

Case Study - Race Rocks

Project Name	The Race Rocks Tidal Energy Project
Location	Race Rocks, BC, Canada
Installed capacity	65 kW
Technology Type	Horizontal axis bi-directional ducted turbine
Project Type/Phase	Part-scale model testing
Year	2006

Project Description

The Race Rocks Tidal Energy Project is Canada's first free-stream tidal power project. Located at Race Rocks Ecological Reserve, offshore of Vancouver Island in British Columbia 10 nautical miles southwest of Victoria, the project will allow the world-famous marine park to tap into surrounding ocean currents and convert tidal energy into electric power. The multi-year demonstration project involves the installation, operation and monitoring of a 65kW free-stream tidal turbine generator in the water.

The key objectives of the project are to:

- Provide electricity to replace two diesel generators.
- Reduce greenhouse emissions.
- Reduce environmental impact of generating electricity – measure changes against baseline.
- Demonstrate the efficiency of the tidal turbine generator.
- Demonstrate power conditioning capabilities.
- Demonstrate maintenance processes.
- Study behaviour of sea mammals and fish in relation to operation of the turbine generator.
- Demonstrate safety procedures.
- Contribute to the educational experience of Pearson College students.
- Demonstrate the ability to install the system in an extreme tidal environment.
- Demonstrate the performance of the support structure during turbine operation.

Clean Current's tidal turbine generator is a bi-directional ducted horizontal axis turbine with a direct drive variable speed permanent magnet generator. This proprietary design delivers

high water-to-wire efficiency. Operability is enhanced by a simple design that has one moving part - the rotor assembly that contains the permanent magnets. There is no drive shaft and no gearbox. The turbine generator has a design life of 10 years (major overhaul every 10 years) and a service life of 25-30 years.

The Clean Current tidal turbine generator (TTG) was installed in 20 metres of water near Race Rocks during the period July to September 2006. The prototype tested is 3.5-metres in diameter and can produce enough electricity for 10 houses. Full scale models will be 14 metres (or more) in diameter and of more than 1 MW in capacity (according to the site's tidal velocity regime). The hydraulic and electrical performance of the TTG was tested using an offline load bank for two months.



Installation of the turbine, September 27, 2006

After testing was completed on December 5, 2006, the TTG was connected to the control system that feeds electricity into the battery storage at Race Rocks. Clean Current's testing at Race Rocks has validated its performance claims for the direct drive permanent magnet generator and the flow enhancement duct design. The tidal turbine generator has successfully extracted power in flows up 6.6 knots. The company is disappointed with the performance of the water lubricated bearing system.

The tidal turbine generator was successfully extracted on May 24, 2007. The unit is being carefully inspected and will be refitted with a new bearing system. The same bearing system will be designed into the commercial scale unit. The retrofit will also include an improved augments duct design and an improved antifouling coating. All of the lessons learned at Race Rocks will be incorporated into the commercial scale design.



Project Partners

The project is a partnership between Clean Current Power Systems Incorporated, the Lester B. Pearson College of the Pacific, EnCana Corporation and Sustainable Development Technology Canada.

Clean Current is a private British Columbia-based company that designs and licenses technology that efficiently converts the energy of tidal currents into electricity. The Race Rocks Tidal Energy Demonstration Project was an important step in the company's technology development plan aimed at early commercialization. To ensure success Clean Current enlisted technical assistance from AMEC Americas Limited and AMEC Dynamic Structures Limited (both subsidiaries of AMEC PLC), Powertech Labs Inc. (a subsidiary of BC Hydro), OceanWorks International, Xantrex Technology Inc., Robert Allan Ltd and Triton Consultants Ltd.

Pearson College is dedicated to protecting the marine ecosystems within the reserve and to increasing the awareness of students, visitors and the public about marine systems, ecological reserves and environmental issues. Students and staff worked elements of the tidal power demonstration project into their studies. Their scope is to develop support for alternate energy technologies to make the island energy-self sufficient.

EnCana, the largest producer and developer of natural gas in North America, invested \$3 million in the project from its environmental innovation fund. Sustainable Development Technology Canada is a foundation created by the Government of Canada that operates a \$550 million fund to support the development and demonstration of clean technologies — solutions that address issues of clean air, greenhouse gas (GHG) emission reductions, clean water, and clean soil to deliver environmental, economic and health benefits to Canadians.

Cost and Financing

The total Project Cost was \$C 4,000,000, and it was made possible by a \$C 3,000,000 investment from EnCana's Environmental Innovation Fund (EEIF). Clean Current and Pearson College, the core project partners, also won a grant of just under \$1 million in 2005 from Sustainable Development Technology Canada.

Further Information

Clean Current's website: <http://www.cleancurrent.com/technology/rrproject.htm>

<http://www.racerocks.com/racerock/energy/tidalenergy/tidalenergy2.htm>