

THE RACE ROCKS TIDAL ENERGY PROJECT

Name of person filing the form

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Project name: The Race Rocks Tidal Energy Project

Project description:

Project Developer: Clean Current Renewable Energy Systems

Technology type: Horizontal axis bi-directional ducted turbine

Resource: MHK (tidal)

Project scale (test site, prototype, array, commercial): 1:5 scale Prototype

Installed capacity (MW): 65 kW

Additional Description: 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. Blade diameter of 3.5 m fixed to a pile driven 10.8 m into the rock bed.

Launch Date: September 2006

Project Website: <http://www.cleancurrent.com/technology/rrproject.htm>

Location: Located at Race Rocks Ecological Reserve in the Juan de Fuca Strait, offshore of Vancouver Island in British Columbia, Canada, 10 nautical miles southwest of Victoria. The device was installed in about 20 meters depth of water near Race Rocks.

Coordinates: 48°17'52.9"N, 123°31'53.1"W

Process status: The Clean Current tidal turbine generator (TTG) was installed during the period July to September 2006. The hydraulic and electrical performance of the TTG was tested using an offline load bank for 2 months. After testing was completed on December 5, 2006, the TTG was connected to the control system that feeds electricity into the battery storage system at Race Rocks.

The tidal turbine generator successfully extracted power in flows up 6.6 knots, but the Company was disappointed with the performance of the water lubricated bearing system. The tidal turbine generator was successfully extracted on May 24, 2007. The unit was carefully inspected and was refitted with a

new bearing system. The same bearing system was designed into the commercial scale unit. The retrofit also included an improved augments duct design and an improved fouling release coating.

Clean Current successfully redeployed the turbine at Race Rocks in October 2007 and began testing the improvements. Tests were completed with tidal currents exceeding 7 knots (3.5 m/s). The improvements to the turbine include a new bearing system, replacement of all generator connectors, improved augments duct, and new fouling release coating. The fouling release coating will require time to validate. All other improvements have been tested and are meeting expectations.

Licensing information (brief description): A joint project of the Lester B. Pearson College, EnCana Corporation and Clean Current Power Systems Incorporated to use tidal power at Race Rocks near Victoria, British Columbia in Canada.

Key Environmental issues: As a Marine Protected Area and ecological reserve, it makes sense that the environmental impact of the site, both locally and globally, be minimized. The local effects of the current energy system include noise pollution and the significant risk of diesel fuel spills during fuel transportation to and from the island. As well, emitting carbon dioxide and other gaseous combustion products is widely considered to be a global environmental problem. Reducing the impact of such an important site will show Canadian leadership in renewable energy and environmental conscience.

Environmental webpage:

<http://www.racerocks.com/racerock/energy/tidalenergy/envmonitor/envimpactmonitor.htm#Anchor-APPENDIX-4793>

Baseline and project effects studies:				
General description: Studies and collection of data prior to installation of the turbines.				
Receptor	Study description including question and/or objective (several can be listed per receptor)	Design and methods (brief description)	Results (brief description)	Status (planned, underway, completed, with dates)
Invertebrates	Document the black oystercatcher nest position.	A field visit was conducted on April 27, 2005 during a 0.39m low tide cycle.	A dGPS location and elevation (relative to chart datum) of the oystercatcher nest was documented.	Completed
Biophysical	Collect detailed biophysical information (elevation, distance, algal and invertebrate species composition) along two intertidal transects, one at the	A field visit was conducted on April 27, 2005 during a 0.39m low tide cycle.	Typical algal and invertebrate species found on the bedrock in the upper intertidal zone were listed. No rare or endangered plant or invertebrate species were noted.	Completed

	proposed revised barge landing site and one along the directional drill route.			
Bathymetry	The documentation of species and community assemblages along the cable route and at the turbine site prior to the submarine construction phase.	A combination of towed underwater video (SIMS-Subtidal Imagery and Mapping System) and diving.	A list of flora and fauna observed during both the SIMS and dive survey was created. No soft corals, Northern abalone or other rare or endangered marine invertebrates, fish or vegetation were noted. Although abalone have been documented in the vicinity of the jetty where suitable habitat exists, none were observed during the dive survey.	Completed
Fish	Presence of fish communities along the cable route and at the turbine site prior to the submarine construction phase.	A combination of towed underwater video (SIMS-Subtidal Imagery and Mapping System) and diving.	Fish species observed along the proposed cable route include kelp greenlings (<i>Hexagrammos decagrammos</i>)(both male and female), lingcod (<i>Ophiodon elongates</i>) and rockfish (Quillback, <i>Sebastes malingeri</i> and copper, <i>Sebastes caurinus</i>) with kelp greenlings most abundantly noted.	Completed
Reports and papers	- Summary Report on Environmental Monitoring Related to the Pearson College – ENCANA – Clean Current Tidal Power Demonstration Project at Race Rocks Ecological Reserve			
Research Projects	N/A			

Monitoring and adaptive management

General description: Monitoring studies completed after the installation of the turbines.

Receptor	Monitoring program description	Design and methods (brief description)	Results (brief description)	Status
Fish	As a major migration route, will salmon that normally utilize high velocities see the turbine and avoid collision?	Analyses completed by independent consultants.	The risk of impact from our rotor blades is extremely small bearing in mind that the flow spirals in a helical path through the rotor and that nature has adapted marine creatures so that they do not collide with obstructions.	Underway
Marine Mammals	Will seals collide with turbine?	Analyses completed by independent consultants.	The rotors turn slowly (10 to 20 rpm), so a collision would cause little damage.	Underway
	As a major migration route, will killer whales see the turbine and avoid collision?	Analyses completed by independent consultants.	the risk of impact from our rotor blades is extremely small bearing in mind that the flow spirals in a helical path through the rotor and that nature has adapted marine creatures so that they do not collide with obstructions (marine mammals generally have sophisticated sonar vision).	Underway
Nearfield Habitat	Marine pollution related to leakage of lubricants and the type of paint or coating that the subsurface structures would use to prevent excessive growth of marine organisms	Analyses completed by independent consultants.	There is no significant risk of leakage of noxious substances.	Underway
Reports and papers	- Summary Report on Environmental Monitoring Related to the Pearson College – ENCANA – Clean Current Tidal Power Demonstration Project at Race Rocks Ecological Reserve			
Research Projects	N/A			