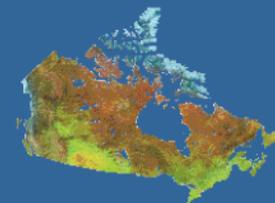


IEA-RETD Workshop:  
Capitalizing on Renewables: Short- and Medium-Term  
Opportunities and Economic & Employment Impacts



# Marine Renewable Energy: Global and Canadian Overview

Michael Paunescu  
Natural Resources Canada  
Ottawa, Ontario  
September 27, 2012

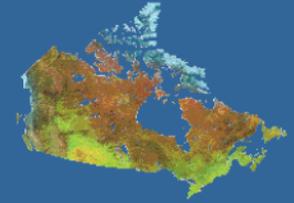


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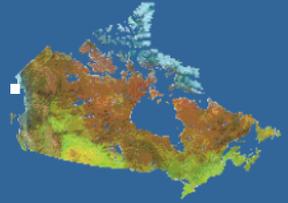
# Outline



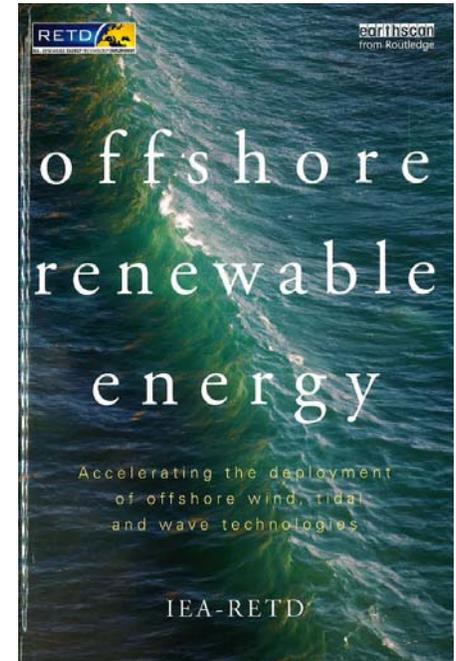
1. Global Marine Renewable Energy: Status and Potential
2. Canadian marine renewable energy: Status, Potential and Targets
3. Capitalizing on Marine Renewable Energy
4. What is happening in Canada: federal and provincial governments' actions



# 1. Marine RE has significant potential...



- In February 2011, the IEA-RETD released the results of its ADORET study:
  - Offshore renewables can contribute significantly to world energy generation, under the right conditions.
  - Offshore wind is the frontrunner; wave and tidal devices under development without any clear winner to date.
- World theoretical resource for offshore renewables is 260,000 – 330,000 TWh/year,
  - ...although practical potential will be lower (the global figure is not yet available).
  - most of which would be offshore wind and wave; tidal smaller contribution
- World electricity consumption grew more than 6% in 2010 to reach over 21,500 TWh
  - Growing electricity demand is expected to continue to create a significant burden on global resources.



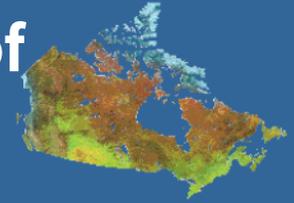
This report is available at <http://iea-retd.org>



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...and the forecasted growth is the proof



## Offshore wind is already commercial, wave and tidal technologies are reaching full scale demonstrators



- Commercial offshore wind projects operational since the 1990s.
  - 4.1 GW – global offshore wind power installed capacity in 2011
  - U. K. (2.1 GW), Denmark (0.9 GW), China (0.26 GW), Netherlands (0.25 GW), and Germany (0.2 GW)
  - 26 GW in 2017 – U.K. (7.4 GW), China (7.0 GW), Germany (4 GW), Denmark (1.7 GW) and France (1.5 GW)
- Wave and tidal devices are still maturing towards winning solutions.
  - 0.5 GW – the global ocean power installed capacity in 2011
  - 0.71 GW in 2017 - South Korea (260 MW) and France (240 MW) – largest capacity
  - U.K., Canada, U.S. and South Korea have long-term ocean energy technology plans

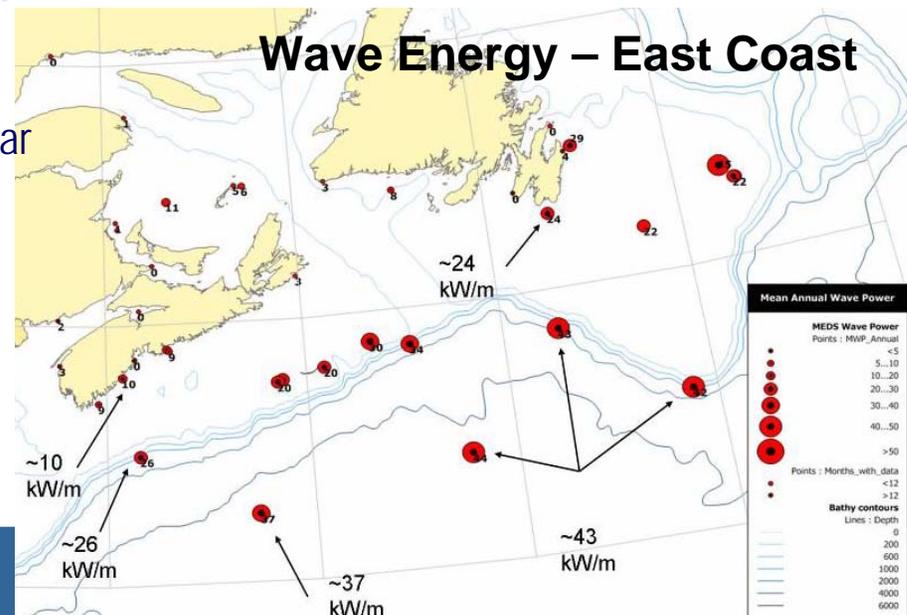
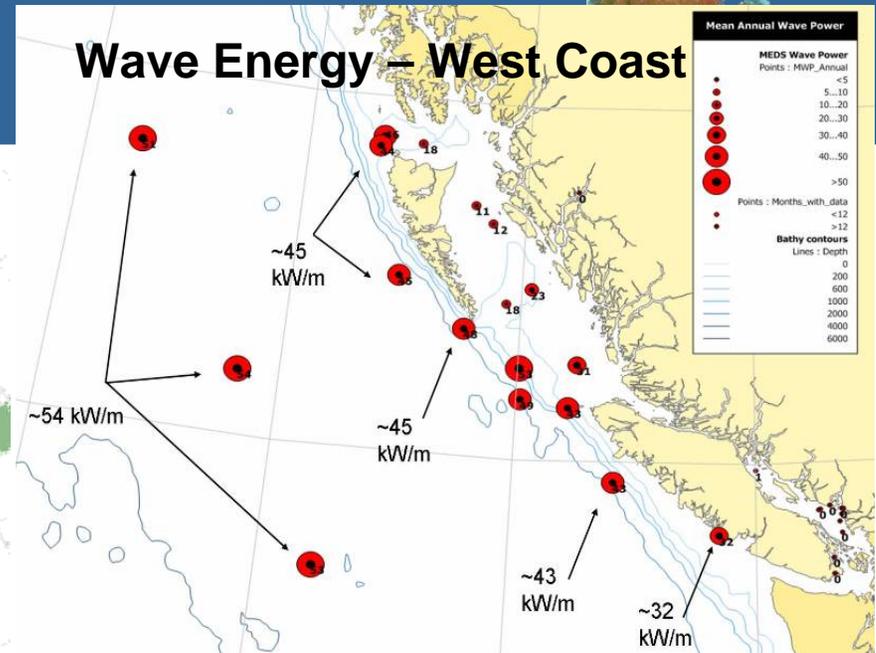
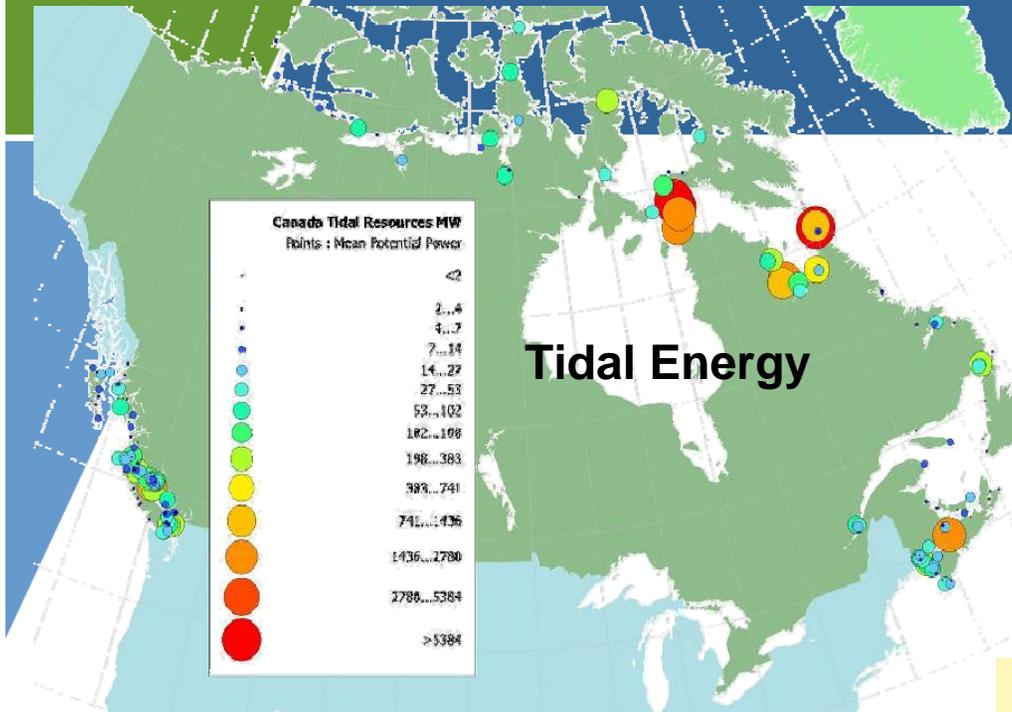
This report is available at: <http://www.iea.org/w/bookshop/add.aspx?id=432>



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## 2. Canada has great marine energy resources...



- Theoretical Marine Energy Resources: ~ 2,300 TWh/year
  - Tidal: ~ 370 TWh/yr
  - Wave – West Coast: ~ 500 TWh/yr
  - Wave - East Coast: ~ 1,400 TWh/yr
- Canada's current electricity demand: ~ 600 TWh/year

NRC, A.Cornett 2006,

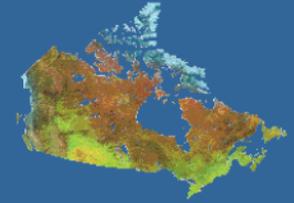
<http://canmetenergy.nrcan.gc.ca/renewables/marine-energy/publications/2888>



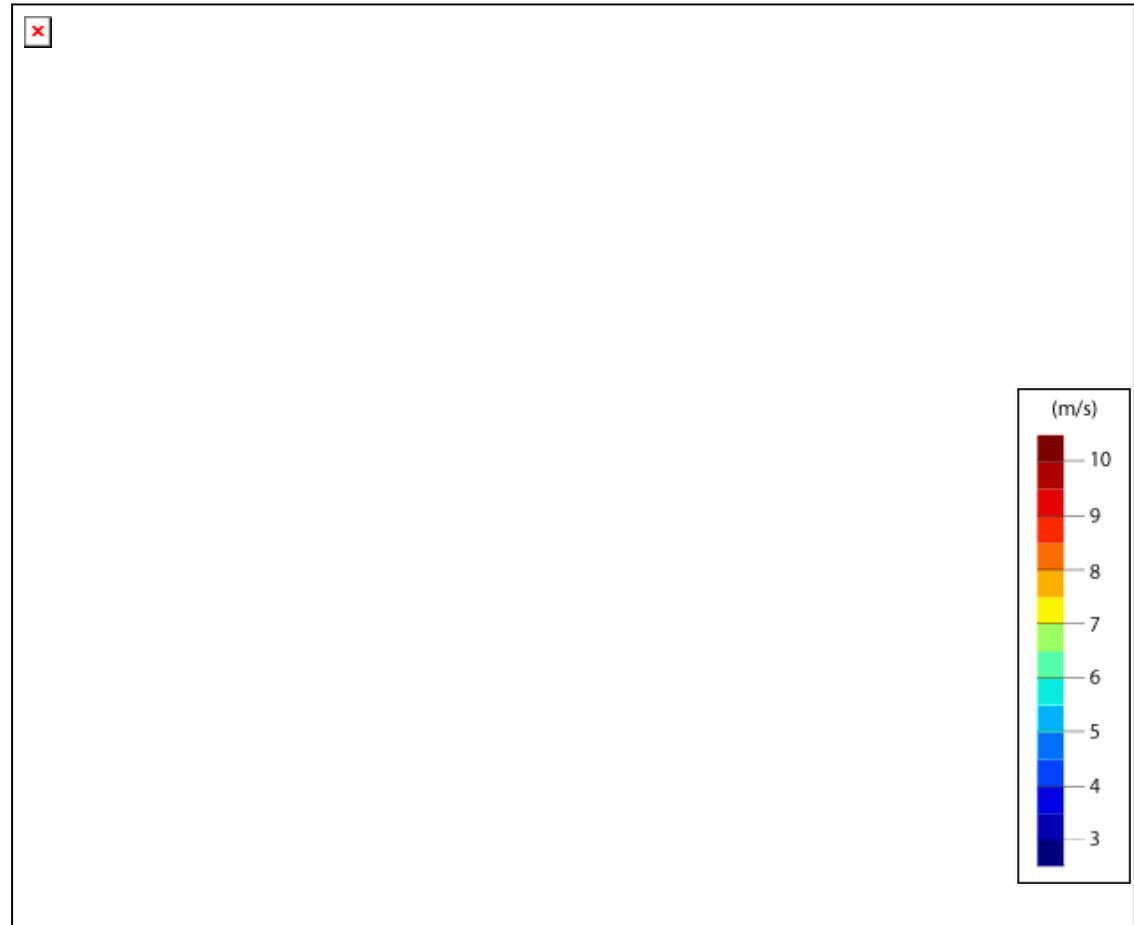
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## ... including offshore wind



- Canada's strongest wind resources are offshore
- Winds are more consistent and predictable than on-shore
- Significantly more expensive to develop than on-shore



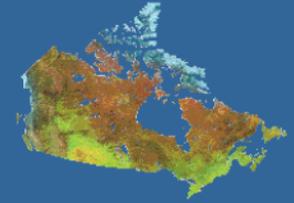
Source: Environment Canada – Wind Energy Atlas



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# The 2011 Canadian Marine Renewable Energy Technology Roadmap...



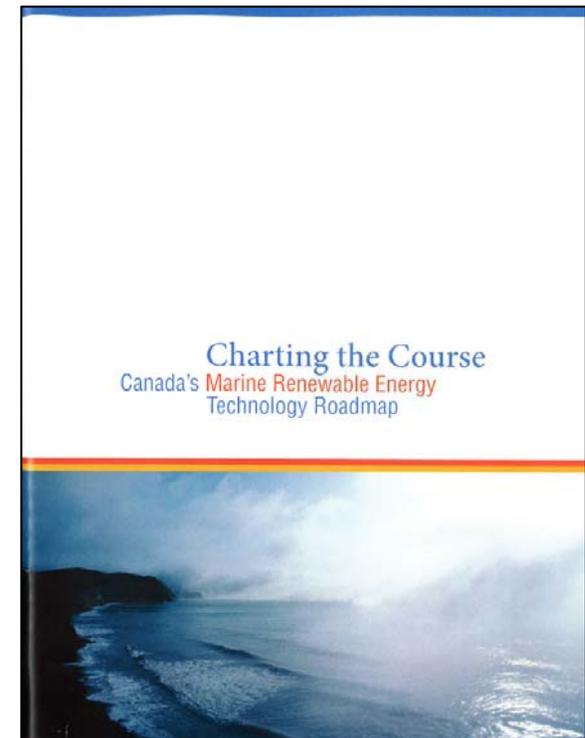
...developed by industry, provides:

## A Vision...

- Demonstrating leadership in technical solutions and services to provide value-added goods or services to
  - 30% of all global marine renewable energy projects by 2020; and
  - 50% of all projects by 2030
- Becoming a world leading developer of integrated, water-to-wire river-current systems by 2020

## ...and targets:

- A generating capacity, installed by Canadian industry, of:
  - 75 MW by 2016;
  - 250 MW by 2020; and
  - 2,000 MW by 2030—bringing in \$2 billion in annual economic value



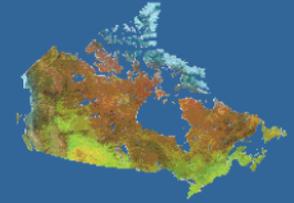
Roadmap available at: <http://www.marinerenewables.ca/technology-roadmap/>



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### 3. Capitalizing on marine renewable energy...



- ...means considering and addressing technical challenges:
  - Technology and design optimization
  - Improving reliability
  - Installation and decommissioning
  - Operation and maintenance
  - Grid connection and integration
- ...non-technical barriers:
  - Access to project financing
  - Complex planning and permitting
  - R&D funding and of long-term support policies for deployment
- ...as well as others challenges:
  - **Health & Safety** issues
  - **Environmental** challenges
  - Competing **sea usage**
  - **Supply chain** issues
  - **Skills** shortages



...then, ADORET proposed a model policy framework



### Investment opportunities

- Stable and sufficient financial support
- Project risks mitigation

### Innovation and competition

- RD&D
- Commercial scale-up
- Market entry and diffusion

### Favourable power markets

- Short term forecasting
- Use of aggregators
- Long-term FiT

# Model Policy Framework

### Permitting and planning

- Consistent and supportive policy
- Clear, transparent and efficient process

### Grid connection

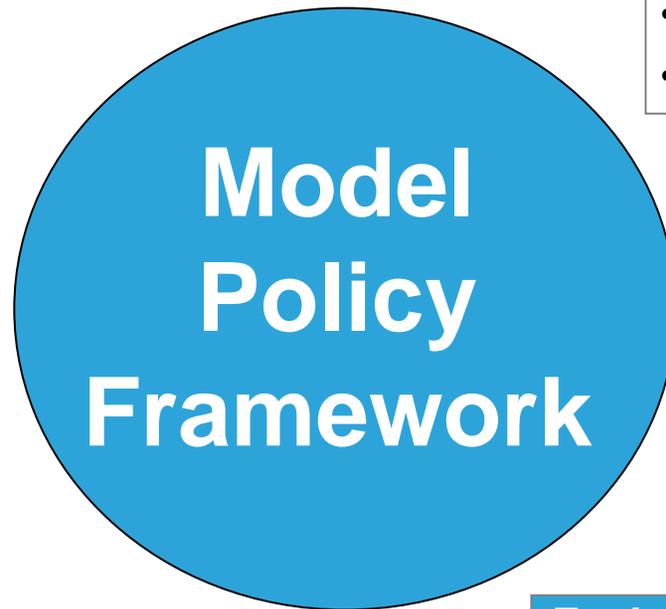
- Grid development
- Facilitate access to grid

### Environmental and social impacts

- Life-cycle EAs
- Robust marine data
- Encourage public acceptance



Various levels of governments in Canada have primarily focused on...



### Innovation and competition

- ecoEnergy for Innovation Initiative
- SDTC (pilots)
- FORCE

### Permitting and planning

- NS One-Window Permitting System
- NS Regulatory Plan
- Marine Renewable Energy Enabling Measures program

### Environmental and social impacts

- NS SEAs
- Marine resource data
- Public acceptance

### Grid connection

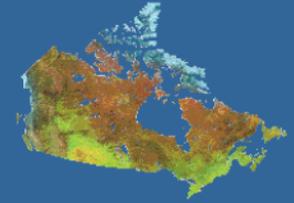
- FORCE subsea cables

### Favourable power markets

- Nova Scotia COMFit
- Up-coming NS Development FIT
- BC SOP
- Class 43.2 (ACCA)



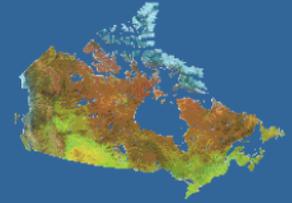
## 4. Federal Government actions on R&D and a regulatory framework



- Clean Energy Fund
  - Sub-sea cables and small scale demonstrations at FORCE- \$20 M
  - Several environmental and industry studies - \$1 M
  - Monitoring equipment for FORCE projects - \$5 M
- ecoENERGY Innovation Initiative program
  - Support research, development and demonstration (RD&D) projects, including renewable technologies.
- November 2011: Marine Renewable Energy Enabling Measures program
  - Develop the policy framework for administering renewable energy activity in the federal offshore.



## The Need for a Legal Framework...



- ...stems from the federal offshore jurisdiction and responsibilities
- Budget 2011, provided a new \$4 million Marine Renewable Energy Enabling Measures Program program over five years
- Program objective is to develop and present a policy framework to the federal government
- Program activities include:
  - legal analysis
  - examination of international approaches
  - consultations with stakeholders

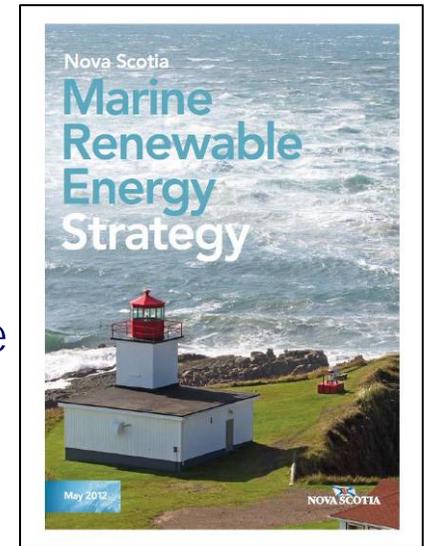


# Provincial direct support policies for marine renewable energy



## ■ Nova Scotia

- World's most aggressive FIT for in-stream tidal energy
  - 65.2 cents/kWh for community-based projects (COMFIT)
  - Tidal FIT for pioneer array-scale projects to be set in 2012.
- May 2012: Marine Renewable Energy Strategy released
- One-window framework and approach for the permitting of the Bay of Fundy demonstration project at FORCE

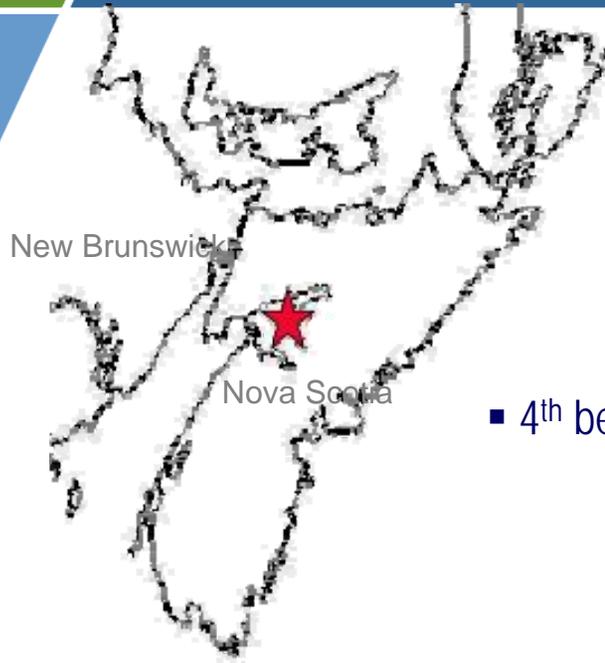
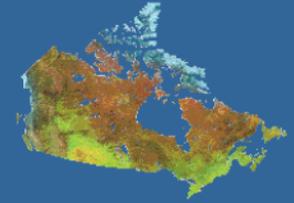


## ■ British Columbia

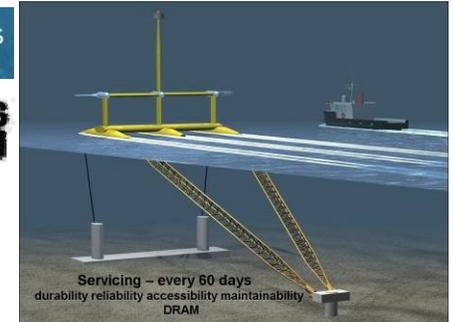
- Standing Offer Program under the Clean Energy Act
  - a standard price that includes hydrokinetic in-stream technologies.
- Developing a regulatory process that is more streamlined and effective
  - Recently released a leasing policy for marine renewable energy projects



# Fundy Ocean Research Centre for Energy (FORCE)



Marine Current Turbines  
*Turning the tide*



- 4<sup>th</sup> berth still available; CFP 2012 ( <http://fundyforce.ca/technologies> )



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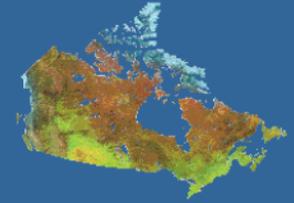
Image: cleancurrent.com



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## In Conclusion...



- Marine renewable technologies can play an important role in meeting policy objectives of cleaner and more secure sources of energy combined with economic opportunities.
- Each country or region faces unique circumstances that shape their decision to support, or not, the development of offshore RET and projects.
- ADORET suggested a model policy framework that can be used by countries or regions already involved in or considering the development of an offshore RE programme.

