

# Imagine the power of the highest tides in the world. Imagine the technology to harness it.

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

FORCE's test site is in the Minas Passage area of the Bay of Fundy near Parrsboro, Nova Scotia, Canada.



FORCE installs one of four power cables along the Minas Passage sea floor in October, 2014.

About 160 billion tonnes of water flows through the Bay of Fundy each tide, equal to four times the estimated flow of all the freshwater rivers in the world combined.

About 14 billion tonnes of that water passes through the Minas Passage, helping to create the highest tides in the world.

Research suggests up to 2500 megawatts of clean, renewable energy may be safely extracted from the Minas Passage, equal to power for nearly one million homes.

FORCE provides a shared observation facility, submarine cables, grid connection, and environmental monitoring at its pre-approved test site.

Four submarine cables give FORCE the highest power capacity of any in-stream tidal site in the world (64 megawatts).



11 km of 34,500 volt submarine cable.

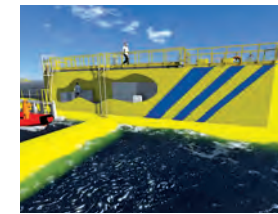


Connection to the power grid.



Ongoing research and environmental monitoring.

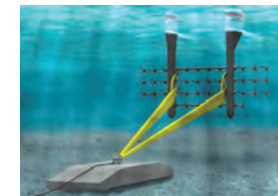
## Participants



Minas Energy's technology partners are Marine Current Turbines and Blue Water Energy Services.



OpenHydro tested North America's first commercial-scale turbine at FORCE (2009) and returns with a 2-MW turbine.



Black Rock Tidal Power is supported by SCHOTTEL's experience in propulsion design.



Atlantis Resources is partnered with Lockheed Martin and Irving Shipbuilding.

## Tidal Technology

"In-stream" tidal turbines tested at FORCE are designed to use the flow of the water as a source of power, the way a windmill uses wind.

Tidal turbines do not need to spin as fast as windmills to generate power, because water is roughly 800 times denser than air. Power goes up exponentially with speed; every time water speeds double, power goes up eight times!

## The Fundy Standard

Tidal devices operating in the Bay of Fundy may experience tides moving at speeds over 18 kilometres per hour, expanding up to five kilometres over flat ground, and rising up to 16 meters vertically – the height of a five-storey building.

If you can produce power under these conditions, and produce it safely and reliably, you've met the Fundy Standard.

## A History of Innovation...

**2009**

Nova Scotia Power tests a one-megawatt OpenHydro turbine at FORCE.



**2012**

New substation and transmission lines built.



**2014**

Wired for power: four subsea power cables installed at FORCE.



**2008**

Minas Energy leads site development and approvals.



**2011**

FORCE observation facility opens its doors.



**2013**

Team installs first data monitoring cable at FORCE (in a blizzard).



**2015**

Advanced sensor platform constructed.







*Sensing equipment is lowered to the sea floor 40 meters below where it will measure current speeds by sending acoustic pings through the water column.*



*This new FAST platform will carry ocean monitoring sensors into extreme underwater conditions.*



# FUNDY OCEAN RESEARCH CENTER FOR ENERGY

## FORCE Visitor Centre

Open spring to fall, offering educational exhibits, interactive displays, a small theatre, and a direct view of the ocean test site.

## Location

1156 West Bay Road, 10 km west from Parrsboro, Nova Scotia, Canada.

**Tel:** 902.254.2510

**Email:** [visitor.centre@fundyforce.ca](mailto:visitor.centre@fundyforce.ca)

**Web:** [fundyforce.ca/visit](http://fundyforce.ca/visit)

[facebook.com/fundyforce](https://facebook.com/fundyforce)

[twitter.com/fundyforce](https://twitter.com/fundyforce)

## Hours of Operation

10:00 a.m. - 5:00 p.m. daily in July and August.  
Reduced hours in spring and fall. Closed in winter.

## Marine Operations

Safety comes first at FORCE – our people work in tides that equal the power of a class four hurricane. Any marine operation involves dedicated planning, including a combination of tide modeling, weather monitoring, back-up communication systems, as well as vessel and equipment rehearsals.

## Environmental Monitoring and Research

FORCE's environmental monitoring program, in place since 2009, is designed to better understand the effects turbines have on the environment, and to report those effects to the public. Studies relating to lobster, fish, marine mammals and other environmental variables are all shared online.

FORCE receives ongoing monitoring advice through an independent environmental monitoring advisory committee, with membership from the scientific, fishing, and First Nations communities.

## FAST (Fundy Advanced Sensor Technology) Program

The need for reliable site data has led to the creation of new subsea monitoring platforms – designed to work reliably in the hurricane-like conditions of the Minas Passage. These platforms support new ways of capturing data in high flows, improving both turbine development and environmental monitoring.

## Participation and Support

FORCE is a non-profit institute, supported by the Governments of Canada and Nova Scotia, Encana Corporation, and participating developers. FORCE is administered by a board of directors, aided by environmental monitoring and community liaison advisory committees, and graciously supported by many other partners.