



## Wave Energy Technology – New Zealand

Name of person filing the form

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Project name: Wave Energy Technology – New Zealand

Project description:

*Project Developer:* WET-NZ

*Technology type:* Point absorber like WEC (non-axisymmetric)

*Resource:* Wave

*Project scale:* 1:2 prototype in open ocean conditions

*Installed capacity:* The 1:4 scale experimental models had a rated capacity of 2 kW peak. The 1:2 scale prototype has a rated capacity of 20 kW peak. The full-scale devices are expected to have a rated capacity of 200-500 kW peak (0.2 to 0.5 MW peak)

*Additional Description:*

The aim of the WET-NZ programme is to design and develop a WEC that maximises engineering efficiency through the novel use of direct drive and adaptive response to changes in wave motion. The device consists of two rigid bodies or parts, a reactive hull and an active float, which are hinged together at the waterline. The bulk of the hull is submerged but floating and so it is moored to keep it on location. Refer to the website for an animation of the 1:2 scale device in operation. WET-NZ has a New Zealand patent for its device and has submitted for patents in Europe, the US, Australia, and elsewhere.

*Project Website (Company website):* <http://www.wavenergy.co.nz/>

Location:

WET-NZ has tested scaled devices in three locations in New Zealand and one in the United States.

Two test sites are near Christchurch, off the east coast of New Zealand's South Island in the Pacific Ocean. The 1:4 scale experimental device was moored in relatively shallow water at Taylor's Mistake and the first generation 1.2 scale device was evaluated at a deeper water site at Akaroa Heads. Both of these sites are close to accessible cliff top locations which allows for excellent shore based visual observation of performance under varying wave conditions. The 1:2 scale device was then tested for 6 weeks at a consented site called Moa Point, which is located along the south coast of Wellington on the edge of the Cook Strait, the body of water between the North and South Islands. A site off the Taranaki coast near Waitara, east of the North Island, has also been consented for future use.

*Coordinates:* 43°34'24.8" S, 172°47'3.8" E (Taylor's Mistake)  
41°12.4022'S, 174°48.2873'E (Moa Point)



#### Process status:

WET-NZ is currently the only developer in New Zealand to have deployed a marine energy converter of any configuration; and its scaled prototypes are currently being tested in open ocean conditions. Two 1:4 scale devices have been built and successfully rested during numerous short-term deployments up to 163 continuous days. The first 'proof-of-concept' device was deployed in 2008 and the second more robust experimental test unit in 2010.

Fabrication of a 1:2 scale prototype was completed in June 2011 and it was deployed at the Akaroa site mentioned above for three months until December 2011. In early 2012, it was refurbished and transferred to the Moa Point test site near Wellington where WET-NZ has a consent to deploy it for up to five years with the option to deploy two more scaled devices for array testing. It has been tested for 6 weeks so far with more deployments planned.

In the USA, laboratory wave tank tests were conducted on a 1:30 scale model in October 2011, and a second generation 1:2 scale device, based on data from the initial 1:2 scale model and the wave tank testing, was fabricated and deployed off the Oregon coast for 6 weeks in 2012.

#### Licensing information (brief description):

In New Zealand, a resource consent is required from a regional, city, or district council to use a resource in any way or to do something that might affect the environment. The type of consent, application procedures and durations of the consent process vary depending on the scale and type of the proposed activity and its potential impacts. Approvals from Maritime New Zealand are also required to install, relocate or remove any aids to navigation marking devices at offshore sites. WET-NZ has secured approval from three regional councils for its New Zealand test sites: Taranaki Regional Council for Waitara, Environment Canterbury for Taylor's Mistake and Akaroa, and Greater Wellington Regional Council for Moa Point. The resource consent obtained for the Waitara site was the first ever consent granted in New Zealand for a wave energy project.

#### Key Environmental issues:

Environmental monitoring of the WET-NZ device is of particular importance at the Moa Point test site due to the intended deployment duration of at least two years.

During the resource consenting process for the site, an Assessment of Environmental Effects was produced. This identified potential environmental impacts, both negative and positive, that could potentially arise as a result of deploying a single 1:2 scale device for at least two years and ways these impacts could be mitigated, reduced or avoided if necessary. Subsequently an Environmental Monitoring Plan was created that laid out a proposed plan for monitoring environmental effects through three stages: before deployment, during deployment and post decommissioning.

Desktop reports and baseline surveys have been completed to establish the baseline environmental conditions at the test site. The most significant environmental concern is for marine mammals that frequent the areas surrounding the test sites, in particular endangered or critically endangered species such as the Maui's dolphin, killer whale and southern right whale. Details on monitoring plans for marine mammals and other aspects of the marine environment, such as fisheries, the seabed, benthos, are outlined in the tables below.

Environmental webpage: N/A



Baseline and Project Effects Studies: Wave Energy Technology - New Zealand (WET-NZ)				
Receptor	Study Description	Design and Methods	Results	Status
Physical Environment	Assess the condition of the seabed to determine potential effects from installation of the anchoring system and device operation.	Side scan sonar survey, sediment sampling, grab samples and air lancing. Existing multi-beam echo sounding data also available.	The seabed at the site is made up of a ~2 m layer of well-sorted fine sand overlying bedrock. The majority of the site is of a uniform morphology, consistent with smooth sand. Nearby however are indications of scouring.	Conducted February & September 2011; completed.
Biological Environment	Establish type, abundance and distribution of benthos to determine biological community composition.	Grab samples and photographic imagery.	Sediment analysis revealed total organic matter ~1% only. Calcium carbonate content also low at ~6%.  Camera work showed the habitat is impoverished with respect to both the abundance of individuals and the number of taxa recorded.	Conducted February 2011; completed.
	Establish type, abundance and distribution of marine mammals to determine potential interactions with the device.  Mitigation measures include the low number of moving parts, the slow speed at which the device components move through the water and the bright colored paint used.	Desktop study reviewing existing documented sightings of cetacean species in a large (1,415 km <sup>2</sup> ) area around the 2-hectare test site.	Whales and dolphins are regularly sighted in the survey area particularly in summer. Sightings of three endangered or critically endangered species (Maui's dolphin, killer whale and southern right whale) have also been recorded.  It is thought that the WET-NZ will have no adverse effects on marine mammals.	Conducted February 2011; completed.
Marine Uses / Users	Establish type and level of maritime activity and competing uses of the marine space during the temporary deployment.	Consultation with commercial fishermen, recreational fishermen and ferry companies. Desktop study reviewing local commercial fisheries.	Consultees raised no significant concerns, as the site is located in an area used infrequently for other activities. Most commercial trawling is carried out in deeper water depths. Nearby reef habitat supports fisheries for rock lobster. Recreational fisheries exist in the vicinity of the test site.	Conducted February 2011; completed.
Reports and Papers	N/A			
Research Projects	N/A			



Monitoring and Adaptive Management:: Wave Energy Technology - New Zealand (WET-NZ)				
Receptor	Study Description	Design and Methods	Results	Status
Physical Environment	Underwater acoustics	Monitor noise created by device in varying sea states using hydrophones.	To be collected during operations.	Planned for operational phase of project; every 6 months.
Biological Environment	Benthic habitat and ecology	Monitor type, abundance and distribution of benthos to compare with baseline data using the same technique of capturing video footage using a towed camera.	To be collected during operations.  The device is expected to have no adverse impact on the benthic habitat or ecology because it is floating and therefore separated from the seabed. the paucity of existing individuals in the benthic environment adds confidence to this.	Planned for operational phase of project; every 6 months.
Biological Environment Marine Uses / Users	Marine Mammals	Record behavior of marine mammals, species type, abundance and distribution in the immediate vicinity of the device to compare with baseline data. Will use C-PODs, video surveillance and visual surveys.	To be collected during operations.	Planned for operational phase of project; every 6 months (except visual surveys during general onsite monitoring and maintenance).
	Commercial and recreational fisheries, surfers and recreational boat surveys.	Monitor level of maritime activity and competing uses of the marine space through consultation with affected and interested parties.	No significant concerns to date.	Ongoing
WET-NZ equipment	Condition of deployed equipment.	Dive inspections to monitor the amount of bio-accumulation on deployed equipment and ensure all cables are clear of entangling material.	To be collected during operations.	Planned for operational phase of project; every 3 months.
Reports and Papers	N/A			
Research Projects	N/A			