

Japan, South Korea, and Taiwan Moving into Offshore Wind

Japan's recent Fukushima disaster and growing public energy requirements in many Asian nations is pushing the region to make a leap into offshore wind development. Three nations – Japan, Taiwan, and South Korea – are making pretty quick headway as they adapt and develop technology for their unique offshore wind conditions.

Offshore Wind Development: Japan

Perhaps the Asian nation seeing the most exciting growth in offshore wind right now is Japan. The country has most or all of their nuclear power plants switched off at present in order to undergo safety checks against new regulatory guidelines following the Fukushima disaster. As such, the country is highly motivated to find other sources of energy to replace those that have been lost. Offshore wind power has been making big waves as a result.ⁱ

One of the major challenges facing the island nation as far as offshore wind development is concerned is the fact that their coastal waters are extremely deep. In normal conditions, waters deeper than 50 meters are a problem for offshore wind installations, but Japan's waters are between 50 m to 200 m deep. As such, the country is developing several innovations to overcome this challenge.ⁱⁱ

In fact, the most intriguing development on the international stage is the launch of the country's first floating wind turbine. Set to sea about 20 km off the coast of the failed Fukushima Daiichi nuclear plant, the floating wind turbine is the first in what is set to be the country's largest offshore wind farm.ⁱⁱⁱ

The foundation for the Fukushima installation is semi-submersible platform with three buoyancy tanks (in a triangle around the platform) and four columns which are tethered to the sea floor with huge steel chains. The offshore substation serving the turbine will be installed on a floating advanced spar foundation which has a price tag of 10-20 million JPY. This substation is the world's first 66 kV floating substation, making use of riser cable of about 830 m and submarine cable of about 23,500 m.^{iv} Though the experimental floating turbine was just switched on at the

beginning of November 2013, before being plugged in it had already weathered several typhoons, a small tsunami, and an earthquake in October 2013.

To date, the government of Japan has invested US \$226 million in this prototype turbine and two additional 7 MW turbines that are to be installed soon. The hope is that, after full testing, the project will expand to include 140 of these floating wind turbines for a total capacity of 1 GW of power by 2020, with investments from Hitachi, Marubeni, Mitsubishi, and others.^v

Other floating wind turbine developments are also underway in Japan, with a 2 MW installation that was launched in Kabashima Island on October 28, 2013. This floating wind turbine is built with a spar design that's essentially a tall, thin buoy with less mass extending deep below the surface. This design is said to offer more stability against the ocean's battering waves, but requires deeper waters for good operation.^{vi}

If Japan can successfully tap into their amazing offshore wind resources, it is estimated that they could provide five times more electricity than the current capacity of all of their power companies – equivalent to 1,570 GW of power.^{vii}

Offshore Wind Development: Taiwan

As an island country that currently imports most of its energy, Taiwan is ripe for new sources of power, and offshore wind has recently been gaining ground in the Asian nation. Though nuclear power had previously been explored as a means of meeting the energy deficit, in light of the recent Fukushima disaster, public opinion favors other options. Given that the country's offshore wind generating capacity has been estimated at 6 GW to 10 GW in the Taiwan Strait alone, wind developers have a lot to be hopeful for.



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In order to speed the development of offshore wind in the country, the Taiwanese government has developed some mandates: 600 MW of offshore wind by 2020, and

3,000 MW of offshore wind by 2025 – a total that has been pegged at US \$16.7 billion in investment opportunities by 2025. The government is providing a 20-year off-taking PPA mechanism as well as feed-in tariffs to encourage offshore wind development.^{viii}

What's more, the government is offering The Incentive Program of Offshore Wind Power Demonstration System grant program for two turbine demonstration projects through which two winners have been selected. They will be given interest free financing for up to US \$5,300/kW as well as US \$8 million in subsidies.^{ix}

This grant program will be the impetus for the installation of two offshore wind farms by 2015. In fact, the Ministry of Economic Affairs (MOEA) of Taiwan recently signed a contract with two companies to get the projects completed.^x This first phase in the country's expansion into offshore wind will involve the installation of either monopole or jacket foundations.^{xi} At this stage, the energy will be transmitted to shore using HVAC with a nominal voltage of 33 kV.^{xii}

Offshore Wind Development: South Korea

The pace of total wind power expansion in South Korea has been rapid, with the country increasing its capacity from 16 MW of wind energy in 2002 to 483 MW in 2012, a massive expansion in only 10 years' time.^{xiii} With relatively low opposition from local residents and a region that receives better than average wind speeds – a recent Kuick Research report found that South Korea holds one of the world's highest wind resource potentials with 243 TWh of offshore wind reserves alone - there's plenty of opportunity for growth in the offshore wind sector.^{xiv}

Currently South Korea has about 15 offshore wind farms in development, several with multiple stages involved. The country's first offshore wind turbine (a demonstration project) was built near Jejudo Island and is capable of generating enough power for 700 households. Paid for by the state-run Korea Institute of Energy Research at a price tag of US \$7.4 million, it is built with a grounded jacket foundation and power sent to land via a 2 km submarine cable.^{xv} The project involved the building of the world's first beta type fixed steel jacket as the structure by KIER as a low-cost option. Authorities tout it as more budget-friendly and easier to install with cheaper support vessels required.^{xvi}

In more recent developments, it was announced that South Korea would be home to a new offshore wind farm – their largest yet – off the coast of Ulsan (though this is pending approval from Ulsan Metropolitan City). Scheduled to commence in 2015, the farm would take two years to build and would generate 196 MW of energy from 28 wind turbines of 7 MW capacity each. Worth US \$726 million,^{xvii} the project will take place in the Sea of Japan, though details such as substation and foundation design have yet to be determined.^{xviii}

With offshore wind becoming more popular in South Korea, the government could encourage the building of 2.5 GW of capacity by 2019 in South Korean waters, with several including Jeju Island and Yellow Sea coast slated for priority development.^{xix} According to Kyung Nam-ho, the head of the country’s Korea Institute of Energy Research (KIER), if they can use this technology to build a 10 GW offshore wind turbine, they would be able to provide 5 percent of all the nation’s electricity.^{xx}

Fledgling Offshore Wind Sectors A Long Way from Maturity



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Despite these exciting developments in Asian offshore wind, there are some controversies slowing down wind power development in the region. For instance, in South Korea, the Ministry of Environment refuses to provide the green light for commencing the construction of onshore wind projects, and as a result 14 proposed construction sites have been stalled. This is having an impact on offshore wind projects as well.

Nevertheless, many within government are pushing for these conflicts to be resolved. The Chairman of Korea Wind Energy Industry Association (KWEIA) recently commented, “Though the domestic wind power industry was created over a decade ago, it is still in its infancy and there have been difficulties faced in moving forward with onshore wind farm projects. The UK has been at the forefront of the industry because the UK has become the world’s first nation to raise the facility capacity of offshore wind power development to 3GW, and aims to increase the

capacity to 40GW by 2020. If the South Korean shipbuilding industry builds the world's largest wind turbines by tapping its excellent technologies, despite being a latecomer to the wind power industry, South Korea can spearhead developing global wind power development to new heights.”^{xxi}

It will be interesting to watch as these Asian nations find their way toward offshore wind independence.

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