

## Making waves: Australia's Carnegie seeks Chinese partners to commercialise wave energy

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China has managed to significantly cut the power generation cost of wind turbines and solar panels over the past five years. Now a company from Australia is betting China can do it again for one of the world's last untapped renewable energy sources – ocean wave power.

Michael Ottaviano, chief executive of Fremantle, Western Australia-based Carnegie Wave Energy, said his firm is seeking potential manufacturing partners in China to help it reach a goal of slashing the cost of producing electricity from waves by 80 per cent to A\$0.1 per kilo-watt-hour, the level needed to mass commercialise the untapped energy.

“Everybody [in China] that we have been in touch with is interested in our project since they can see the potential of wave energy,” he told the *South China Morning Post*. “Some have been involved in the wind or solar equipment industry and understand the market potential.

“The question for us is finding out who could truly deliver quality products at a good price.”

Ottaviano said Carnegie chairman Jeffrey Harding and a few senior staff have recently paid visits to potential partners in China to inspect their production facilities.

The company prefers to work with Chinese firms that have already been supplying the international market, and it hopes to announce a manufacturing partner by the end of March, he added.

Carnegie Wave Energy has a lofty goal of building projects with a combined power of 1,000MW in the next five to 10 years, equivalent to the capacity of a large modern coal-fired or nuclear power generator that can supply some 831,000 Chinese households for a year.



China has been able to significantly reduce the power generation cost of solar panels over the past five years. Photo: AP

Wave energy is derived from wind, which transfers its energy to the water when it blows across the sea surface.

It is different from tidal power, which harnesses energy from the movement of water caused by the gravitational forces exerted by the moon and sun and the rotation of the earth.

Both wave and tidal power are more stable and predictable than wind and solar power and require less land resources.

“In Australia, most of us live near the beach, growing up knowing the power of the waves,” Ottaviano said. “The ocean’s abundance of power is intuitive to us ... wave energy is the last remaining untapped renewable energy resource.”

Areas of the world with abundant wave power resources include the western coasts of Scotland, northern Canada, southern Africa, Australia, and the northwestern coast of the United States, particularly Alaska, according to Washington-based Bureau of Ocean Energy Management.

The US-based non-profit Electric Power Research Institute has estimated the US outer continental shelf’s recoverable wave energy resource to be 1,170 terawatt-hours, equal to almost a third of the country’s annual electricity demand.

This excludes resources in areas with frequent shipping, fishing and naval operations, as well as environmentally sensitive areas.

In Britain, the government said wave and tidal stream energy has the potential to meet up to a fifth of the nation’s current electricity demand, representing 30,000 to 50,000MW of installed capacity.

Of this, between 200 and 300MW may be able to be deployed by 2020.

Ottaviano said the biggest technological challenge is to be able to build a system robust enough to operate in all sea conditions, including stormy weather that causes destructive waves.

Wave energy systems can be installed in nearshore, offshore and far offshore locations.

According to Florida-based education and advocacy group Ocean Energy Council, there are three main types of infrastructure that convert wave energy into electricity.

The “buoy system” uses the rise and fall of ocean swells to drive hydraulic pumps, whose movement induces an electrical generator to produce power that is transmitted ashore via underwater cables.

A second type are oscillating water column devices, in which the in-and-out motion of waves enter a column and force air to turn a turbine.

A third kind uses a shore-mounted structure to channel the waves and drive them into an elevated reservoir. The water flow that passes through the reservoir generates electricity in the same fashion as in hydro power plants.



Wave energy is derived from wind, which transfers its energy to the water when it blows across the sea surface. Photo: AFP

Carnegie’s product is a buoy system, which includes a circular tank-link steel structure that measures 11 metres in diameter and is five metres tall.

Ottaviano said the firm is the only company to have operated a grid-connected wave energy project over four seasons, having 14,000 accumulated operating hours – a world record.

Its product is also the only fully submerged wave energy production system that can be remotely controlled so that it sits anywhere from one to three metres below the ocean surface.

“By having it around a metre below the sea surface, we give up on harnessing the highest level of energy in the ocean, but our equipment is also safe from storms ... when a massive storm comes, we can pull it to three metres below the surface.”

The firm has over 100 patents, of which around 35 have been awarded and some 65 are pending, Ottaviano said.

The Australia-listed firm has so far raised A\$130 million to fund its research and development work, of which A\$70 million is from share sales and the remainder from the governments of Australia and Britain where it has pilot projects.

Besides patents, Ottaviano said his firm protects its intellectual property by “constantly” developing better products and staying ahead of rivals, and by co-investing with international utilities partners that have “bigger balance sheets” to share the task of protecting the intellectual property.

In October Britain’s *The Guardian* newspaper reported that a Chinese firm had come up with a wave power generation product “remarkably similar” to the one developed by Scottish firm Pelamis Wave Power.

The Chinese product emerged a few years after laptop computers were stolen from the Scottish firm in 2011, which had been visited by a Chinese delegation led by then vice premier Li Keqiang two months before the theft.

China’s *Global Times* subsequently quoted state-owned China Shipbuilding Industry Corporation as saying that speculation the Chinese product was based on stolen information from the laptops was “groundless,” adding that it was the result of many years of independent research.

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