

OCEAN

What is ocean energy?

Ocean energy uses the ocean's powerful currents, tides and waves to generate electricity.

Oceans are affected by the gravitational pull of the moon and the sun. This gravitational force creates tides. Created by winds, currents run steadily beneath the waves. Both currents and waves can be harnessed to create electricity.

Tides

When there is a big difference in water level between high and low tides, tidal energy can be collected from both oceans and harbours.

Tidal energy is collected using tides and tidal energy devices:



THE TIDAL BARRAGE AT LA RANCE RIVER IN FRANCE.
SOURCE: DAVIDDARLING.INFO

Barrage

A barrage has a set of gates, which open when the tide is rising. These gates let the water flow in to be collected into a basin inside the barrage. When the tide reaches its highest level, the gates close to hold the water inside. As the ocean tide level drops naturally, the water inside the barrage basin runs out slowly, but first it goes through water turbines, which rotate generators that create electricity.

Currents

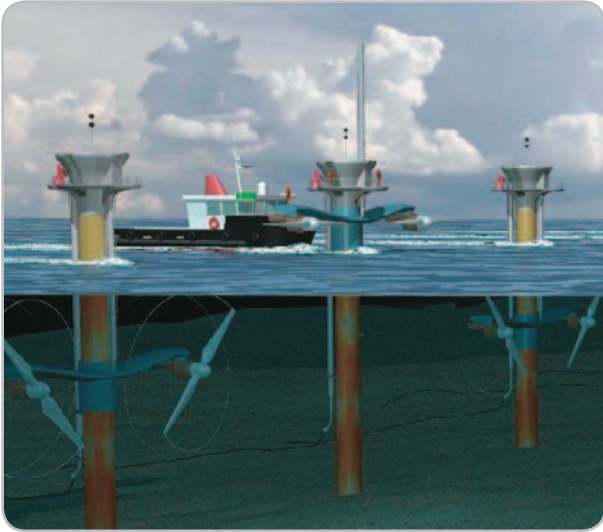
Stream tidal energy is harnessed from currents – horizontal water movement which is created by the rise and fall of tides. These tidal currents move around in a predictable pattern and energy can be collected using tidal energy devices.

Turbines, similar to wind turbines, can be anchored to the sea bed to generate electricity. Ocean turbines are most likely to be placed where there is a fast flow of water, such as harbour mouths. The fast flowing water moves over the blades of the ocean turbine resulting in the ocean turbine spinning. This action is much like a wind turbine when wind flows over the blades.

There are three prototypes of tidal energy devices: horizontal axis turbine, vertical axis turbine, and oscillating devices.



Horizontal axis turbine



AN EXAMPLE OF A HORIZONTAL AXIS TURBINE.
SOURCE: MARINETURBINE.COM

A horizontal axis turbine is similar to a wind turbine and is the most common type of tidal stream turbine. The moving currents spin the turbine's blades. The blades drive a generator, which converts energy harnessed from the ocean currents into power.

Vertical axis turbine

A vertical axis turbine looks like a large egg beater. The turbine has large blades that rotate like a washing machine as currents move past. This movement creates energy, which is then converted into power by a generator.

Oscillating devices

To oscillate is to swing back and forth. A feature of oscillating devices is a blade similar to an aeroplane wing. This blade moves up and down in the water, creating kinetic energy. A generator converts kinetic energy into power.

Waves

Organisations and universities around the world are currently researching and developing new technology to harness wave energy.

One technology which is being tested currently uses long slender floats, which are attached end-to-end to form a long flexible tube. This tube floats on the surface. When a wave moves along the tube, each individual float rises and falls to follow the wave motion. This kinetic energy is captured in the links between each float and electricity is created.

What are the advantages of ocean energy?

The oceans of the world cover about 71% of the earth's surface, which is a lot of resource to generate energy from.

Tides, currents and waves are predictable, renewable sources of energy. Collecting energy from them has a minimal impact on the environment because they do not emit greenhouse gases during generation. Because of the consistent nature of ocean energy, some researchers think ocean energy can be relied on to provide power when other energy sources can't. For example, hydro energy generation is hampered by low rainfall and wind turbines function less effectively in calm weather. In addition, there are increasing shortages of non-renewable resources, such as coal and natural gas.

What are the disadvantages of ocean energy?

Ocean energy uses waterways to generate electricity, as well as the open ocean and therefore building and using them can have



effects on the natural eco-system and aquatic life. Ocean energy technology is currently expensive to install, but costs are expected to fall in the future.

How is ocean energy used in New Zealand?

There are currently no ocean energy plants operating commercially in New Zealand. There are a few tidal barrages around the world - the best example is found in La Rance River in northern France. This tidal energy plant can produce up to 240MW of electricity per year using a 13 metre high barrage device. There are also prototypes being used to collect energy from ocean waves in Spain and Scotland.

New Zealand is surrounded by water. In some places around the country, there are strong waves and tidal currents, which could be used to collect power. Before New Zealand can use these types of energy devices to generate power, there needs to be a lot more testing and trialing.

ACTIVITIES

ACTIVITY ONE

Individual or group activity. Students research how the moon and the sun affect the earth's ocean tides. Develop a model and present this to the class.

ACTIVITY TWO

Students find out the difference between renewable and non-renewable sources of energy. Choose a renewable source of energy and a non-renewable source of energy. Compare their impact on the environment, including climate change.

SUPPORTING RESOURCES

- World Energy Council: www.worldenergy.org
- United Nations Atlas of the Oceans: www.oceansatlas.org/
- Energy Efficiency and Conservation Authority: www.eeca.govt.nz
- Aotearoa Wave and Tidal Energy Association: www.awatea.org.nz

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