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INTERVIEW

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Carnegie rides the green wave

Carnegie Corporation managing director Michael Ottaviano explains to *Business Spectator's* Isabelle Oderberg:

- **How waves are used to generate power and how the energy is harnessed**
- **Why it is superior to other alternative methods of energy generation, such as wind, and could provide 35 per cent of Australia's base load power**
- **Wind energy could be fossil fuel cost competitive in five to ten years**
- **The group has a pilot plant operating in Fremantle, Western Australia, and is planning a 50 megawatt power station**

Isabelle Oderberg: I was wondering if you could tell me a little bit about how energy from waves is actually harnessed?

Michael Ottaviano: So what we're talking about with wave energy is in fact the ocean swell and the origin of that is the large storms that are generated a long way offshore that churn up the ocean and generate waves and that wave, or ocean energy, the swell, is then transported to the beach or back to shore. In Australia those storms typically happen a long way offshore in the Southern Ocean and as their energy is transported back we see that as waves breaking onshore. Now before they break onshore, there's an opportunity some hundred of metres offshore to capture some of that energy and transform that into electricity and that's what we do. There've been a few attempts or quite a few attempts over the last 25 years in particular trying to harness that energy.

Most people have gone down a relatively obvious path or an intuitive path which is they've built floating power stations basically and these are big, large, complicated pieces of equipment that sit on top of the ocean's surface and they bob up and down as waves move past them and it's that bobbing up and down motion that they use to generate electricity, often through a turbine that's spun or through what's called a linear generator, but there're various ways of doing that but basically at the end of the day it's a floating power station that generates electricity and then they have a high voltage cable which runs along the ocean floor to bring that power back to shore.

IO: Would these sorts of constructions, if that's what you'd call it, these floating power stations, would they have a detrimental effect on the coastline environmentally speaking?

MO: Typically the impact you're going to get from that sort of approach is, well it's two-fold in an obvious sense. One is there's going to be a visual impact. You're going to see these large power stations floating up and down on the ocean's surface which is not necessarily a good thing, but the more fundamental problem with them is I think that when you think about the ocean it's a very energetic, harsh, corrosive environment. The last thing you want to be doing probably out there is generating electricity.

What Carnegie Corporation has done is develop a completely and radically different approach to the way you harness that energy which is much simpler. It doesn't have the visual impact and if anything has a positive impact on the environment and so the way that we harness the power of the ocean is in fact by having fully submerged pumps that sit on the ocean floor. They have a buoy that sits above them and that buoy which also fully submerged is picked up and pushed down by the swell in the ocean and that up and down movement drives a piston in the pump which pumps water, a bit like a hand pump, so it's a piston inside going up and down pressurising water and pumping that back to shore through a pipeline. So you have a pipe that connects a whole lot of these pumps together on the ocean floor which brings water back ashore and then once you've got that high pressure sea water back ashore, you can then have a standard off the shelf hydro electric

turbine where the water hits that turbine, is spun and then you use that to create the electricity with that movement. So it's a beyond shore component of what we do is standard electricity generation system taken straight out of the hydro electric industry and all we have offshore is a very simple pumping system which is fully submerged and just pumps the water ashore to the turbine.

IO: And is it a sort of a deep water system or how far out would it be?

MO: Typically between 25 to 40 metres of water depth, so that's typically hundreds of metres offshore which in a wave technology sense is a little bit shallower than the other approaches. Most of the other systems are a little bit further than that offshore primarily because they need very large waves because they're such big systems. Carnegie's technology works down as low as a metre in wave height, so you can afford to be a little bit closer to shore which is a good thing. It just makes it more cost competitive because you don't have much pipe work and infrastructure required.

IO: But again, the pump is offshore. How is it powered?

MO: That's purely powered by the waves.

IO: So we're not looking at oil spills?

MO: No. And in fact more than that, most pumps are lubricated in some way. These pumps are actually in fact only lubricated with sea water so if something catastrophic was to happen for whatever reason and a pump was to open or a pipe was to open, you've got no spillage risk. It's only sea water in sea water.

IO: If you use this system that you're talking about, what's the megawatt per hour price compared with sort of conventional energy sources?

MO: So, this is a new technology and our next step… We've got a pilot plant currently operating in Fremantle, Western Australia and our next step is to build the commercial demonstration project. The intention is to build a 50 megawatt power station and that's roughly around about enough for 30,000 to 40,000 households, so it's an industrial scale power station. We expect the cost of that power from that power station to be competitive with wind. Ok? So that's the first power station we ever build. We think we'll start at wind. But what happens with all new technologies is they come down over time, and now so what we've seen in the wind industry is it's probably come down a factor of five times over the last 10 or 20 years and we'd expect something similar to happen in the wave industry. So to start at the cost of wind is not a bad place to start, but we would expect to be fossil fuel competitive within five to ten years.

IO: The 50 megawatt power station… Where's that going to be?

MO: We haven't yet finalised that location, but what I can say is that the front runner for that site is in Western Australia at a place called Albany in the south-west of Western Australia.

IO: How much is it going to cost to build the power station?

MO: About $400 million.

IO: And does that include the water pumps in the ocean?

MO: Yes, that's the full balance of the plant, the whole bit. It's a little bit site specific. I guess Albany's the front runner because the West Australian Government has just granted us a commercial project licence and lease at Albany, so we've actually got, physically got going to a mining analogy, we've actually got a tenement now. We can actually go out and exploit. So that's why Albany's the front runner and, as I say, it's a little bit site specific. It could go up as high as $500 million depending on the actual specifics of the site. So somewhere between $400 million and $500 million is probably a safe number to say.

IO: What sorts of grants have you been given by the government in terms of, you know, technology development?

MO: We've got a small R&D grant going back some three or four years, or four or five years maybe. We've been developing this technology for a long time, nearly ten years. So we had a small R & D grant early on and we've not received anything since then, however we are looking to the renewable fund that exists and we would be hoping to access some of the funding from that for this first commercial demonstration project.

IO: I understand you're hoping to be commercial ready in 2009. Is that the 50 megawatt power station? You're hoping that'll be ready in 2009?

MO: No. The 50 megawatt power station… We'd expect stage one of that to come on stream in 2011. The actual technology itself, so the pilot plant that we've got operating in Fremantle, we expect that to be commercially ready by the end of next year, so by the end of 2009.

IO: So you've got the pilot plant in 2009 and then 2011 would be the 50 megawatt power station?

MO: Yeah. 2011 is stage one of the 50 megawatt power station which is in fact 5 megawatts, 2013 is the full 50 megawatts and then probably 2015, we'd go to 100 megawatts.

IO: When did your company list?

MO: This is interesting. We were a spin-out in fact of another company, a company called Hardman Resources which is an oil and gas company.

IO: You're hoping to be fossil fuel cost competitive by between five and ten years. What's the comparison for wind? Where is wind?

MO: Wind will probably never be fossil fuel competitive. The unfortunate thing about wind… What's happening with wind at the moment is it's getting more expensive primarily because of there's a drastic shortage of wind turbines around the world, so wind is actually increasing cost in the last couple of years and is forecast to continue to increase slightly and then probably plateau. Wind is now relatively mature for renewable technology, so it's unlikely to drop too much more if anything over the longer term. Solar is still dropping. You know we'd expect solar to continue to come down, but wave is really at the start of the experience curve, but that should come down significantly over the next five or ten years.

IO: Obviously everything you've told me is really interesting and it sounds very positive, but we've heard so many of these stories before, you know wind is the answer and solar is the answer and you know, what's different about wave? How is this actually going to make a difference?

MO: There're lots of differences, so let me give you the big one and that is that the drawbacks with current renewable alternatives is that they're intermittent. If you're a coal man or you're a gas man or a nuclear man, you'll always criticise the renewable energy industry for not being able to supply base load power.

So for example some solar plants can only produce electricity when the sun shines and that's, depending on where you are, five hours to ten hours a day, so for the rest of the time, the other 14 to 19 hours of the day, you're not producing power and that's not good enough. If you're an industry, then you want to run your plant 24/7.

The best wind sites produce power about 30 per cent of the time, so for 70 per cent of the time, your wind turbines are sitting there not doing anything. The big kicker with wave is it's constant base load and this report we've released which was an independent report conducted by a group that were commissioned by the UK Government to do the report on the UK wave energy study. Carnegie commissioned them here to do the Australian one. It's not speculative, it just goes back to the data that's available that measures it and it says yes, the wave resource in Australia is base load, it's huge, it could power Australia; it could power 35 per cent of Australia's base load energy requirements today. So it's a phenomenal resource and the big difference is it's constant.

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