

The allure of deepwater wind power

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European experience with offshore wind farms in relatively shallow coastal waters is a maturing technology. With a dozen operational windfarms built over the last 12 years in waters up to 60 feet deep and with 20 or more in the construction and permitting stage their economic, environmental and safety issues have been largely addressed. These shallow water windfarms make use of well developed simple monopole foundations driven deep into the seabed or, so called "gravity bases," concrete structures much like a flat bottom Christmas tree stand that are floated in place, submersed and filled with rock.

Certainly far offshore winds in deep water are more plentiful and stronger than those nearer the coast. And the lure of such development is understandable from the potential of enormous wind energy production. However technical viability and economic practicality lay somewhere in the future. The question is how far in the future? And what must be done to get there? And must we wait?

Future deepwater windfarms in over 60 feet of water or so will require much more expensive multi-leg structures or floating platforms for depths up to several hundred feet. This technology is being explored by energy companies with experience in offshore oil and gas platforms. Currently such construction is possible but its economic viability and operational performance is far from reality.

For example, the first deepwater demonstration project now in the permitting stage is undertaken by Talisman Energy, an oil and gas producer in the North Sea. It will consist of two newly designed five-megawatt (MW) wind turbines 14 miles off the Scottish coast in 150 feet of water. Perched on top of four-legged undersea lattice-type foundation structures, the two wind turbines will provide power to nearby oil and gas platforms in their Beatrice complex. The total cost of this project is \$58 million provided by Talisman, Scottish and Southern Energy (UK), and three government agencies. This cost does not include the expensive high-voltage undersea cables that would be required to bring wind power ashore. Talisman will collect performance data, look for ways to reduce costs and develop operating procedures over five years to examine the feasibility and benefits of creating a future commercial deepwater wind farm at this site.

Compared to conventional shallow water offshore windfarms that cost about \$2 million per MW installed, the fixed-pile foundation Talisman project at \$5.8 million per MW is almost three times as expensive and prohibitively uneconomical in the near term.

In a cautious statement Talisman Energy has said "current forecasts for electricity prices will never render this Demonstrator Project economic. It is an R&D project, not a commercial one, and as such requires public sector funding in order to proceed." Furthermore, they say it is impossible, at this stage to give any definitive answer regarding the go ahead for the commercialization of this project, "but it certainly should not be regarded as inevitable."

For even deeper water installations from 600 to 2,000 feet, anchored floating platforms are envisioned. The first experiment with this type of foundation is under development at Hydro Oil & Energy in Norway. In this project a single 3MW wind turbine will be mounted to an undersea floating concrete foundation that's anchored to the sea floor 400 feet below the surface of the ocean. The hub of the turbine monopole will be 260 feet above the surface of the sea. For the concept to work, it is crucial that the wind turbines be light, requiring further technological development.

This floating wind turbine demonstration project will require about \$23 million to complete. The comparative unit cost is about \$7.7 million per MW installed. Hydro's future goal for large offshore floating windfarms is far in the future, "but if we're to succeed in 10 to 15 years, we have to start the work today," said Alexandra Bech Gjørsv, Hydro's director of new energy forms.

General Electric, in addition to manufacturing the 3.6 MW turbines slated for the Cape Wind project, has embarked on a multi-year research effort to design a 7 MW far offshore unit. The U.S. Department of Energy has signed a \$27 million contract with GE for this development. The advanced wind system concepts will include innovative foundations, construction techniques, rotor designs and electrical components designed for use in the ocean's harsh environment.

So the question remains. How far in the future will these research and development projects become realistically competitive with shallow water projects? History is replete with promising technologies that have taken decades to commercialize. For example the evolution of the transistor to large-scale integrated circuits of today has taken 50 years. Photovoltaic cells have existed since the early 1900s and have yet to evolve into competitive large-scale energy sources.

It is simply conjecture to answer the question of "how long?" for deep water wind. "The biggest challenge for deepwater wind turbines will be to merge the mature but expensive technologies borne of the oil and gas industry with the experience and low-cost economic drivers fueling the shallow water offshore wind energy industry," said Walt Musial of the National Renewable Energy Laboratory. He speculated that "commercial deepwater technology is 10-15 years away." And Greg Watson, Vice President of the Massachusetts Technology Collaborative, adds: "A number of issues need to be addressed before economically viable electricity-generating wind facilities can be erected in the deep waters off the US. Our experts are confident they can be addressed, but not overnight, and not without the benefit of experience gained from shallow water projects."

All evidence makes it clear that we cannot afford to wait to avoid catastrophic consequences. How much time do we have? The mounting crisis of energy prices, national security and global warming can be eased in part with the development of shallow water wind farms. Let's embrace the Cape Wind project, the flagship of our country's first offshore windfarm. Let's get started now and make it work.

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