

Nova Scotia Power Stream Tidal



**2006 OREG Fall Symposium
Halifax, NS December 1, 2006**

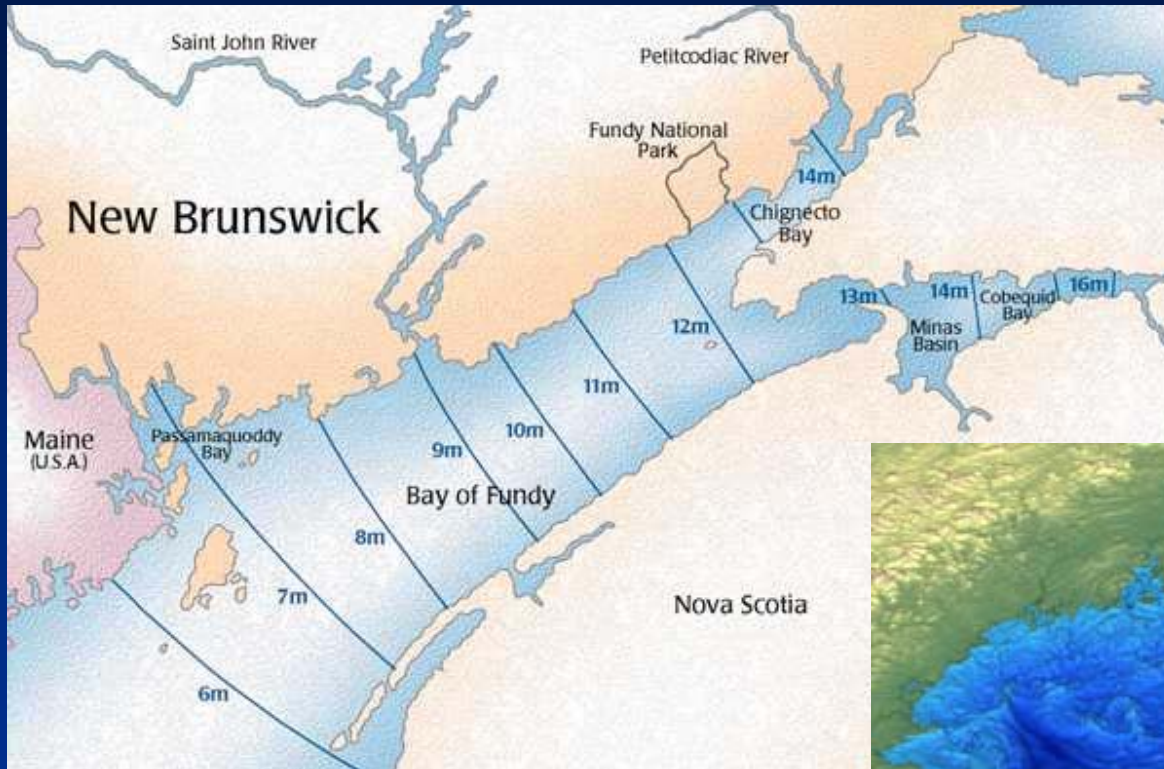
Renewable Energy

- Commitment to growing renewable energy
 - *NSPI has more generation from wind than the other Atlantic Provinces combined*
 - *Over 200 GWh annually from new renewable sources*
- Growing electrical demand
- EPRI North American jurisdictions study
- Nova Scotia side of the Bay of Fundy identified as the best location to develop tidal power in North America

Renewable Energy Comparisons

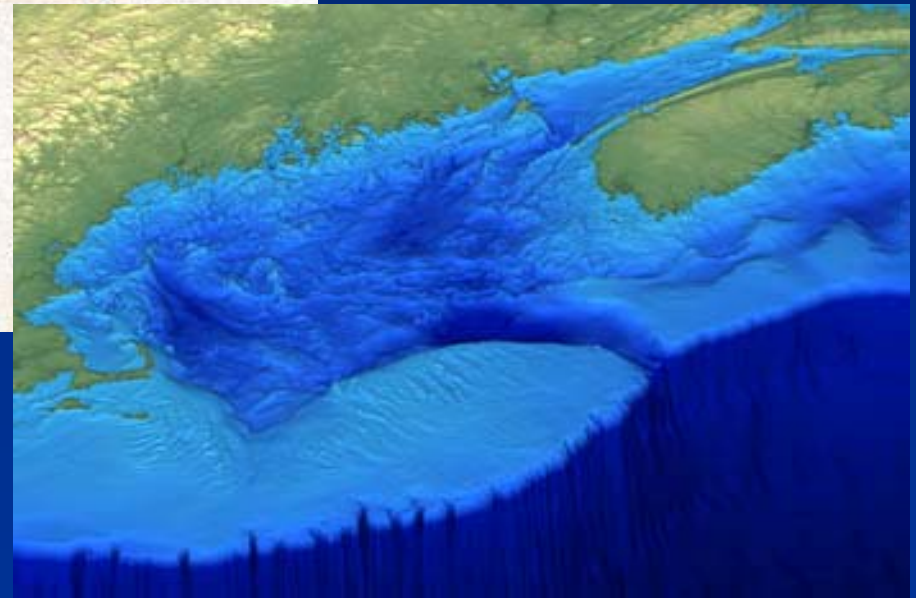
	Solar	Wind	Wave	Tidal Stream
Development Status	Early Commercial	Mature Commercial	Pre-Commercial	Pre-Commercial
Source	Sun	Uneven solar heating	Wind blowing over water	Gravity of moon & sun
Annual Average Power Density	0.175 - 0.2 kW/m ² (fixed tilt at latitude Winnipeg - Calgary - Edmonton)	0.6 - 1 kW/m ² (Rocky Mountains, offshore BC)	30 - 45 kW/m (Pacific Coast) 10 - 25 kW/m (Atlantic Coast)	4 - 9 kW/m ² (Minas Basin) 0.5 - 2 kW/m ² (other Fundy sites)
Intermittency	Day-night; clouds, haze, and humidity	Atmospheric fronts and storms (local winds only)	Sea (local winds) and swell (from distant storms)	Semi-diurnal (four daily peaks, flood & ebb, advancing ~50 min./day)
Predictability	Minutes	Hours	Days	Centuries

Estuary Influences: Funnelling and Resonance



The natural seiching period along the basin formed by the Gulf of Maine and the Bay of Fundy is very close to the periods of the main lunar semi-diurnal constituent and the lunar orbital constituent (M2 and N on next slide)

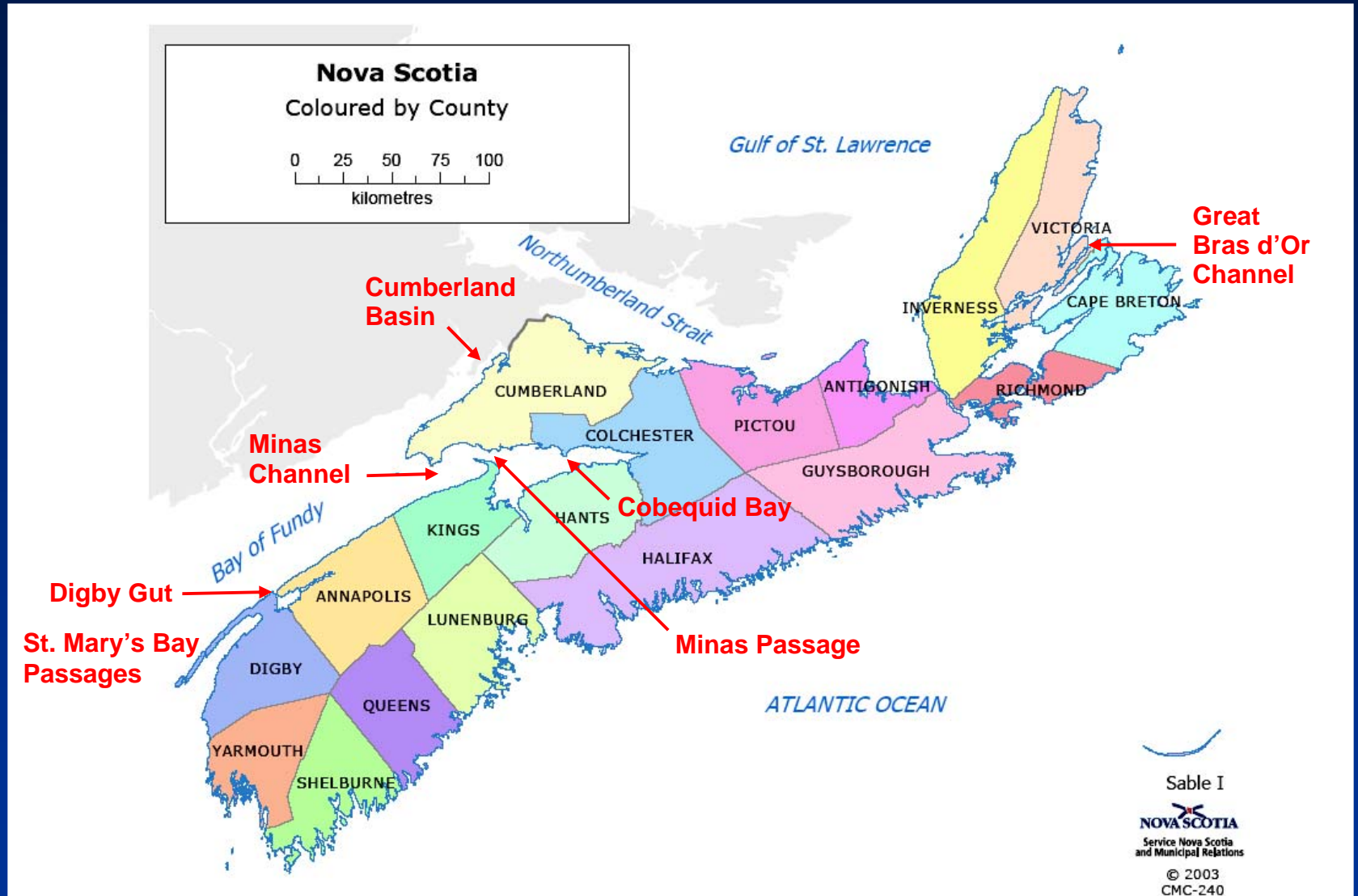
Tidal range increases as depth and width decrease farther into the Bay of Fundy. The highest recorded tidal range off Burntcoat Head in Cobequid Bay is 16.3 m, and the mean tidal range there is 12.1 m.



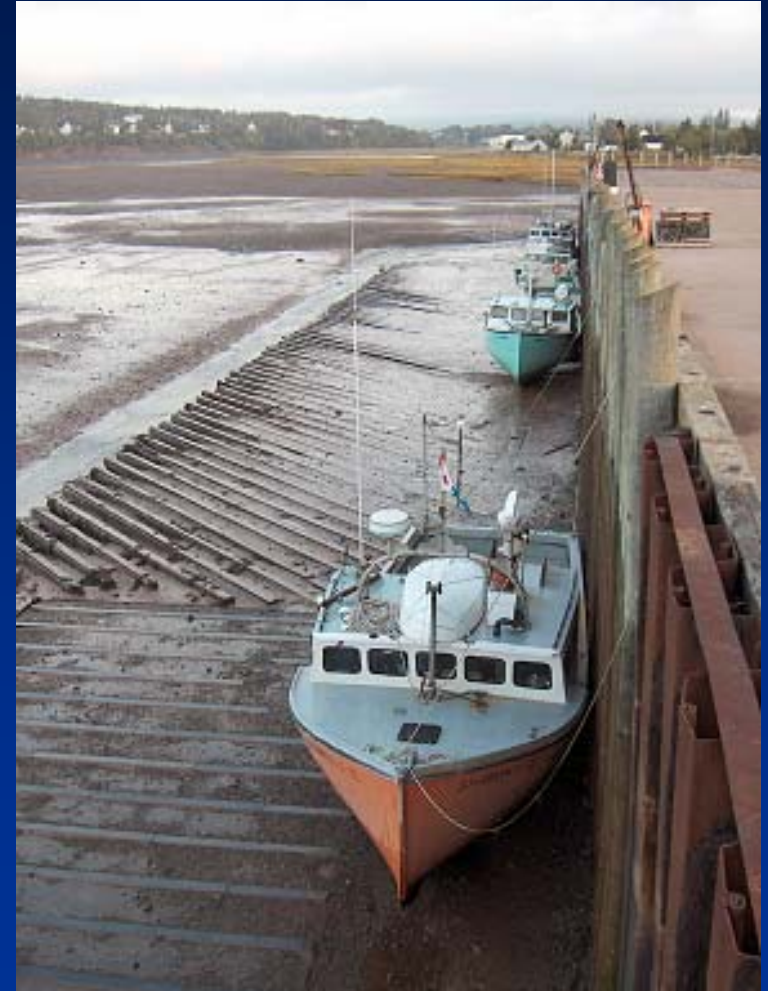
NSPI Annapolis Tidal Station



Eight Potential Stream Tidal Sites Surveyed



Minas Passage – Opportunity



Minas Passage Commercial Potential

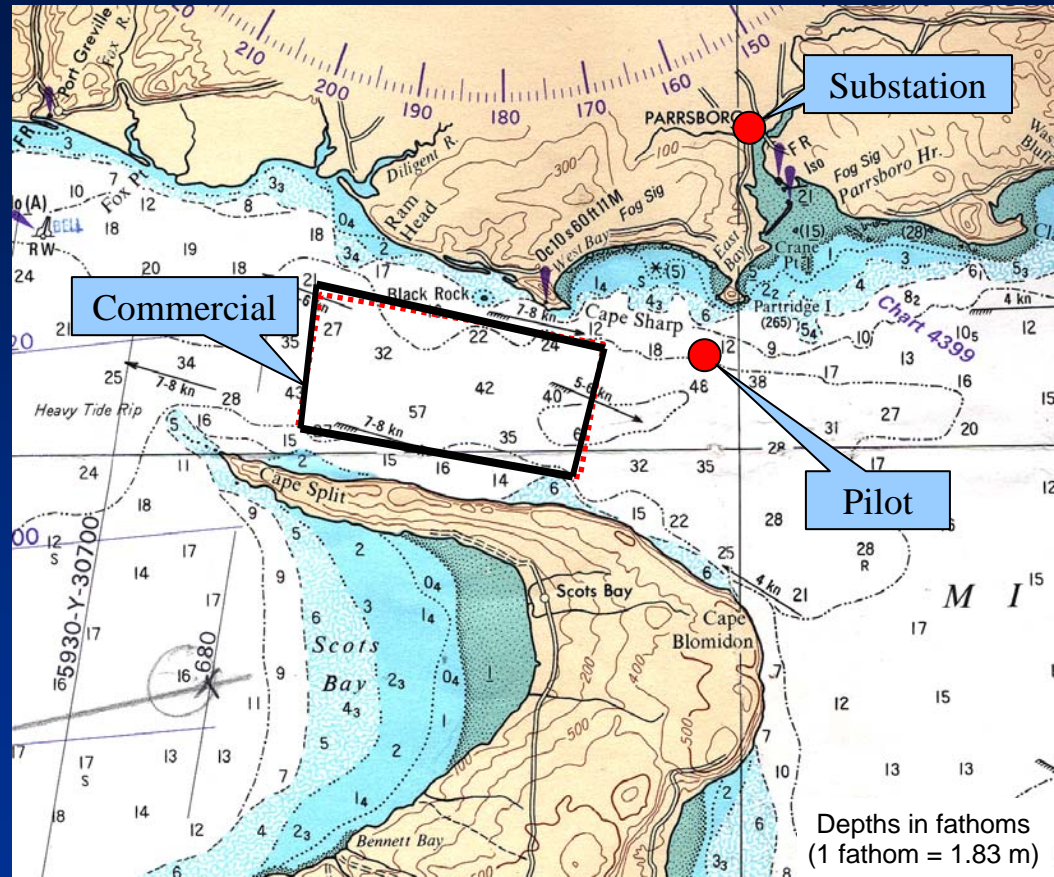
Commercial project site large enough to:

- Extract an average of ~150 MW using totally submerged technology

EPRI estimates physical resource to be 1,010 MW (annual average power)

- EPRI-imposed environmental extraction limit is 15% of physical resource, which would limit average extraction to ~150 MW

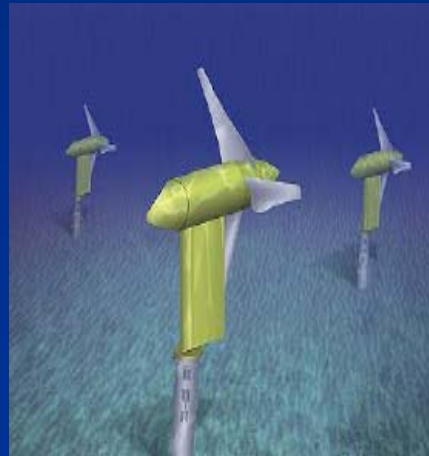
Recently released *Inventory of Canada's Marine Renewable Energy Resources* (Report No. CHC-TR-041, April 2006) has independently estimated Minas Passage resource in two different ways that yield larger values: 1,900 MW and 2,850 MW



Verdant Power

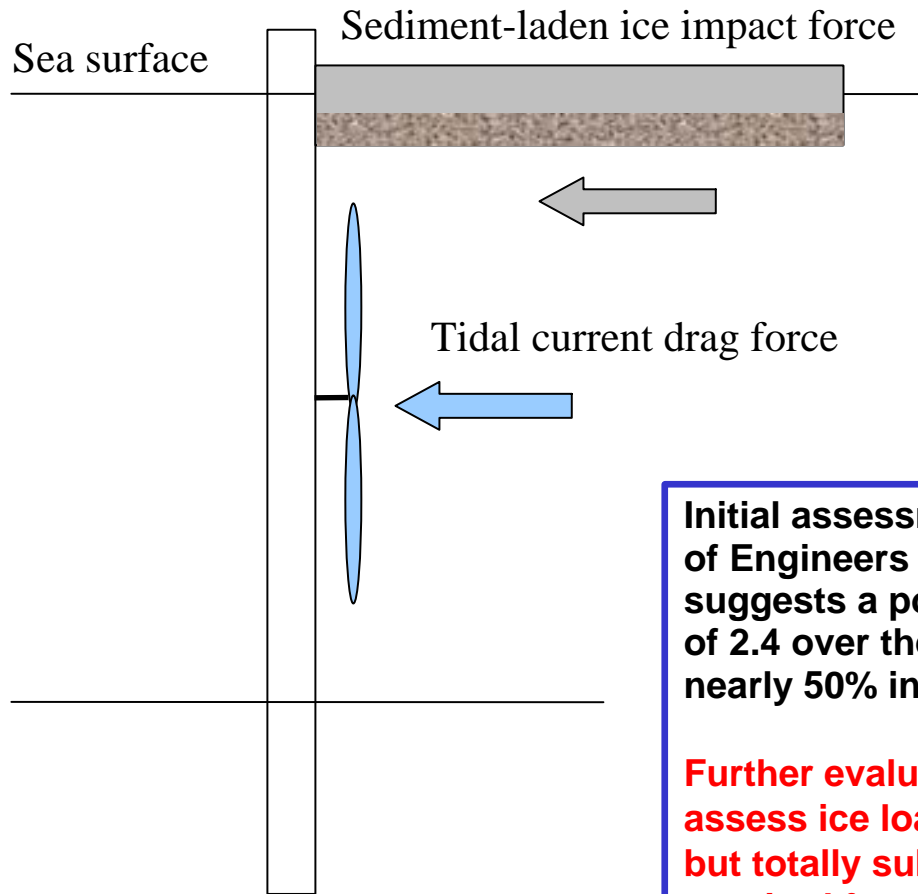


Six-turbine, 200 kW test array to be installed for 18 months in East River, New York City for environmental monitoring pursuant to FERC commercial project licensing



Downstream, 3-blade rotor; yaws to accommodate reversing flow

Impact of Floating Ice



Initial assessment based on US Army Corps of Engineers *Ice Engineering* design manual suggests a potential monopile weight increase of 2.4 over the baseline design, resulting in a nearly 50% increase in the cost of energy.

Further evaluation required to more accurately assess ice loads on surface-piercing monopile, but totally submerged solution likely to be required for commercial scale project

Next Steps

- Demonstration project
 - *Demonstrate in the MW scale*
 - *Demonstrate energy removal, effects on eco-system, relationship with aquatic life*
 - *Establish operating and maintenance practices*
- R&D
 - *Possible expansion of demonstration to a multi-berth test facility*
 - *Fully characterized and monitored for aquatic life, bathymetry and velocity*
 - *Accelerate technologies to commercial level*