Carnegie Rides Development Wave

The ever-growing focus on the need for alternative, renewable energy sources has seen the emergence of a number of new industries in Australia over the past two decades. Solar has long been championed as a clean, renewable alternative, while geothermal and wind-generated energy have also attracted government and petroleum industry investment.

While still in a developmental phase, the backers of wave-generated energy believe it has the potential to rival solar, wind and geothermal as the alternative energy source of choice. Australian wave resources are believed to be amongst the best in the world, and a number of companies are developing technologies designed to capture wave energy to provide baseload supply.

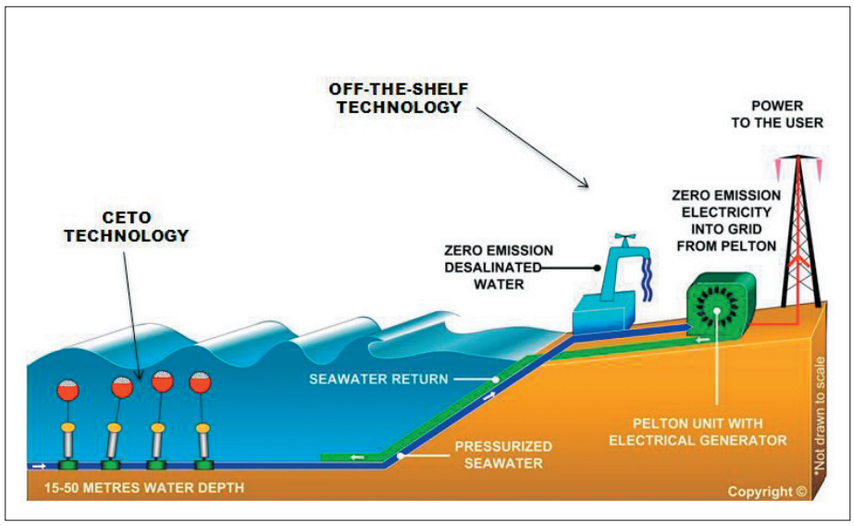
ASX-listed Carnegie Corporation is one such company seeking to harness the power of the deep blue. Carnegie has begun 2009 at a canter, securing a $12.5 MM grant from the Western Australian Government and announcing the signing of a license agreement to investigate a suitable site for the development of a wave energy project in South Australia.

Dr Michael Ottaviano, Carnegie Managing Director, said Carnegie has also announced an MoU with the Department of Defence to investigate the potential to build a wave farm off Garden Island in Western Australia, and another MoU with Western Australian energy retailer Synergy to sell power from a wave farm.

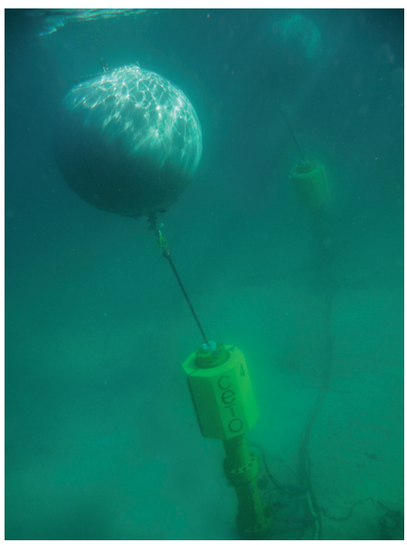
While Carnegie is also investigating the potential of other renewable energies, the company is focusing all its present efforts on wave energy, which Ottaviano labelled the "nearest-term opportunity".

Ottaviano explained Carnegie is seeking to develop its CETO technology, submerged wave power converters, originally conceptualised by company chairman Alan Burns in the 70s. CETO derives its name from an ancient Greek sea goddess.

"Alan's reasonably well known in the oil and gas sector, and what he did, when he conceived CETO, was to combine his knowledge of energy, offshore oil and gas engineering, and his love of the ocean—waves, boating, diving, all those sorts of things—all together to come up with the concept", Ottaviano said.



An overview of how the CETO technology works.



Carnegie has a test site for its CETO technology in Fremantle, Western Australia.

"We have been going through the development of that technology since '99-2000. What we call CETO 1 was the first generation prototype, proof of concept, back in 2006.

"We got a small amount of government funding through that process. CETO 2 then was the pre-commercial, prototyping phase, which has just been completed.

"Last year CETO 2 produced power and water at our test site at Fremantle. We were shortlisted for our first offtake agreement to the WA Government desalination plant last year, and we were awarded our first commercial site, our first project. That's the first one ever awarded in Australia."

In 2008 the Western Australian Government awarded Carnegie a license to investigate the potential for a wave energy farm off Albany in Western Australia's southwest. This year's $12.5 MM grant will contribute toward the development of a 50 MW project to be located in Western Australia.

Carnegie currently holds license areas at: Albany, Naval Base at Garden Island, and Port Macdonnell in South Australia. It has also recently been awarded three Victorian wave energy sites at: Portland, Warrnambool, and Philip Island. Carnegie is working towards the development of Australia's first wave farm, a 50 MW commercial demonstration facility, by 2013; either of the six sites, or potentially another site, could be selected.

"The technology has developed extremely well. The commercialisation strategy was really around acquiring access to the ocean, so that effectively you can exploit the wave resources there, and getting those sites that allow you not just a good wave resource but also the ability to put the power you're generating into the grid—so it's matching those two things up", Ottaviano said.

While most other wave technologies being developed around the world are designed to operate on the ocean's surface, using technology which bobs up and down and converts the vertical motion to electricity, Ottaviano said the CETO technology is designed to be fully submerged.

The CETO technology allows zero-emission electricity to be produced, similar to hydroelectricity, or, utilising standard reverse osmosis desalination technology, zero-emission freshwater. CETO units are permanently anchored to the seafloor, and are self-tuning to tide, sea-state and wave pattern, enabling them to perform in a wide variety of wave heights and in any direction.

"The main issue with wave energy is not how do you harness the energy, because there's a lot of energy out there and it's very reliable, the issue is that you get extreme events from time-to-time", Ottaviano said. "You get storms coming through and you get very big waves; you've got to have the means to survive those storms. These guys [with surface-mounted technology] all have issues with storm survivability because they're in the worst place to be when a storm is coming through, on the surface. The best place to be is under the water.

"We looked at what people had done, and looked at the opportunities, and we came up with a new means to generate power—and that, conceptually, is what our technology is.

"Waves come through, drive the pump, pumping high-pressure seawater to a hydroelectric plant onshore. There's no power generation happening offshore at all—it's very, very simple. It's just water being pumped ashore to spin a turbine. Because it's simple, it's cheap to manufacture, cheap to deploy, and cheap to maintain.

"The side-bonus, apart from being able to pump the water ashore, and utilising hydroelectric power generation, is that high pressure seawater is exactly what a desalination plant needs.

"It's by far-and-away the simplest wave energy technology in the world. It's the only fully-submerged power technology that generates its power onshore not offshore."

Ottaviano said the wave farms will ideally operate at around 25 m water depth, with the economics of a farm being better the closer it is to shore.

"Technically you could be tens of kilometres offshore, but you then have tens of kilometres of pipe", he explained. "You want to try and optimise that. The best sites are going to be where you've got a good resource, where you've got deep water close to the coast, and where you've got transmission infrastructure not too far from the coast."

He said the CETO units, which are constructed using offshore oil and gas materials, are designed for 20-plus years of life. Being submerged, they create no visual impact and, according to Ottaviano, actually attract marine life.

Ottaviano said, with each individual unit being 200 KW and the system being inherently scalable, wave energy has the potential to generate hundreds of MW of electricity. He said wave energy carries an advantage over other types of renewable energy as it is capable of operating 24/7.

"We commissioned an independent report last year by RPS MetOcean, which is considered one of the leading oceanography firms in the world, and they came back with two main points—one was that the resource in Australia is huge and it could easily supply Australia multiple times over, so you're not constrained by the resource.

"We also got them to look at how available that resource is—a typical wind farm is 30% capacity factor of generation, a solar farm 25–30% —what you see from the wave resource, looking around the country, is that you're typically well and truly over 90% all the way along. Albany, for example, you're 100%", he said.

"One of the advantages that you've got, say, wave energy over, for example, a wind farm, is that the medium that is transmitting energy is incredibly dense with waves.

"If you think about water being compared back to wind, which is air, water is 800 times denser than air. So, you've got a hugely dense medium to transmit energy. Therefore, you only need very small energy to transmit significant quantities of energy—about 10% the size of a wind farm will deliver the same amount of power as a wave farm."

Carnegie states an estimated 1 MM GW hours of wave energy hits Australian shores annually, and quotes a World Energy Council estimation that approximately 2 TW, about double the current world electricity production, could be produced from the oceans via wave power. Ottaviano said the southern Australian coastline is ideally suited for wave energy.

"The best wave resource comes from the southwest—anything that's based in the southwest is always going to have a good wave resource—but, even as you get back up onto the southeast side of the country, you've still got very, very good numbers.

"Australia has the world's best wave energy resource—we should be the world's leading wave energy technology developer for that reason." ■