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# New generation wave energy: could it provide one third of Australia's electricity?

A company called Carnegie Wave Energy is pushing the boundaries of wave-energy technology, and Australian island and coastal communities could be the first to take advantage of it

What is Guardian Sustainable Business?

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Alan Burns had an "epiphany" about the potential of ocean energy after being pummelled by the surf off Rottnest Island, near Perth. Two decades later and Burns' company, Carnegie Wave Energy, appears to be finally on the verge of delivering on his dream.

Wave energy - at least in theory - has the potential to provide one third of Australia's electricity needs. The challenge has been to design a wave energy system that can resist the brutal power of the ocean, and to find a niche in the market in the face of plunging costs of solar energy and other renewables.

Carnegie believes it may have found the answer. For the last six mon
installation (the CETO 5) - just a few kilometres from where Burns swam all those years ago.

It's been delivering zero emissions electricity and desalinated water to the facilities at Garden Island - Australia's biggest naval base - and now plans to take that concept a crucial step further, to a renewable energy micro-grid based around wave energy.

The first micro grid - also to be based at Garden Island - is a local energy grid that combines wave energy, solar (photovoltaic) energy, a desalination plant and energy storage. In this case it will use three of its commercial scale CETO wave energy machines, each with a capacity of 1MW, and add 2MW of solar and 500kW hours of battery storage. The micro grid can connect or disconnect from the electricity network and operate autonomously, and the idea is to enable Garden Island to be completely independent for its electricity and clean water requirements. The plan has already got the backing of the Commonwealth Bank, in the first major private sector financing transaction for a wave technology project.

Carnegie believes this micro-grid concept can be applied elsewhere - in island communities off Australia and other areas in the Pacific, Atlantic and Indian oceans, as well as coastal communities in remote and fringe-of grid areas around the world.

"This is seriously transformational, because it allows island, off grid and fringe grid communities to tap into the biggest advantage of wave energy, which is its consistency," says chief executive Michael Ottaviano.

"This is going to allow very high penetration of renewable energy into island networks. Up until now that has not been possible. Cheaper battery storage and solar helps, but the combination of wave with other renewables makes it easier to take higher penetration renewables into places it hasn't been before, comfortably and cost effectively."

Renewable-focused micro-grids are expected to play an increasingly prominent role in the world's electricity systems. In Australia, the Byron Bay shire is considering an approach from Siemens and Brookfield to create a renewable focused micro-grid, while smaller towns such as Tyalgum are considering doing the same.

Developers of new housing divisions - such as KLW for its Huntlee development near Newcastle, are looking for renewable-based micro-grids rather than connecting to the main grid, while a new company chaired by Professor Ross Garnaut is looking for similar projects in South Australia.

Carnegie's plan, however, is to establish its own micro-grid business, targeting those islands and communities that may be too small for competitors. By adding solar, wind and storage, these communities will be able to reduce significant amounts of diesel, and the later addition of wave energy could take the renewable energy penetration to 100%, and provide desalinated water.

"Its lack of onshore footprint is also a major advantage for islands, as is its lack of aesthetic impact," Ottaviano says. "Its inherent synergies with seawater desalination also help."

Indeed the technology is having minimal impact on the environment, he says. The only part in contact with the sea floor is a standard pile foundations used for years in the marine space.

"The CETO units themselves have been designed to avoid being a trap for marine life and we constantly monitor potential impacts such as acoustic or fouling," he says, noting that the current project has over 350 measuring devices collecting data and feeding back in real time. And because the system is completely submerged, there is no visual impact.

Carnegie is now emerging as one of the leading wave energy developers in the world. Others have come and gone, with prototypes generating publicity rather than electrons when mishaps saw the machines sink to the bottom of the ocean, in the case of Oceanlinx, or projects abandoned, in the case of OPT.

Ottaviano says technology "attrition" is to be expected. The same thing occurred in other technologies, such as solar thermal, where industry standards - and the best way to capture the energy - have been slow to develop.

But he points out that Carnegie has only been doing "serious" technology development since 2009, and has spent "just" $118m in that time.

"That is just a blink of the eye compared to the amount of time invested in solar, nuclear, gas, or coal," he says. "And the money invested is just a drop in the ocean compared to the hundreds of billions that have been spent on nuclear, and is still being spent, and the billions being spent on offshore wind.

“Wave is one of the last renewable technologies to be commercialised. And if Carnegie is able to commercialise its wave energy technology for, say, $160m, that is exceptionally good value for money.

“And we will have commercialised a power technology quicker and more cheaply than any other technology that came before it.”

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