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NZ's renewables a global manufacturing advantage

Felicity Wolfe - Fri, 22 May 2015

New Zealand's clean electricity could be exploited in high-tech, energy intensive processes such as carbon-fibre manufacturing, US renewables proponents say.

California wind turbine developer Jim Dehlsen is developing a 500-kilowatt marine current turbine. He plans to use an Auckland manufacturer to make the carbon-fibre blades for the machines, which may be in the water by the end of next year.

"I have the aim of trying to make one of the key parts of these marine current turbines a product of New Zealand."

Dehlsen has been working on the turbine since 2011. His idea is to take advantage of steady currents such as the Gulf Stream off Florida's south-east coast which has a 1.6 metre per second flow. Other potential markets include Brazil and Mexico. Japanese firms have also expressed interest in using the turbines in the Kuroshio Current off Japan's coast.

He says the design is now entering the commercialisation phase and he plans to have 500 MW of the turbines installed by 2020. This would require between 1,500 and 2,000 blades, priced at about \$250,000 per unit.

"It sounds like a tall order, but we have done things similar to this in wind power."



[1]

Dehlsen's spar-buoy system utilises his 35-year experience in wind turbine design and manufacture. He is recognised as one of the original proponents of wind energy in California, beginning with Zond which he started in 1980. The firm was bought by Enron in 2000 and the assets were later taken over by General Electric to form GE Wind Energy.

Speaking at a Callaghan Innovation hosted energy workshop in Wellington recently, Dehlsen noted GE has now produced about 25,000 turbines based on his original concepts.

"It has been a very successful design."

Following the sale of Zond, Dehlsen turned to marine energy. But he soon realised that the "extremely low RPM and extremely high torque" gearbox he was developing for an under-water environment would also enable larger, higher-powered wind turbines.

He formed Clipper Windpower around his "distributed gearbox". The design was used to develop the 2.5 MW Liberty wind turbine with the US Department of Energy. He sold Clipper in 2010 to a division of Pratt and Whitney and returned to marine energy.



[2]

Composite expertise

The underwater blades of the marine turbine currently being developed will have "a lot of carbon-fibre" in their structure to help them withstand the very high marine loading. At the workshop Dehlsen noted that carbon-fibre

processes require a lot of energy and could be a way of utilising New Zealand's 80 per cent renewable generation.

Dehlsen, who now lives part-time in New Zealand, says another reason for manufacturing the blades here is the country's expertise in marine design using composite materials - thanks, in part, to the America's Cup campaigns.

He has been working with specialist marine design and manufacturing firms in Auckland and Warkworth to finalise a blade design for his latest Aquantis AQ 500 marine turbine.

The two-blade turbine design is his third, and will be the easiest to commercialise, he says.

Dehlsen says marine currents provide a solution to the problem of generating consistent renewable energy on a large scale.

The AQ500's capacity factor in the Gulf Stream would be at least 70 per cent, possibly higher – especially in summer when the current has a slight peak.

But Dehlsen notes that any activity in the electricity sector is driven by the cost of energy.

"It's not that you have to deploy with that competitive cost of energy, but you better have a pretty clear path of how you're going to get there as you spiral down to advanced levels of the design."

Dehlsen believes his design will deliver electricity for USD \$110 per megawatt hour which is not competitive with gas, but is favourable to some other renewables.

The Liberty turbine experience showed that increasing unit size delivers better economies of scale. But he also believes the current "relaxed" global response to climate warming will not last. He expects this will become a primary driver for financial markets and government policies which will then make marine energy more attractive.

"I believe there is going to be a 'Berlin Wall moment' that we are going to see in climate change and I think we are getting close to it."

Electricity challenge

Fellow Californian Bob Beth also wants New Zealand to find "new opportunities" exploit its high percentage of renewable electricity.

Also speaking at the Callaghan workshop, Beth said 'Kiwi ingenuity' should be exploited to create renewable energy opportunities for New Zealand companies.

"You've got amazing ingenuity here – you don't know how good you are," he told participants. "Your mission, should you choose to accept, is to identify massive new demand for electricity."

Beth says New Zealand has many opportunities to "innovate and lead" clean energy developments.



[3]

He says in "today's connected world" New Zealand can avoid others' mistakes while "taking leaps, building on the successes that have proven out around the world".

The transport sector could make use of the country's renewable electricity - whether directly in battery storage or as electrolysed hydrogen.

He says there is also an opportunity to set up a carbon-fibre industry here, highlighted the rising demand for "green" materials and the growing use of carbon composites in aviation, automotive and wind turbine production.

Composite materials require a "huge energy input" to make, and "are the future of all manufacturing", Beth says.

"It is so worth the investment - so worth the risk."

Disrupt or die

Beth is a special advisor to the "[Clean Energy](#) [[4](#)][Moonshot](#) [[4](#)]", a programme which aims to make all California's energy renewable by 2025. The idea, led by the World Business Academy non-profit think tank, is inspired by John F Kennedy's 1961 resolution to have people on the moon by the close of that decade.

He says that was achieved and the clean energy goal can be too – as long as people move beyond "business as usual" complacency.

Instead, firms need to embrace innovation, Beth says. He points out that Steve Jobs constantly challenged the computer industry and says a similar character will revolutionise the energy sector.

“Elon Musk is the next serial disruptor and he is in your industry.”

The lesson from the post-Jobs computer industry is that firms that do not innovate and constantly disrupt themselves “will die”.

“Harsh? Yes it is, but that is the reality of today that we have lived with in Silicon Valley for decades.”

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