

Nova Scotia Tidal Energy



The power of the highest tides in the world. The plan to harness it.

Fundy Power

The Resource

Nova Scotia is home to the Bay of Fundy, where roughly 160 billion tonnes of water flow twice a day. That's more than four times the combined flow of every freshwater river in the world.

Tides moving from the outer Bay into the smaller Minas Basin can reach peak surface speeds of 5-6 metres per second, and rise up to 17 metres vertically – the height of a five-storey building. The flow of each tide delivers a commercial potential of approximately 2,500 megawatts (MW) of power, equivalent to the peak consumption of energy used in Nova Scotia. Nova Scotians have long been aware of the power of the Bay of Fundy, building tidal mills as early as 1607, and constructing a tidal power plant in 1984 in Annapolis Royal – one of only three in the world. The Fundy tides developed responsibly could play a much larger role in Nova Scotia's energy future.

The Opportunity

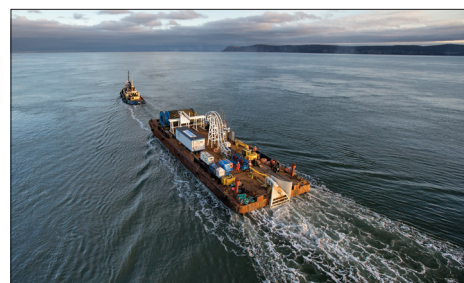
Nova Scotia is a leader in the global tidal energy industry. The province is home to a world class ocean technology sector and a network of active, high-profile marine researchers. Tidal energy is a clean, predictable, and renewable energy source.

Tidal energy has the potential to contribute \$1.7 billion to the province's gross domestic product (GDP). Already, Nova Scotia companies are benefiting from the opportunity to participate in local projects, developing skills and products that will help them reach global markets.

A Plan to Harness It

To develop the Bay of Fundy's resource, the Province of Nova Scotia has taken a number of strategic actions:

- Supporting the Fundy Ocean Research Center for Energy (FORCE)
- Continuing research on engineering, scientific, environmental and socio-economic aspects of tidal energy, and activities of the Fundy Energy Research Network (FERN) and the Offshore Energy Research Association (OERA)
- Developed the Marine Renewable Energy Strategy, establishing the Marine Renewable-energy Act and created feed-in tariffs for large and small-scale projects
- Supporting and encouraging opportunities for our Nova Scotia supply chain
- Developed a Statement of Best Practices for In-Stream Tidal Energy Development and Operation



In 2014, FORCE successfully deployed four subsea power cables, allowing for 64 MW of capacity to be installed at its site.

Bay of Fundy

"One of the best places for tidal power in the world."

James Ives, CEO, OpenHydro

FORCE

FORCE (Fundy Ocean Research Center for Energy) is Canada's leading test centre for in-stream tidal energy technology. FORCE collaborates with industry, government, and researchers to study the interaction between tidal turbines and the Bay of Fundy environment.

FORCE provides a shared observation facility, submarine cables, grid connection, and environmental monitoring at its test site. The site is ideal for testing, with water depths of 30 to 45 metres at low tide, a bedrock sea floor, straight flowing currents, and peak surface speeds of up to 6 metres per second. FORCE also conducts innovative research, including the deployment of the Fundy Applied Sensor Technology Platform (FAST) and Vectron Project, designed to improve environmental monitoring at the site.

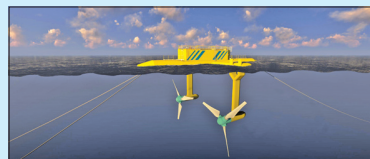
Nova Scotia has permitted five participants to test commercial-scale devices at FORCE:

- Minas Energy
- Black Rock Tidal Power (Schottel Hydro, Tidal Stream, local and national partners)
- Atlantis Operations Canada, with DP Energy, Lockheed Martin, and Irving Shipbuilding
- Cape Sharp Tidal Venture (OpenHydro and Emera)
- DP Marine Energy

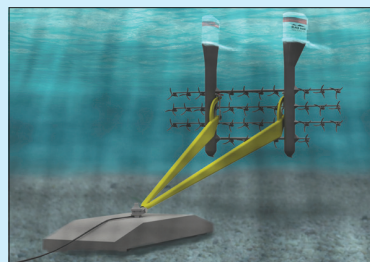
In 2009, Nova Scotia Power Inc. and OpenHydro deployed the first commercial-scale device (1 megawatt) in North America at the FORCE test site. The successful deployment and retrieval of the device resulted in a greater understanding of the environment in the Minas Channel and of the operational challenges of working in the strong current of the Bay of Fundy.

FORCE has received funding support from the Government of Canada, the Province of Nova Scotia, Encana Corporation, and participating developers. More information is available at fundyforce.ca

Developers & Technologies at FORCE:



Minas Energy



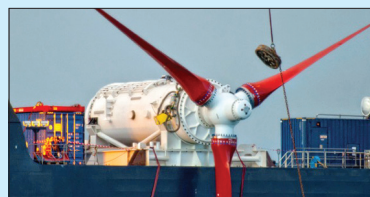
Black Rock Tidal Power



Atlantis Operations Canada



Cape Sharp Tidal Venture



DP Marine Energy

A Plan Forward

In May 2012, the Province released its Marine Renewable Energy Strategy. The Strategy sets out broad policy, economic, and legal conditions for projects, technologies, and services in anticipation of commercial development and the establishment of a new industry.

The Strategy consists of three main plans – research, development, and regulatory. These plans will help to achieve

Nova Scotia's vision to be a global leader in the development of technology and systems that produce environmentally sustainable and competitively-priced electricity from the ocean. The Strategy first articulated the Province's objective of harnessing 300 MW of in-stream tidal post-2020. To view the Strategy, visit energy.novascotia.ca

Legislation

In December 2015, the Province's Marine Renewable-energy Act was passed to provide a clear, predictable and efficient process to support the sustainable growth of the sector. It will do this in such a way that will protect the environment, respect community and local needs, and ensure that Nova Scotians benefit.

The Act will apply to key areas of marine renewable energy priority in the province – within parts of the Bay of Fundy and Cape Breton Island's Bras d'Or Lakes. Marine renewable energy projects will not be able to proceed in these areas without approval from the Minister of Energy. In addition, the Act formalizes the Strategic Environmental Assessment process, establishes an in-depth consultation process prior to the designation of space used for commercial generation known as 'Marine Renewable-electricity Areas', and establishes a licensing and permitting regime for effective oversight of marine renewable-energy projects.

Feed-in Tariffs (FIT)

The Community Feed-in Tariff (COMFIT) Program provides projects owned by community-based entities the opportunity to participate in the production of renewable electricity. Eligible groups receive price certainty (65.2 cents per kilowatt hour) for a period of 20 years for smaller-scale distribution-connected tidal projects. To-date, COMFIT approvals have been granted to Fundy Tidal Inc. for in-stream tidal energy projects.

The Developmental Tidal FIT for tidal devices greater than 500 kilowatts was set by the Nova Scotia Utility and Review Board in 2013 and approvals were issued to the berth holders at the FORCE site. The Province has limited these developments to a maximum of 2% impact on electricity rates to limit the cost impact on ratepayers.

With the introduction of the 2015 Electricity Plan, the Province has ended its feed-in tariffs program for new applicants in favour of more transparent and competitive processes for new renewable electricity generation.

"Nova Scotia's commitment to tidal energy has put our province in a leadership position in the global tidal energy industry." John Woods, VP Energy Development, Minas Energy

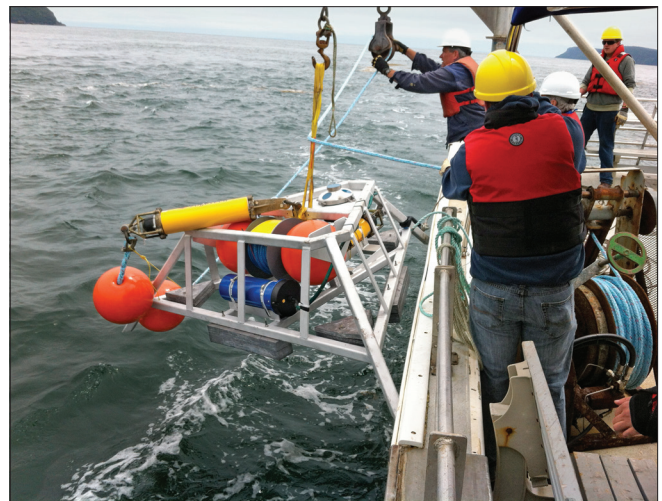
Research & Monitoring

The Bay of Fundy is an important environmental, historical, biological, and socio-economic resource to Nova Scotia. Research and monitoring plays a critical role in determining public acceptance of the emergent tidal energy industry and its possible impacts on the environment. Therefore, supporting research and monitoring represents one of the Province's strategic priorities in developing tidal energy.

In 2007-2008, with provincial funding, the Offshore Energy Research Association of Nova Scotia (OERA) carried out a Strategic Environmental Assessment (SEA) focused on tidal energy in the Bay of Fundy in order to receive feedback on whether, and how, to proceed with potential development.

In 2014, an update to the 2007 Fundy SEA was completed, as was an SEA for the Cape Breton coastal region including the Bras d'Or Lakes. Additional OERA research areas include tidal resource assessment, sediment dynamics, marine mammal and fish behaviour, near and far field effects, potential effects of ice and debris, and potential effects of tidal lagoons. Learn more about OERA at oera.ca

FORCE has ongoing environmental effects monitoring in place for the test site, with a particular emphasis on fish and



Researchers deploying monitoring equipment in the Bay of Fundy. Photo courtesy of FORCE.

marine mammals. This ranges from fish tagging and acoustic monitoring for marine mammals to marine bird surveys, as well as fish migration echo sounder and netting trials. Monitoring data is available to the public at fundyforce.ca/monitoring

Continued research will be vital to Nova Scotia's responsible development of tidal energy.

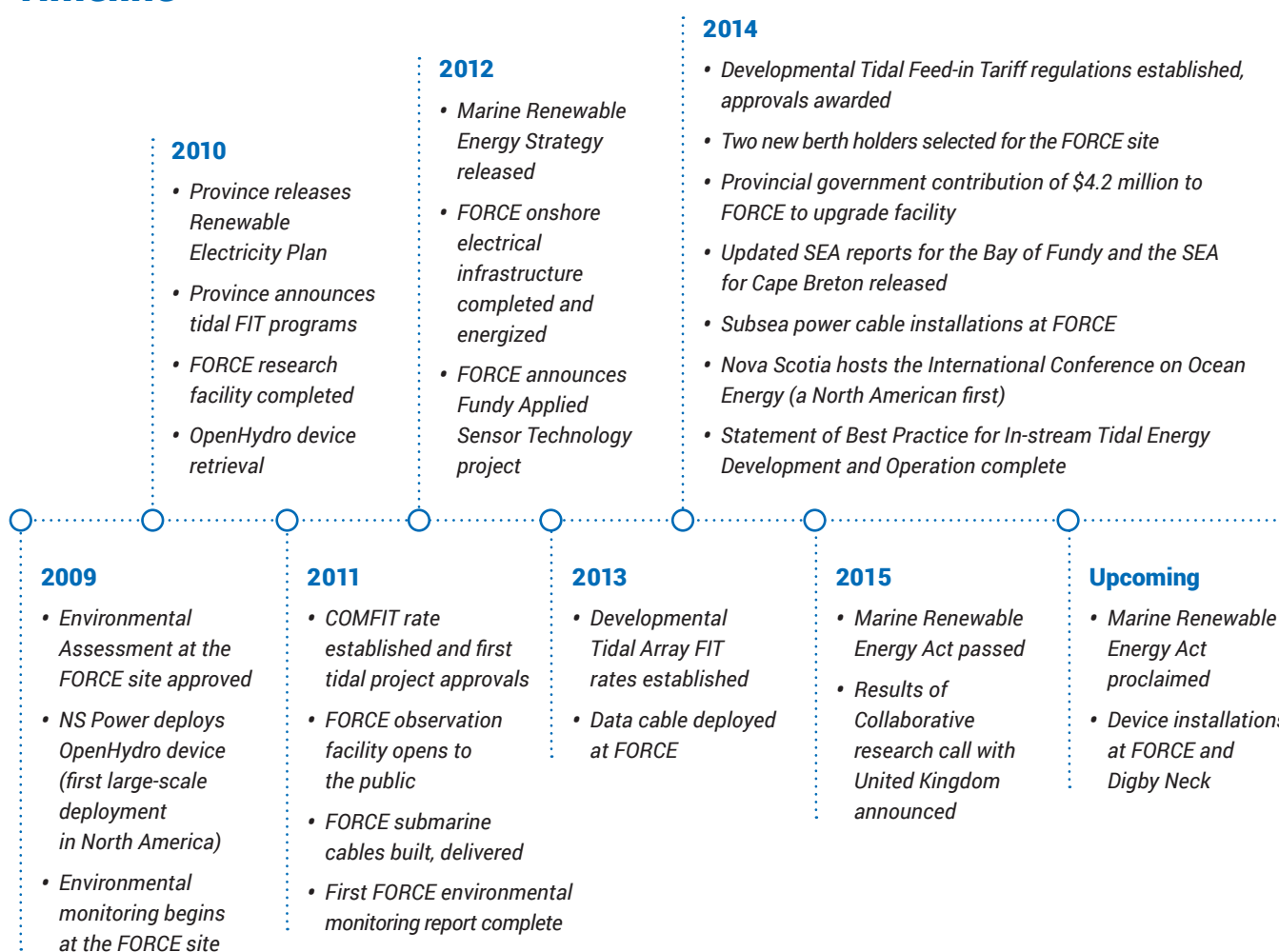
Supply Chain Opportunities

Nova Scotia is well positioned to capitalize on the economic benefits associated with tidal energy. The province has over 300 ocean technology firms – the largest concentration in North America. Many of our small- and medium-sized enterprises with proven capabilities in environmental research, resource assessment, fabrication, and innovative design are already engaged in the tidal energy sector. In fact, estimates suggest that Nova Scotia will be able to provide as much as 70% of the

content for local projects, which will develop our capabilities to participate in global markets.

The Province is committed to leveraging our existing supply chain and helping to build additional capacity to support this growing industry. Nova Scotia Business Inc. and Innovacorp can help businesses with investment, identifying trade opportunities, and through programming support. For more information visit: novascotiabusiness.com or innovacorp.ca

Timeline



Contact

Sustainable and Renewable Energy Branch
Nova Scotia Department of Energy
902.424.4575

energy.novascotia.ca
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