

wind

# Big strides for offshore giants

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The potential of offshore wind is driving the development of a new generation of giants. There are open discussions about 20-MW turbines; ten times more powerful than the current standard, and although the limit for wind turbines is currently Enercon's E126 at 7.5 MW, it is likely that larger and more powerful turbines will appear in a few years. It looks like nothing will stop the march of giants across our oceans.



The Danish Risø Institute, one of the most active in wind research, presented earlier this year what it defines as "the first design basis" for a 20-MW machine. According to initial estimates by project manager, Peter Hjulser Jensen, the cost of one of these turbines would be only 15% to 20% higher than the large machines currently in existence. Jensen refers only to a design "on paper", not to increases in manufacturing costs. This design is the result of the so-called UpWind Project, a pan-European initiative launched in 2005 under the baton of Risø, with a European Union grant of €23 million. The main task of

UpWind is to investigate the possibility of building a 20-MW wind turbine with the materials available today.

## Twenty thousand components

The project, which covers all of the approximately 20,000 components that make up a multi-megawatt wind turbine, focuses especially on smart performance, especially on the so-called smart aeroelastic rotor that can respond to numerous wind variables, especially turbulence, in real time through measurement systems distributed across the rotor's width, and to changing wind conditions through blade adjustments. One of the proposals of UpWind is to fit turbine blades with adjustable flaps, similar to those used in aircraft wings. Several models of this innovation have already been tested in wind tunnels.

## Great among the greatest

UpWind is not the only project of its kind in the world. In Spain, the Azimut Project has brought together eleven companies, including Gamesa which coordinates the project, Acciona, Iberdrola and Alstom, and 22 research centres under one project which aims to generate the know-how required to develop a large offshore wind turbine with an estimated capacity of 15 MW. €25 million has been earmarked for the project until 2014. The same players are also involved in another project called Zefir Test Station, which involves the Energy Research Institute of Catalonia (IREC) installing an international offshore wind turbine R&D testing facility in deep waters off Tarragona. The project is split into two phases: the first will be to install a maximum of four machines with a total capacity not exceeding 20 MW anchored to the seabed some 3.5 kilometres from the coast; the second will be to install a maximum of eight floating wind turbines that will add up to 50 MW about 30 kilometres offshore.

## Ten-megawatt turbines

The Norwegian company, Sway Power, and the British company, Clipper Windpower Marine, are also working to develop 10-MW machines. A really ingenious turbine with the same power rating has also been designed by another British company, Wind Power Limited. Together they comprise the largest dreams of giants being sparked by the wind.

And everyone is looking out to sea because they know that, sooner or later, offshore wind will dominate the landscape. Earlier this year, the US consultancy firm, Emerging Energy Research (EER), released the report "Global Offshore Wind Energy Markets and Strategies: 2009-2020". The offshore segment, it noted, received orders totalling 6 GW in 2010, which could reach 43 GW by 2020. Between 2009 and 2013, 76% of this offshore wind capacity will be installed in Europe, forecasts EER.

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## Europe will continue at the helm

Other analysts go even further. BTM Consult ApS predicts that 75 GW of offshore wind capacity can be achieved by 2020 (from the current 3,514 MW, almost all of which is located in the seas of northern Europe). Of these, over 52 GW would be located in Europe and the rest mainly in China (19 GW), followed some way behind by the United States and Canada (2,000 MW between them). The 52 GW of offshore wind capacity forecast in Europe in 2020 would represent almost 23% of the total wind capacity installed in Europe (230 GW), compared to 4% today.

## Semi-submerged

All this has led to even the most cautious of manufacturers, Vestas, saying yes to offshore wind. In February, the Danish multinational signed an agreement with the Portuguese utility, EDP, and other partners to install a prototype floating offshore turbine near Oporto. EDP's involvement in the project is through WindPlus, a consortium led by the utility and involving the American engineering firm, Principle Power, which has developed and patented the floating platform known as WindFloat. Development of this system – based on semi-submerged structures used in the oil and gas industry – is already well underway says Vestas, which will adapt and provide a 2-MW machine for the platform. According to the company, the system "carries the potential to become the first commercial semi-submersible floating platform for wind offshore electricity generation".

## Turbines at previously unfeasible sites

The WindFloat technology consists of a triangular structure floating in a horizontal position. A floating column is located under each vertex of the triangle, providing stability to the structure and anchored to the seabed. The wind turbine tower is installed at one of the three points. Water displacement systems also help to ensure that movement of both the waves and the turbine itself is dampened to maintain stability. According to Vestas, the partners expect the system to "enable offshore wind turbines to be sited in previously inaccessible locations where water depth exceeds 50 metres".

## UK has its mind made up

The UK offshore wind market recently surpassed 1,500 MW thanks to the launch, after several months' delay, of the first phase (183.6 MW) of the Walne offshore wind farm. The array, located nine miles off the coast of Cumbria in northwest England belongs to the Danish company, Dong Energy (50.1%), Scottish & Southern Energy (25.1%), and a group of investors (the remaining 24.8%). The wind farm consists of a total of 51 Siemens Power (Model SWT-3.6-107) wind turbines of 3.6 MW each. The partners expect to complete the second phase in 2012 and estimate that the power output of the two phases will be about 1,300 GWh per annum on average. This wind farm will boast a far higher load factor than can be achieved onshore, with a factor of 43%, which translates as approximately 3,767 hours.

## Cost reductions over the next decade

The figures easily add up without having to look too far ahead. The report, entitled "Offshore Wind: Forecasts of future costs and benefits", commissioned by the British wind energy association, RenewablesUK, and written by the consulting firm, BVG Associates, maintains that over the next ten years, the cost of the energy of British offshore wind farms will fall by 15% in a scenario similar to the current situation. Under even more favourable market conditions, reductions of up to 33% are deemed possible. According to Maria McCaffery of RenewablesUK, "we know the costs of offshore wind are too high... we can reduce costs by as much as a third over the next decade".

## Machines topping fifteen megawatts

In early summer, work also began on a power train test site for wind turbines of up to 15 MW in the British county of Northumberland. The funds for the project, amounting to €28 million, received approval from the Energy Technologies Institute (ETI), a consortium of private energy companies and public agencies. The centre is located in the town of Blyth and is housed on the premises of Narec: an organisation created to accelerate the widespread integration of renewable energy in electricity grids. The launch of the test facility is scheduled for June 2013. It is one of the largest investments made by the ETI, whose Chief Executive, David Clarke, said it represents "a major step in establishing the UK as a leader in the wind turbine industry".

## Spain off the pace?

Despite the R&D projects underway, Spanish companies believe that Spain (which led the field in the roll-out on onshore wind capacity in Europe alongside Germany) may miss the boat as far as offshore wind is concerned. In July, Navantia and Acciona announced the signing of a cooperation agreement "aiming to contribute to the launching of an offshore wind industry". At the same time, they stressed the need for "efficient regulatory procedures in Spain that will enable the growth of offshore wind energy and support the continuity of the technological achievements of this country in the development of onshore wind power generation". Spain's Ministry of Industry has postponed the installation of the first commercial offshore wind farms in Spain until 2014, and has reduced the target from 3,000 MW in its Renewable Energy Action Plan (Paner) to 750 MW in the draft of the new Renewable Energy Plan.

## Weather stations, floating structures and installation vessels...

The agreement commits both companies to jointly implement "technological or offshore business development

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projects including the development of fixed and floating foundations for the installation of wind turbines". These also include the development of "vessels and platforms for installing foundations and/or wind turbines, as well as for maintaining and disassembling facilities". As a naval and marine technologist, Navantia is carrying out key R&D work "in projects that are already underway for the design of weather stations, floating structures and ships for the installation and support of offshore wind farms in deep water". Acciona has a total budget for offshore wind of close to €100 million, mainly earmarked for "the design of structures conceived for great depths, ideal for countries such as Spain, which has a very narrow continental shelf". Part of this effort is focused on the aforementioned Zéfir Project.

### Looking ahead to 2014

Another Spanish technologist, Gamesa, used the RenewablesUK Offshore Wind 2011 trade fair and conference in Liverpool in late June to give some clues as to the progress of its 5-MW G128 offshore wind turbine, which has a rotor diameter of 128 metres, a modular design and "is equipped with the proven and tested G10X-4.5 MW technology". The new machine will "minimise down time, reduce maintenance work and achieve competitive energy costs and optimal returns throughout the lives of wind farms," says the company. The first prototypes "will be ready by the end of 2012," David Guíu, Head of European Sales of the Offshore Division, told *Renewable Energy Magazine*. The company plans to install the first pre-series in 2013 and begin commercial production in 2014.

### Shipping partners

Gamesa has also secured very important shipping partners, such as the Northrop Group (USA) which has joined its offshore wind activity. According to Javier Perea, Offshore Managing Director of Gamesa: "We have used the established and tested technology built into our most ambitious onshore platform to date, the G10X-4.5 MW, in the G11X-5.0 MW platform. In so doing, we have realised that we are well along the learning curve". Meanwhile, Gamesa is already working on the development of another family of offshore turbines, with capacities of 6-7 MW, and affirms that "pre-series runs are slated for 2014, in time to meet the anticipated growth in demand medium and long term by coming to market with the next generation of higher-capacity offshore turbines".

### Formerly Ecotècnia

Alstom, the wind division of which was established through the merger with the Spanish firm, Ecotècnia, is also dipping its feet in the sea. It has already announced that its first 6-MW prototype offshore wind turbine with a 150-metre rotor (comprising 73.5-metre LM blades) will be a reality before year end. Alstom defines its machine as "the world's largest direct drive permanent magnet generator for offshore wind power", which it plans to market starting in 2014.

### The second renewables revolution

Elsewhere, Iberdrola, a global wind energy leader, signed "the biggest ever agreement for the purchase of wind turbines for a wind farm signed by the company" three months ago – notably for an offshore wind farm. Siemens will supply 108 of its 3.6-MW wind turbines for the West of Duddon Sands wind farm in southeast England, owned by a joint venture involving ScottishPower Renewables (a subsidiary of Iberdrola) and Dong Energy. It is planned that the wind farm will enter operation in 2014 and the value of the contract is worth around €700 million. West of Duddon Sands, located nine miles from the coast, has a capacity of 389 MW, enough to meet the electricity consumption of 300,000 British households, making it one of the largest offshore wind farms in the world when it is commissioned.

### What does the future hold?

Iberdrola reports that the commissioning of West of Duddon Sands "marks the start of one of the most important technological missions in the company's history: to take the lead in the future development of this technology, which is considered a second renewable-energy revolution". To achieve this goal, the company has created an Offshore Wind Division, based in Scotland, from which the Spanish company plans to oversee the gradual implementation of the offshore wind facilities in its project portfolio, which already amounts to more than 10,000 MW around the world.

Among them, is the East Anglia Array, to be developed jointly with the Swedish company, Vattenfall. Last year, this (7,200-MW) project received approval from the National Grid, the operator of the British electric power network, to connect to the mainland power grid, making it the most important authorisation for grid connection ever received by the Iberdrola Group in its history. Other developments in Germany, Spain and the United Kingdom amount to an additional 2,500 MW between them. They include Wikinger, a wind farm located in German waters of the Baltic Sea, with a capacity of 400 MW, and the Argyll Array, in Scotland, whose offshore facility has a potential capacity of between 500 MW and 1,800 MW.

[Translation by Toby Price of an original article in Spanish in the [print version](#) of *Energías Renovables*, *Renewable Energy Magazine*'s sister publication, which is published monthly and read by over 7,000 subscribers.]

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