

***A Response to the Nova Scotia Department of Energy
Request for Public Submissions
Regarding Marine Renewable Energy Legislation***

by

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***Marine renewable energy legislation in Nova Scotia should be
designed to achieve three long-term provincial goals***

I. Province of Nova Scotia should become permanently energy self-sufficient in reliance on indigenous renewable energy resources, the most important of which is tidal electricity.

It is best for all jurisdictions to not be dependent on foreign energy sources, since foreign sources are less reliable than local sources. Foreign sources can fluctuate due to political changes and/or civil unrest in the supplier country, changes in global market conditions and, speaking more broadly, international conflict affecting the harvest, transport and delivery of energy.

Renewable energy sources are superior to non-renewable energy sources by virtue of being generally less polluting than non-renewable fossil fuel sources and renewable or, by definition, perpetual and therefore more stable than non-renewable (i.e., exhaustible) energy sources.

In Nova Scotia, tidal electricity is the most obvious, essentially undeveloped renewable resource. Tidal energy has three virtues over other obvious renewable energy sources in Nova Scotia.

First, tidal energy is likely more quantitatively significant than Nova Scotia's wind and solar energy resources, although it is difficult to predict acceptable tidal energy extraction maxima in advance. That is to say, one needs to monitor environmental and ecological impacts of energy extraction both before any energy is extracted and as energy extraction is initiated and gradually increased. If environmental/ecological effects become unacceptable, one will need to either modify the extracting device to reduce impact, or remove the extracting device. Using such a real-time empirical monitoring protocol, tidal energy extraction maxima can be safely determined.

Second, both solar and wind renewable energy resources may be impacted by global climate change. For example, both the direction and velocity of wind could change if global weather patterns are modified. In addition, shifts in weather patterns could alter the average number hours of sunlight in Nova Scotia.

Tidal flows, on the other hand, are likely not altered by global climate change, since the ultimate source of tidal kinetic energy is the universal force of gravity, which is not subject to modification by events occurring on this planet.

Admittedly, Nova Scotia's tidal energy resource could conceivably be diminished by global climate change, if such changes alter the geologic features which support tidal currents in Nova Scotia. For example, if rising sea level and increasing storm intensity eventually were to erode the Isthmus of Chignecto, less tidal flow might be forced into the Minas Channel/Passage. Instead, some of this water would vent directly into Northumberland Strait, and thereby reduce the velocity of tidal flows in the Minas region of the Upper Bay of Fundy, Nova Scotia's premier tidal electricity resource.

However, if this erosion were to be gradual, it may be possible to armor the Isthmus of Chignecto. Armoring the Isthmus could prevent the creation of a direct communication between the Bay of Fundy and Northumberland Strait, thereby preserving the tidal currents in the Minas region indefinitely.

The third advantage tidal energy has over wind and solar sources is its precise predictability. In terms of societal planning, energy predictability is of great significance. With tidal generation, cycles of generation and storage can be coordinated with daily, weekly, seasonal, and annual electricity demand patterns. This is not possible with non-periodic intermittent renewable energy sources such as solar and wind.

Marine Renewable Energy Legislation should be directed towards supporting a thousand years of tidal energy in Nova Scotia

II. The Province of Nova Scotia should develop a globally competitive economy based on inexpensive, predictable tidal electricity.

In the future, electricity will likely be increasingly used to deliver energy to its applications. Presently, electricity is the major energy currency of energy for illumination, household appliances and industrial equipment. It is also a major source of energy for space heating and cooling in the residential, municipal and industrial sectors.

In addition, electricity may eventually provide significant energy for transportation through the use of gasoline-electric hybrids, electric vehicles with fossil fuel backup, all-electric vehicles or vehicles powered by hydrogen made with tidal electricity. Hence, inexpensive tidal electricity could become the foundation of a globally competitive provincial economy with a high standard of living, perhaps even one not dependent on federal/provincial transfers to balance its budget.

To facilitate the emergence of Nova Scotia's tidal electricity industry, marine renewable energy legislation should pursue two tacks.

First, it should support the development of the marine industries to provide the components of the tidal electricity industry, such as surface and submersible vessels capable of precise maneuvers in strong tidal currents. Both surface and submersibles will be necessary to deploy, service, repair and remove tidal current harvesting devices, and their associated components such as cables, in the Minas region of the Upper Bay of Fundy.

Further, to assist stabilization in turbulent tidal flows, all submersibles and all tidal electric devices deployed in the Minas region of the Upper Bay of Fundy should share universal docking devices. This should be an early requirement, probably at the regulatory level.

The second tack marine renewable energy legislation should pursue is the support of technologies for the industrial-scale storage of (tidal) electricity. Thus electricity generated in excess of demand during flood tide could be stored and delivered to meet demand during slack tide.

These electricity storage modalities should minimally include pumped storage as gravity-based potential energy, chemical storage using industrial-capacity batteries and chemical storage as hydrogen or ammonia. Eventually, Nova Scotia should become an exporter of technologies for the storage of intermittent renewable energy from all sources, including tidal, wind, solar generation.

III. The Province of Nova Scotia should exert more control over the development of its tidal resource.

The current confused, conflicted, complicated approach should be abandoned because it is both unsuccessful and unlikely to become successful.

The collective intelligence of the Nova Scotia Department of Energy, Nova Scotia Power Incorporated, Minas Basin Pulp and Power and representatives of academia in Nova Scotia has failed in at least two major aspects of tidal industry development.

The first failure of the collective intelligence described above was to deploy an expensive device in the absence of critical preliminary data. These preliminary data would include an annual census of the animate and inanimate sub-surface traffic through the Minas Passage, or, failing that, even the annual submarine traffic at the deployment location prior to installation of the \$10 million OpenHydro tidal electricity device on November 12, 2009.

Failure to adequately characterize the premier tidal electricity resource in Nova Scotia prior to device deployment appears to have had almost immediate consequences. Communication with the deployed device was lost within two weeks of submersion in the Minas Passage. Further, upon gross examination using a submerged video camera during the spring of 2010, when weather permitted surface vessel access to the deployment site, the device was seen to have sustained obvious damage, specifically at least two of its electricity-generating blades have been broken.

A rather simple hypothesis, based on the functional and physical damage, is that the device was disabled by contact with a submerged material, which was transiting the Minas Passage, propelled by tidal currents to the site of the device deployed to harvest kinetic energy from these same tidal currents.

The second failure of the collective intelligence described above was to deploy a \$10 million, 400 tonne device with no method of access for repair or service or routine maintenance. As a consequence, this device must be retrieved for forensic examination and repair.

Deployment of a \$10 million device into uncharacterized waters is a reckless expenditure of public money. Further, deployment with no means of repair or service is at a variance with both common sense and basic engineering protocols.

The current confused, conflicted, complicated unsuccessful approach is unlikely to become successful for three reasons.

First, this approach has been heavily reliant on secrecy. For example, data generated using public money has not been peer reviewed. Nor has this data been made available for public inspection even in a non-peer-reviewed state. Specifically, in spite of a formal request over 6 months ago, consultants reports have not been made public. Hence, the public of Nova Scotia, who are, through taxes and electricity costs, supporting the tidal electricity initiative, could not evaluate the decision to deploy an expensive prototype in 2009.

Second, the tidal electricity initiative is lead by members of the economic oligarchy in Nova Scotia, whose mutual interest are in conflict with the interests of the people of Nova Scotia. Thus, companies are profit-driven and academics want money for research.

Third, the leaders of the tidal electricity initiative have created complex dysfunctional patterns of conflicted interest to maximize control. For example, representatives of private sector companies and academia sit on multiple boards and committees, whose mandates conflict. Specifically, one of the private sector proponents of a tidal electricity technology has representatives on the FORCE Board and the environmental committee monitoring FORCE.

Further, one member of the Board of FORCE co-chairs the environmental committee monitoring FORCE. In addition, the chair of the board of FORCE holds a senior position at one of the private sector companies seeking to test a tidal electricity technology at the facility run by FORCE.

This highly conflicted economic oligarchy should be replaced with provincial control of the tidal resource and selected components of the electricity infrastructure in Nova Scotia. Elected officials and senior civil servants should make all significant decisions, and be held so accountable, thereby decreasing the influence of Nova Scotia's oligarchs and increasing the likelihood that the public's interests will be protected.

Specifically, the electricity grid should be nationalized. The fossil fuel generating facilities should remain privatized. For now, emerging technological development may be contracted out to venture capitalist-funded firms. Eventually, Nova Scotia should develop its own tidal electricity industry as described above.

Under no circumstances should Nova Scotia's tidal resource be removed from the direct control/ownership of the people of Nova Scotia.