FLOATING WIND POWER: THE NEXT WAVE?

by Steve Sawyer, Secretary-General, Global Wind Energy Council

The development of floating technologies is offering a solution to some of the environmental and logistical problems associated with offshore wind turbine construction. With some pilot projects now scaling up, do they offer a feasible alternative?

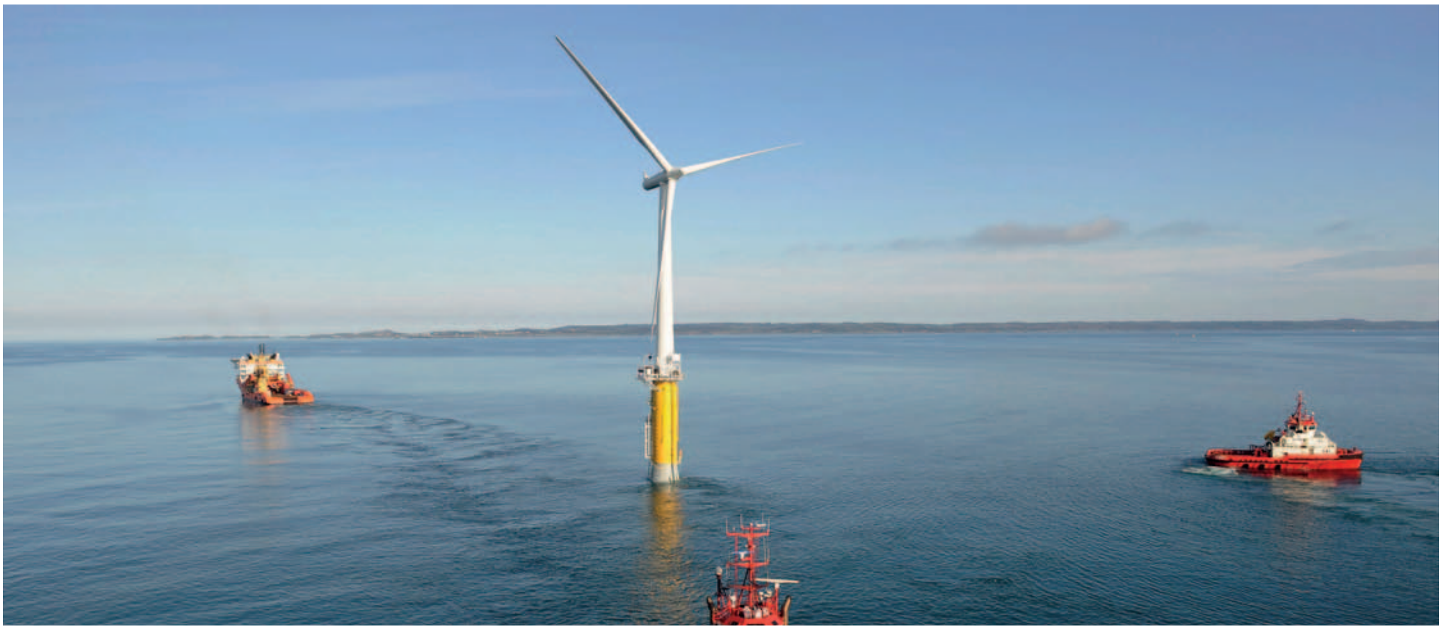
100kW floating offshore wind turbine in Kabashima, Nagasaki Prefecture, Japan. Photo © MoE

OFFSHORE WIND energy, pioneered in Denmark more than 20 years ago, is just now beginning to come into its stride. While industry, governments and regulators have struggled to adapt to moving the increasingly successful and competitive onshore wind business offshore, build-out schedules have experienced significant delay. But it now seems that, at least in the northern European seas, despite continuing challenges, we are in the process of scale-up, and the synergies and savings are in the process of being realised.

At the same time, over the past five years a new wrinkle has emerged in the form of floating technologies, which could potentially alleviate two of the major challenges associated with offshore wind: logistical and environmental difficulties associated with siting; and the challenge of building a robust 'permanent' bottom-mounted structure in a hostile marine environment in ever-increasing water depths; all of this in pursuit of the stronger, more stable and less turbulent wind resource offshore.

In addition, after watching the difficulties of trying to find a weather window when turbines can actually be placed on foundations in the seabed, not to mention the relatively short season for foundation construction in the hostile marine environment in northern Europe, there is a very real attraction to the notion of being able to fully assemble the structure in a sheltered port and tow it out to its location. The corollary, of course, is that if you have a major malfunction, you can unhook the machine and tow it into port for dockside repairs.

> "The biggest question for me was always what would happen to the structural, electrical and hydraulic systems of the turbine waving around atop a moving platform at sea."



Statoil's successful Hywind floating offshore platform is towed into position. Photo: Øyvind Hagen © Statoil

The other advantage, of course, is that not even the Kennedys could complain about a turbine located in deep water well out of sight of land.

SUCCESSFUL PILOTS

The first floating offshore pilot project was installed off the coast of Sicily in the summer of 2008 by the Dutch Blue H Group Technologies, deploying a small (80kW) two-bladed turbine atop an innovative semi-submersible platform. It was to be followed up with a 2MW prototype platform last year, but that has yet to appear.

The first real full-scale test of the idea was, of course, Statoil's initial Hywind project, installed in 200 metres of water off the south-western coast of Norway. A submerged 100-metre 'spar buoy', eight metres in diameter, supports a six-metre-diameter foundation, held in place by three anchors. Atop of this sits a fairly standard Siemens 2.3MW turbine, set up for offshore operation. Commissioned in September 2009, the project was a complete success, generating power at around a 40% capacity factor, and surviving storms with waves up to 11 metres high.

The biggest question for me was always what would happen to the structural, electrical and hydraulic systems of the turbine waving around atop a moving platform at sea. The answer is, apparently, not much. We forget that even land-based towers do move in the wind, and that a spar buoy going down 100 metres does, in fact, actually provide a very stable platform … it moves, yes, but slowly and not very much.

> "These types of platform could justify the build-out of the 10, 12, 15 and even 20MW machines which at this stage remain on the drawing board."

TRIALS WORLDWIDE

The other full-scale test was deployed 5km off the coast of Portugal in June of 2012 by a consortium including EDP, Repsol, Principle Power, ASM, InovCapital and Vestas, with the latter supplying the 2MW V-80 machine which sits atop the semi-submersible WindFloat platform. The three-legged platform is moored with four lines, two attached to the leg which supports the turbine, and has various features designed to dampen motion from waves.

Also last summer, the first floating offshore platform was installed off Goto Island near Nagasaki in southern Japan: a 100kW Fuji machine atop a spar buoy. There are ambitious plans to roll out the testing of a variety of floating systems and configurations over the next few years in Japan, with a 2MW Hitachi machine atop a spar buoy to be added in the summer of 2013, also near Goto Island. At the same time, off the east coast (near the site of the Fukushima nuclear disaster), another Hitachi 2MW machine on a spar-type platform will be put in the water this summer, to be followed in 2014 by a test of the new Mitsubishi 7MW machine on a semi-submersible platform. The plan is that another Mitsubishi 7MW machine, this time on an 'advanced' spar buoy-type system, will be deployed in the same area in 2015.

Finally, at the end of May, the first US floating turbine was lowered into the waters of the Penobscot River in Maine, which will be towed out to sea, anchored in water just over 30 metres deep and hooked up to the grid. The eighth-scale model machine will be tested and, if successful, scaled-up to 6MW and deployed in deeper waters further offshore, perhaps as early as 2017.

A number of companies and governments are very excited about the possibility of large-scale deployment of floating offshore wind turbines, and they do have many attractive features. In addition to those mentioned above, these types of platform could justify the build-out of the 10, 12, 15 and even 20MW machines which at this stage remain on the drawing board.

ECONOMICS OF SCALE

However, the costs for the initial projects are very high, and as with any new technology configuration, years of testing will be required to understand how reliable and economical the technology can be. And then the challenge will be the same as for the current round of offshore deployment, that is to say how to get the scale-up required to make the economics work.

Photo: Principle Power

WindPlus has been awarded European Commission project funding to build the 27MW NER300 'pre-commercial' second phase of its Aguçadoura floating offshore wind farm off north-west Portugal, consisting of five WindFloat platforms developed by Principle Power. The final build-out phase is planned to have a capacity of 150MW. The current 2MW WindFloat prototype is the first offshore wind turbine to be installed without the use of heavy lift equipment.