

## PROJECT SITE METADATA SURVEY FORM

Name of person updating the form

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Date submitted

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**Project Name:** Race Rocks Tidal Energy Project

Planned

In-Operation

Completed

Canceled

**Project Description:**

*Project Developer:* EnCana Corporation

*Technology Developer:* Clean Current Renewable Energy Systems

*Technology type:* Horizontal axis bi-directional ducted turbine

*Resource (wave, tidal):* Tidal

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

*Installed capacity (MW):* 65 kW

*Project Website:* <http://www.cleancurrent.com/>

*Launch Date:* September 2006

*End Date (if applicable):* September 2011

*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.

**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:* 48.29802°, -123.53141°

**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: 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.cleancurrent.com/environment>

Baseline studies and project effects studies: Race Rocks Tidal Energy Project				
General description		Studies and collection of data prior to installation of the turbine.		
Receptor	Study description including question and/or objective	Design and methods	Results	Status
Invertebrates	Document the black oystercatcher nest position.	A field visit was conducted on April 27, 2005 during a 0.39m low tide cycle.	A GPS 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 proposed revised barge landing site and one along the directional drill route.	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
Bathymetry	The documentation of species	A combination of	A list of flora and fauna	Completed

	and community assemblages along the cable route and at the turbine site prior to the submarine construction phase.	towed underwater video (SIMS-Subtidal Imagery and Mapping System) and diving.	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.	
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 malinger</i> and copper, <i>Sebastes caurinus</i> ) with kelp greenlings most abundantly noted.	Completed
<b>Reports or Papers</b>	<ul style="list-style-type: none"> <li>Summary Report on Environmental Monitoring Related to the Pearson College – ENCANA – Clean Current Tidal Power Demonstration Project at Race Rocks Ecological Reserve.</li> </ul>			
<b>Research Projects</b>	N/A			

Monitoring and adaptive management: Race Rocks Tidal Energy Project				
General description		Monitoring studies completed after the installation of the turbine.		
Receptor	Monitoring program description including question and/or objective	Design and methods	Results	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	Will seals collide with	Analyses completed by	The rotors turn slowly (10 to 20	Underway

Mammals	turbine?	independent consultants.	rpm), so a collision would cause little damage.	
	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
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<b>Research Projects</b>	N/A			