The Ocean Renewable Energy Group

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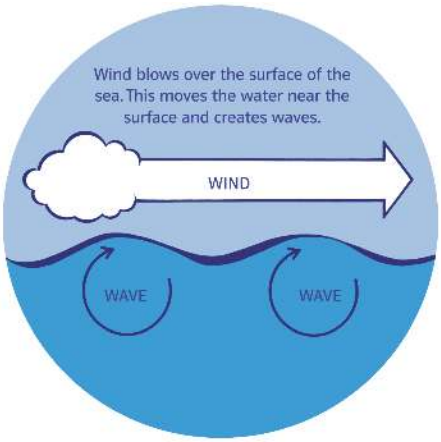
Ocean Renewable Energy in Canada

Harnessing green power from the waves and tides

Ocean energy is an emerging sector in the renewable energy industry. While ocean energy itself has been researched and tested for many years, new advances in technology and new interests in the ocean energy resource are resulting in new development activities. Ocean energy is being pursued as a source of green energy in countries around the world, with the majority of activity in the UK, Europe, Australia and New Zealand, and North America. Canada is uniquely positioned amongst these countries because of its long coast line and large ocean energy resource, its power and ocean industry expertise, and its commitments to the environment.

What Is Wave Energy?

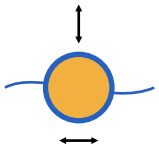
Wave energy is the term used for the energy generated from the power found in waves. Differential heating of the ocean surface from the sun creates wind, which creates waves and swells. The energy that is available in a wave depends on its the length and height. Preliminary studies show that the wave energy potential off the Canadian Pacific coast is equal to approximately half of all of Canada's electricity consumption, and wave energy off the Atlantic is double current electricity demand.



Wave Energy Devices

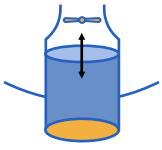
Wave energy devices are designed to capture the energy found near the surface of the water and convert it to power. While numerous configurations of wave energy devices have been invented and tested, there are commonly five categories.

BUOYS - floating structures which are carried up and down and/or pushed side to side by the waves and convert that movement into power to drive a generator.

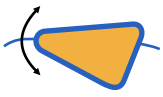


SURFACE FOLLOWING - floating structures hinged together following the surface movement of passing waves using the motion of the parts against each other to drive a generator.

OSCILLATING WATER COLUMN - enclosed column of air which rises and falls with the motion of the waves, pushing out and sucking back through a turbine which drives a generator.



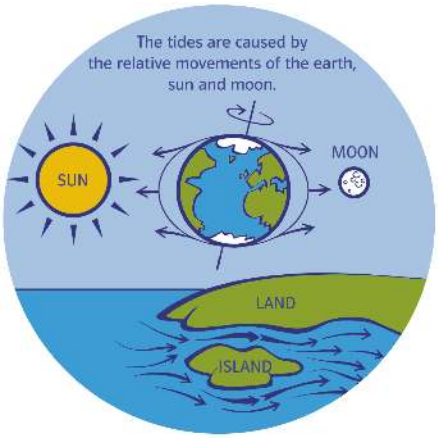
TERMINATORS - line of floating structures placed facing the oncoming waves and forced to move against each other using the power to drive a generator.



OVERTOPPING - an offshore reservoir is created as waves flow up a ramp into the structure, then flow back out through a turbine that drives a generator.

What Is Tidal Energy?

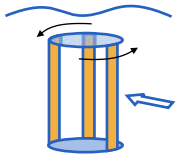
Tidal energy is the term used to describe the energy generated from power found in ocean tidal currents. The tides are created by the gravitational forces of the sun and moon, and their movement in relation to the earth.



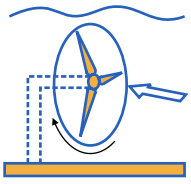
Tidal streams are currents in the ocean water column, created as the water of the ocean rises and falls with the movement of the tides. Tidal currents are strongest where the water passage is constricted, such as narrows, channels, around islands and headlands and in fjords. It has been estimated Canada's tidal energy potential is equivalent to approximately two thirds of the country's current electricity demand.

Tidal Energy Devices

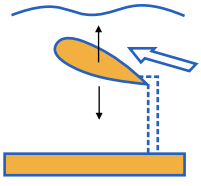
Tidal energy devices are designed to capture the energy found in the tidal stream flows and convert it to power. There have been many tidal energy device designs, however three main methods are used.



CROSS-FLOW OR VERTICAL AXIS TURBINES - the turbine is placed in the tidal stream flow, as the water flows past the vertical turbine blades rotate to drive a generator producing power.



AXIAL OR HORIZONTAL AXIS TURBINES - these turbines are similar to modern wind turbines; as the tidal stream flows past, the turbine blades rotate producing power through a generator.



RECIPROCATING HYDROFOILS - working like a fish's tail and controlled by pitch, the hydrofoils are forced up and down by the stream flow capturing power to drive a generator.

Ocean Energy in Canada

What?

Ocean energy systems will be generating offshore power, connected to the electricity grid or integrated into off-grid or micro-grid communities. These ocean energy power plants will undergo strict permitting and regulatory processes to ensure that there are no conflicts with other ocean-based industries or local stakeholders, and that all environmental impacts are minimized.

Wave and tidal energy power plants will consist of a number of devices either moored, tethered, sunk and resting on the sea floor, or attached to a pile. The devices will be connected to each other and to the shore by a electrical cable. The cable will most likely be buried under the sea floor to minimize impacts.

Wave energy devices may also be installed into existing breakwaters or harbour walls. Floating wave energy devices will most often be placed in deep, offshore waters, barely visible from shore.

The majority of tidal energy devices will be completed submerged underwater.

Where?

Through a number of studies, Canada's ocean energy project “hot spots” have been identified. The west coast of BC has been identified as having some of the best wave energy potential in the world. Future projects may be constructed along the west coast of Vancouver Island, and along the north coast near the Queen Charlotte Islands. BC also has numerous areas of tidal energy potential, located in the coasts many inlets and channels.

The Bay of Fundy, along the borders of Nova Scotia and New Brunswick, contains the highest tidal range in the world. This immense flow of water was recognized many years ago, and a tidal power plant was built in the Annapolis Valley in the mid 1980's. While a tidal power plant of this kind will not be constructed again in the region, many proposals using modern technology have been brought forward.

Modern tidal turbines are also being installed in rivers, irrigation canals, wastewater flows, and estuaries. Canada's abundant river and estuary networks provide further renewable energy opportunities for the majority of its population.

Why?

GREEN POWER - The power from ocean energy will be green electricity, using a renewable source of energy and not emitting greenhouse gases. This decreases the need for fossil fuels for electricity production and aids in combating the effects of climate change. Through production standards and climate change programs and policy, utilities throughout North America are required to purchase and provide green power. Canadian green ocean energy will be in demand for energy exports.

ENERGY DIVERSITY & PRICE SECURITY - Utilizing a number of different energy sources aids in energy security, decreasing the reliance on a single energy source, and increasing energy self-sufficiency. Energy security is important for long-term planning and preventing blackouts and brownouts. The use of regional ocean energy resources will decrease the need for importing electricity or conventional fuels for electricity generation. Ocean generated electricity is a method of reducing the risk associated with price fluctuations of convention fuel sources, creating energy price security.

REGIONAL DEVELOPMENT - Ocean energy project and device development will create direct jobs as well as employment for related industries such as marine manufacturing, engineering and oceanography, and power supply and service sectors. Ocean energy projects will provide direct economic benefits to the project region because main device components will have to be manufactured near-by and installation, operation and maintenance will require local industry.

RESEARCH EXPERTISE - Canada has the opportunity to become a leader in ocean energy research and testing. Universities across the country are seeing an increased in interest in ocean energy research from students and industry. Research institutes on both the Atlantic and Pacific coasts have expertise in numerical and physical modeling and testing. Networks and collaborations among Canadian institutions as well as with international research communities are being pursued to maintain Canada's position at the forefront of ocean energy research.

REMOTE POWER - Ocean energy devices are being pursued for project development in remote regions not connected to electricity grid systems. There are numerous coastal communities that currently rely on expensive and polluting diesel generators for power. Through the use of renewable energy sources such as ocean energy, these communities can decrease their reliance on diesel and use saved fuel costs for community development initiatives.

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