Marine Renewable Energy

Marine renewable energy refers to energy produced by ocean waves, tides, salinity, ocean temperature differences, and river currents. The movement of water in the world's oceans and rivers creates a huge amount of kinetic energy that can be harnessed to generate electricity. In Canada, the main sources of marine renewable energy are waves, tides, and river currents.

TIDAL ENERGY

In-Stream Tidal (Tidal Current)

In recent years, emphasis has been placed on the development of in-stream tidal technologies which extract the kinetic energy (free-flowing) from tidal currents. These tidal currents are generated by the water movement through natural constrictions (e.g. around headland, in and out of bays and between islands). This approach have been applied and proposed for projects in British Columbia and Nova Scotia.

Clean Current in-stream tidal turbine

Tidal Range (Tidal Height)

Another approach to extract energy from tides focuses on the actual rise and fall of the tide. Tidal range technologies use some type of holding basin such as a dam, barrage, or lagoon structure. Water flowing from the high side to the low side of the structure energizes a turbine, much like a hydro dam in a river. Barrages are essentially dams across the full width of a tidal estuary. When the tide goes in and out, the water flows through tunnels in the barrage and generates electricity. Nova Scotia Power has been operating the Annapolis Tidal Station in Annapolis, Nova Scotia since 1984—a facility which uses tidal range. It has a capacity of 20 megawatts (MW) and a daily output of roughly 80-100 megawatt hours (MWh), depending on the tides.

Annapolis Tidal Station

Following are several types of tidal range technologies:

Tidal Lagoons

Tidal lagoons use a rock-walled impoundment, which would look like an oval or similar shaped breakwater enclosing an area of shallow coastal sea forming a 'lagoon'. Tidal water is trapped and released from the lagoon through electricity generating water turbines built within the impoundment walls. Currently, tidal lagoon technology is at a conceptual phase and there are no constructed examples anywhere in the world.

Tidal Fences

A trade-off between the "free stream" and "barrage" methods is the use of a bridge-like structure known as a "fence" or "caisson", which supports a set of turbines across the flow of sea water. This approach provides some freedom for marine life to pass between the turbines and less restriction on tidal flow and area. It can also serve the dual function of a bridge and a tidal power plant.

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WAVE ENERGY

Wave energy is created by the wind passing over the surface of the ocean. The irregular and oscillating flow of wave energy in oceans (kinetic energy) can transmit energy over long distances with little degradation. The energy in a wave is determined and calculated by wave height, speed, length, and the density of the water. Wave technologies can be used in near shore, offshore, and far offshore locations, but it is likely that the further from shore the electricity is being produced, the more costly it will be to deliver to the grid.

Several proposals have been brought forward for British Columbia but there are no active project development plans in Canada at present.

Pelamis wave power device

RIVER ENERGY

River current energy devices generate power only from the kinetic energy of moving water (current). Unlike traditional hydropower which uses a dam or diversion structure to supply a combination of hydraulic head and water volume to a turbine to generate power, river current approaches uses generators installed directly in rivers. They require no diversions and use minimal infrastructure. The power produced is a function of the volume of the water and the speed of the current cubed.

These approaches are being envisaged in Alberta, British Columbia, Manitoba, the Northwest Territories, and Quebec.

New Energy Corporation river current power generation system