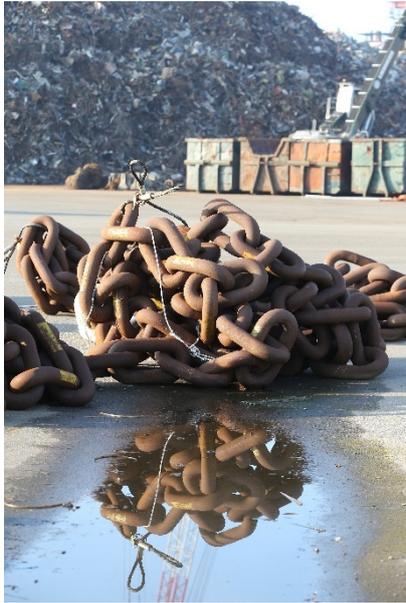
The above timeline demonstrates the core advantages of the technology developed: all of the construction activities were carried out in a sheltered port (not offshore) thereby reducing the associated risks and costs.

The inauguration took place on 13th October 2017 in Saint-Nazaire. In keeping with naval traditions, the Floatgen wind turbine was named on the *Quai des Darses*, only a few metres from where its floating foundation was built. In the presence of Sébastien Lecornu, Secretary of State to the Minister of Ecological and Solidarity Transition, and Catherine Chabaud, the christener of Floatgen, this event brought together no less than 300 international wind energy players from France, but also Japan, Norway and Scotland, to celebrate this first for France and the kick-off of this new floating offshore wind industry. The organizers invited some 400 primary, middle and high school students from the region to discover the wind turbine close-up in the afternoon.



©Ideol

The **anchoring system**, which is made up of chains, nylon anchoring lines, buoys, and anchors, was preinstalled offshore at the SEM-REV site in July 2017.



This specialist ship, chartered by Bourbon, led offshore anchoring system installation activities. ©CentraleNantes/Above All



The base and wind turbine were towed to the installation site on 29th April 2018

The anchor lines, and export cable were connected enabling electricity to be injected into the grid at the end of summer of 2018.



©Centrale Nantes / Above All

Floating turbines: the future of offshore wind power

Offshore wind power is a developing sector which is becoming increasingly competitive. In terms of sheer developmental capacity, the number of projects launched both in France and at the European level speaks for itself. According to Giles Dickson, chief executive for WindEurope, an offshore wind turbine has been installed approximately every day in Europe over the past two years. In total Europe has installed at least 1,558 MW's worth of energy generated by offshore wind turbines in 2016 alone, with a cumulative capacity of 12,631 MW.* Looking to the future, around 26.4 GW's worth of offshore wind farms could be built during the next decade with projects containing a combined generation capacity of 63.5 GW (the equivalent of the whole of the energy generated in France by nuclear plants) in the planning stages. Furthermore, cost reduction has occurred rapidly, far more than initially expected, primarily due to increases in the unit sizes of wind turbines (currently around 8-9 MW per wind turbine) and to the capacity per project (over 1 GW for certain recent projects). The latest tenders launched in Denmark, the Netherlands, and the United Kingdom have been awarded at prices which are close to current market prices. It therefore seems that offshore wind power is a source of energy that perfectly addresses current energy and climate challenges.

Floating wind turbines provide an ocean of possibilities. Wind energy, as the name would imply, is produced by the force of the wind blowing either over land (land-based wind energy) or over the sea (offshore wind energy). Offshore wind turbines can be installed in two different ways: either attached to the sea floor (bottom-fixed) or floating, i.e. floating on the surface of the water whilst being held in place by anchors.



Bottom-fixed wind turbine



Floating wind turbine

Over 3,590 wind turbines had been installed offshore around the world by the end of 2016, resulting in nearly 12.6 GW in generation capacity. These turbines are all bottom-fixed with the exception of six floating units currently in operation: one in Norway, one in Portugal, and four in Japan.

Floatgen is the only floating wind turbine in France today.

Floating wind turbines have a number of advantages: unrestricted by depth, they can be more widely deployed, therefore having less or no visual impact from the coast, and can also endure stronger, more constant winds, thereby increasing their capacity for electricity generation. **Floating wind turbines are the future of offshore wind power.**

* WIND Energy Report- 2016

Floating wind turbines – an opportunity for France to become a world leader. A number of offshore wind power projects are currently in various stages of development: 6 commercial projects for bottom-fixed wind turbines with a generation capacity of 500 MW each (at the Tréport, Fécamp, Courseulles-sur-Mer, Saint-Brieuc, Noirmoutier-en-l'Île/Île d'Yeu and Saint-Nazaire sites) and 4 projects for floating wind turbines with a generation capacity of 25 MW each (for the Groix, Leucate, Gruissan and Fos-sur-Mer sites) have been green-lit with tenders in place by the French government, with deployment set for 2020 and 2021. The French government has also started consultations for the purposes of preparing a tender for commercial floating wind farms. France's potential in this area is significant: it is estimated at 6 GW (the equivalent of 3.6 EPR nuclear power plants) by 2030.

Among the floating wind turbine tenders already awarded, the EOLMED project is of particular note, as the winning consortium is led by Quadran Energies Marine (Quadran Marine Energy) and combines Ideol's floating foundation system with Bouygues Travaux Publics's construction expertise. The purpose of the project is to create the first Mediterranean wind farm, with four units to be deployed off the coast of Gruissan, which has one of the largest wind resources in Europe.

France benefits from the expertise of its companies, leading universities, research centres, and key industry players such as Ideol, the Centrale Nantes, and Bouygues Travaux Publics, and aims to develop a competitive national industrial sector capable of exporting energy and becoming a market leader.

The potential for floating wind turbines is vast and worldwide. Floating turbines are taking off around the world, with projects booming in Asia, the United States, and Europe.

A number of countries are active in this market. Japan is in the lead, and is currently in the process of redefining its energy mix. The Japanese Ministry of the Environment has forecast that by 2030 between 2.7 and 5.6 GW of its energy will be generated by floating wind turbines, and in the mid-2018, it will install a demonstration unit designed by Ideol.

According to a report commissioned by the Scottish government, floating wind turbines account for 80% of wind energy potential in Europe*

Europe, the US, and Asia make up the most advanced and promising markets for this sector. As the President of the European Wind Energy Association, WindEurope, stated during the last FOWT conference on floating wind turbines in Marseille, *"Floating wind turbines will play a major role in meeting the renewable energy objectives set by Member States for 2030."*

* By the Carbon Trust, as cited by WindEurope in its Floating offshore wind vision statement



Project Partners



The French floating solutions leader at the forefront of the global offshore floating wind turbine market

Ideol was founded in June 2010. Until this point the market for offshore wind power had been based around fixed offshore wind power with technology that can only function at relatively low depths. Driven by the conviction that this market would rapidly turn to floating foundations, which are much more suited to the marine environment, Ideol's objective is to develop floating foundations for this market that ensures both technical reliability AND economic sustainability. Using this ambition as a blueprint, Ideol's experienced multi-disciplinary teams came up with a technical solution based on its patented Damping Pool® concept. With its extraordinary hydrodynamic properties, this system ensures Ideol's floating bases are compatible with all wind turbines currently available on the market while remaining compact – even for the most powerful wind turbines – and technically reliable at an optimised cost.

These various features have translated into a period of sustained growth for the La Ciotat-based Company, (with a workforce of 65 located at the head office as well as representatives in Germany for Northern Europe and in Japan for Asia), with work undertaken for demonstration, pre-commercial, and commercial projects around the world. As part of its partnership with Japan's Hitachi Zosen group and because the Japanese government, for whom floating wind is a strategic issue, deemed that the solution offered by Ideol was the only one capable of reducing the cost of floating wind turbines, the construction of a demonstration model fitted with Ideol's solution has been ordered for the Japanese market with installation due in 2018. Ideol's floating base solution has also been selected for the first Mediterranean wind farm (EOLMED, consisting of four units), with partnerships established with other developers (such as Acacia Renewables in Japan) for the provision of a pipeline for commercial projects. These various projects have positioned **Ideol as French ambassador for floating wind turbines at the international level, in addition to its position as market leader for a sector in full bloom.**

- > Founded in La Ciotat in 2010
- > €2.8 M turnover in 2015, €4 M in 2016 (100% export markets)
- > 60 staff, 90% of whom are experienced engineers
- > Internationally renowned patented Damping Pool® technology
- > 2 demonstrators currently deployed (1 in France and 1 in Japan)
- > 1 24 MW pilot farm under development in the Mediterranean





The unrivalled expertise of Centrale Nantes

With over 30 years of research in this field in partnership with the CNRS, as well as leading European platforms in ocean engineering, and several incubated startups growing at an exceptional rate, Centrale Nantes is recognised as one of Europe's leaders for research and innovation in the field of marine renewable energies today.

Training in tune with the economic world, at the heart of innovation

Centrale Nantes is a major school of engineering in France, offering academic pathways based on cutting-edge scientific and technological developments as well as the best management practices. In addition to its recognised excellence in education, Centrale Nantes also enjoys close connections with industry, owing to various research and industrial sector exchanges.

Centrale Nantes places a strong focus on areas such as ocean engineering, navel architecture and construction, the exploitation of clean ocean energy (wind, waves, currents), structural calculations, geotechnology, composite materials, robotics, control systems, numerical simulation, and high performance computing.

Research platforms: natural learning environments to implement new professions in marine renewable energies

The ocean test facilities, which allow model structures to be tested under real-life conditions, are unique in Europe within a university setting. The wave tank is the most coveted research installation for the marine renewable energy sector in Europe, capable of reproducing all the undersea conditions of the various oceans around the world. Fitted with its own wind tunnel, it is capable of simulating storm and wind conditions that sea structures would experience.

SEM-REV, one of Centrale Nantes major test facilities, is fully authorised to test prototypes and is connected to the national grid, meaning energy generated by demonstration units will be used to benefit every French household.

As part of the European Interreg funding program "FORESEA", SEM-REV has already hosted the Acoustics of the Sea project developed by Nereis Environnement (a demonstrator to characterize subsea ambient noise), FMGC with their cast iron shells developed to ballast subsea electrical cables and Floatgen. SEM-REV will soon host the Techno GPS wave energy prototype.

- > Founded in 1919
- > 2 410 students
- > 550 faculty and researchers
- > 60 PhD theses / year
- > Around €15 M in research contracts / year
- > 11 major research platforms





One of the benchmark players in innovative maritime infrastructure construction

Bouygues Travaux Publics is a world leader in land use planning and sustainable infrastructure construction. A subsidiary of Bouygues Construction specializing in civil engineering and civil engineering works, the company has recognized expertise in underground works, river and maritime works, linear projects, industrial civil engineering, earthmoving and open pit mining activities. From Hong Kong to Miami, Bouygues Travaux Publics has worked on many emblematic projects: the Channel Tunnel, the A28 and A41 motorways, the bridges on Ré Island and in Normandy, the Chernobyl sarcophagus, the Cairo and Sydney metros, more than 10 tunnels in Hong Kong. In France and abroad, the company is a recognized expert in the design and execution of complex operations combining business planning, management of major projects and mastering advanced techniques.

River and maritime works are a strategic activity for Bouygues Travaux Publics, with many international references such as the Beirut seafront (Lebanon), the port of Tanger Med 1 and 2 (Morocco) or more recently the Chatou dam (Ile-de-France). The expertise of Bouygues Travaux Publics in this area covers a wide variety of works including: quay, dyke, wharf, port, offshore extension, dam or even works of art. Among its ongoing projects, the company is working on the extension project at the port of Calais (Calais Port 2015) and the Principality of Monaco offshore extension as well as the construction of the viaduct of the New Coastal Road on Réunion Island.

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In 2013, Bouygues Travaux Publics and Ideol joined forces to promote marine renewable energies. This translated into a partnership for the construction of the Floatgen project and the EolMed floating wind farm became the first commercial appointment for the group. This first stage has seen work commence on developing industrial production solutions for floating bases, building on expertise gleaned from serial container construction projects for ports (pictured below is the Tanger Med II Port sea wall in Morocco).

- › Subsidiary of Bouygues Construction
- › Over 5000 Bouygues Travaux Publics employees
- › Bouygues Construction turnover in 2017: €11.7

