Novel approach to wave energy generation

Wave Swell Energy is developing its Oscillating Water Column technology in Tasmania, Australia

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TYPICALLY, BASE LOAD POWER is generated by coal or gas-fired power stations which can store fuel to be used on demand. Renewable energy, without adequate storage capacity, is generally not considered to be base load power due to its intermittency, which can prevent constant production of a given load of power. However, wave energy does not suffer this limitation to the same degree, as it is more predictable and consistent compared to wind and solar. This results in wave energy being considered as a source of complementary base load power, as the longer time frames of variability of wave energy allow it to be used to complement existing fossil fuel base load sources without creating surges in power delivery. Waves are reliable and naturally occurring, and a practically infinite resource.

Wave energy can be used in conjunction with traditional base load sources with a seamless transition between renewable and fossil fuel sources. For example, as waves increase in size, producing more energy, a coal-fired power station can gradually scale back its production, and vice versa. Breaking new ground in generating wave energy, Wave Swell Energy (WSE) has developed a technology that converts wave energy into electrical energy to produce clean electricity that complements base load.

Innovative development

Wave Swell Energy is an innovative Australian renewable energy technology development company, founded in October 2016 to commercialise its unique unidirectional Oscillating Water Column (OWC) technology. The company is currently developing a world first project utilising this new technology at King Island, Tasmania.

The technology has several applications besides conventional energy generation, including:

- Displacing diesel in remote island locations.
- Producing hydrogen and desalinated water.
- Acting as a form of protection against coastal erosion.

The technology involves no moving parts in the water, nor does it entail the use of any oils or other contaminants.

New ground

Based on the concept of a unidirectional oscillating water column (OWC), WSE's technology resembles an artificial blowhole that allows waves to enter a hollow chamber that is open underneath the waterline. The motion of the waves in the chamber displaces the air above, driving a turbine and thereby generating electricity.

WSE's technology works on unidirectional air flow, which simplifies the associated air turbine. This is in contrast to conventional OWC technologies that are bidirectional, requiring air turbines to operate on reversing flow. A bidirectional system necessitates either an inefficient or a complex turbine with pitching blades, or a complicated system requiring the

Below: **King Island OWC under construction**

Left: **Rugged coastline of King Island, Australia**

redirection of flow on each cycle. The WSE technology has been extensively tested by world renowened experts at the Australian Maritime College (AMC) in Launceston, Tasmania, with the results demonstrating the WSE unidirectional OWC produces more energy on average than a corresponding traditional bidirectional unit.

In addition, being unidirectional, the WSE's technology offers a robust, cheap, and efficient turbine over bidirectional systems. And, unlike existing deeper water applications – which use floating units with hi-tech components in and below the water, resulting in high maintenance costs – WSE's units involve no moving parts in the water. This makes access to the device far easier, thereby greatly reducing the cost of operation and maintenance. Having no moving parts in the water also minimises any effects of the technology on marine life.

In fact, WSE devices are primarily constructed from concrete, using simple moulds and steel reinforcement. The King Island unit, for example, sits on the shallow sandy seabed (5.75m deep) under its own weight, requiring a small footprint. The devices can also be re-floated and towed to another location.

Furthermore, WSE's technology covers a range of uses apart from electricity generation, including the production of hydrogen and desalinated water. The units are also beneficial in combating the issue of coastal erosion. The traditional method of dealing with this problem is to install breakwaters, sea walls, and groynes, requiring a significant capital outlay. This is a sunk cost. On the other hand, WSE units, when deployed in close proximity to each other, act as a breakwater or sea wall while converting the energy in the waves into electricity. This not only protects the coastline from erosion but also generates an annuity-style revenue stream from the electricity generated.

WSE is developing the King Island project to demonstrate the technology and its ability to generate electrical energy in a more efficient manner than that of previous technologies. Construction is nearing completion, with the unit expected to be operational by mid 2020. This 200kW wave energy facility on King Island will provide electrical energy into the local grid, operated by Hydro Tasmania, Australia's largest generator of renewable energy. The WSE unit will be integrated with the existing renewable network of Hydro Tasmania. The utility will independently meter the energy produced, thereby validating the efficacy of the project.

Subsequent to the King Island project, WSE will look to deploy follow on projects in several locations, primarily aimed at displacing the use of high cost diesel generation in remote and island locations, with these projects potentially also doubling as a form of coastal protection. The longer-term vision of the company is to see the technology become widespread across the globe, providing both a means of climate change mitigation (by generating renewable energy), and a means of climate change adaptation (by protecting coastlines from the ravages of extreme storm events). ●

Below: **Waveswell map**