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The Opportunity for Marine Energy in Canada

SWITCH, Kingston : Oct 2018

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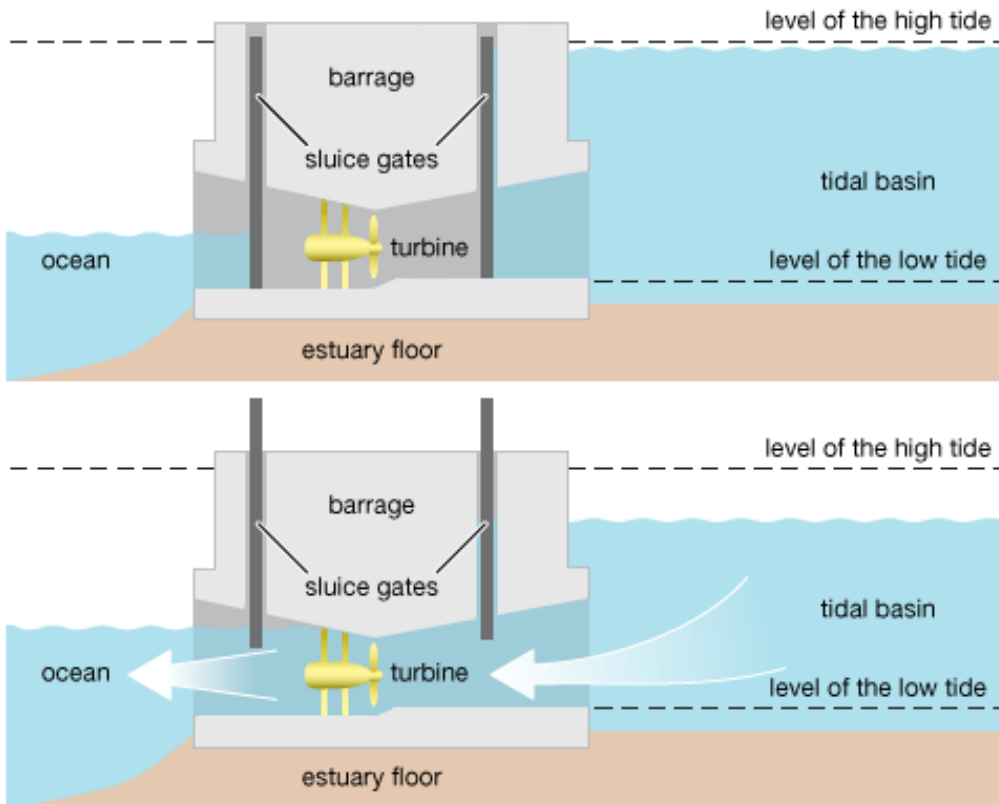
Venn Design Solutions Inc. : a design services company focussed on renewable energy solutions.

- Renewable Energy Systems Design Specialists
- Energy Storage System Design & Optimisation
- Test, Verification and Certification services
- IIOT/SCADA System Development & Integration
- Project Management, Process Development & Sourcing

Marine Overview

- Marine renewable energy (MRE) refers to the energy contained in:
 - Tides
 - River currents
 - Waves
- These clean and sustainable energy sources are appealing as an alternative to wind/solar as they are:
 - More predictable
 - More reliable
 - More energy dense

Tidal Technologies



Credit: <http://www.ei.lehigh.edu/learners/energy/tidal/tidal5.html>

- Tidal Range

- Harnesses potential energy from the low tide and high tide height difference
- Tidal barrage or tidal lagoon – large, dam-like structures
- Many environmental concerns
- Cannot scale-up gradually
- High cost

Tidal Technologies



Credit:

<https://simecatlantis.com/wp/wp-content/uploads/2016/08/AR1500-Brochure-Final-1.pdf>

- In-Stream Tidal Devices
 - Harness the kinetic energy of tidal currents
 - Typically use one or more subsea horizontal axis turbines
 - Easily scalable into an array
 - Easily removable
 - Smaller scale
 - Lower cost
 - Potential smaller environmental/ecological impact



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Tidal Opportunity in Canada

- Number of sites with estimated mean potential > 1 MW = 191
- Total mean potential of 42,000 MW
- Most of these sites are located in BC, Nunavut and Nova Scotia
- Majority of activity is taking place in the Bay of Fundy, NS
- Nova Scotia has put programs, legislation & infrastructure in place to support tidal energy



Credit: <https://www.tourismnewbrunswick.ca/See/BayOfFundy.aspx>



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Tidal Opportunity in Canada

- The leading test and research centre for in-stream tidal energy in Canada is FORCE
- 5 project developers have been granted “berths” at FORCE for a total of 22 MW generation
- Cape Sharp Tidal deployed and grid connected the 1st in-stream tidal turbine in Canada in 2016
- DP Energy recently received a grant of \$29.75 million in support of their 9 MW project, slated to be the largest tidal stream array in the world



Credit:

<https://www.cumberlandnewsnow.com/news/cape-sharp-tidal-successfully-places-turbine-on-floor-of-bay-of-fundy-228296/>

Run-of-River Technologies



Credit: <http://idenergie.ca/en/buy/>



Credit: <https://www.instreamenergy.com/technology>

- Harness the kinetic energy of flowing river currents
- Typically only required to handle continuous flow in one direction making them good candidates for use in base load generation
- Often deployed on floating platforms or subsea mounts
- Horizontal and vertical axis turbine concepts being developed
- Smaller scale than tidal technology, mostly varying between 5 and 100 kW.

Run-of-River Opportunity in Canada

- Run-of-river development has been slow but the resource is immense
- Estimated theoretical energy potential up to 340 GW
- British Columbia, Québec and the Northwest Territories have the greatest potential
- Devices are being targeted for use in rural and remote communities to decrease their reliance on diesel electricity generation
- Through federal funding, Canada has developed the Canadian Hydrokinetic Turbine Test Centre (CHTTC)



Credit: http://mavi-innovations.ca/project_post/performance-testing-at-chtcc/

Wave Technologies

- Wave energy converters (WECs) are devices that extract the energy of moving waves as they change from wave trough to crest.
- The main types of WECs include:
 - Buoys or point absorbers
 - Surface following or attenuators
 - Oscillating water columns
 - Terminators
 - Overtopping devices



- Neptune5B engine rated 250kW
- Full sized unit
- Shown w/2 of 12 floats

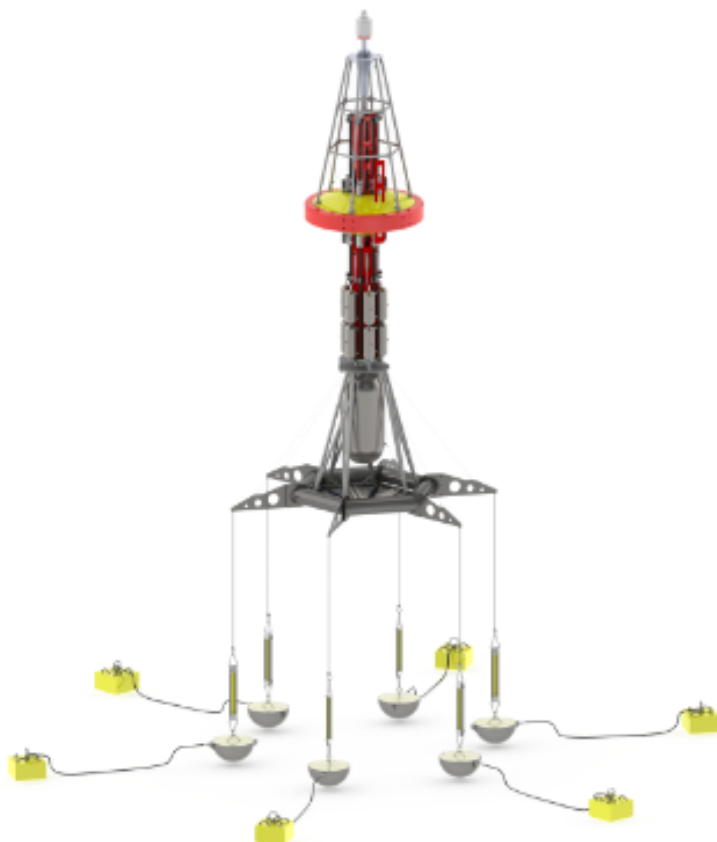
Credit: <https://www.neptunewave.ca/copy-2-of-home1>



Credit:

<https://theovercast.ca/next-gen-nl-grey-island-energys-seaweed-extracts-clean-energy-from-ocean-waves/>

Wave Opportunity in Canada



Credit: http://www.aocanada.ca/public_html/technology/

- Canada's wave energy resources are concentrated on the Pacific and Atlantic coasts
- The estimated extractable potential is between 10,100 to 16,100 MW
- Like run-of-river, wave tech has been slow to develop compared to tidal energy technology, but is still garnering local and international interest
- Many wave energy technology developers are focused on off-grid applications in rural and remote communities along the west coast
- BC has become the Canadian leader in wave energy research, with the federally funded West Coast Wave Initiative initiating the bulk of R&D activity

Marine Energy - Summary

- Europe is currently ahead on technology development / main technology providers.
- Canada's natural resources and marine energy potential make us an attractive market.
- Canada is leveraging its excellent natural resources for marine energy R&D to build an industry

In August of this year, following this market analysis effort, Venn Design Solutions agreed a partnership with Blackfish Engineering of the UK to increase marine competencies.



Further Info / Contact Info

For further information : [Marine Renewables Canada](#)

2018 State of the Sector Report: [Marine Renewable Energy in Canada](#)

THANK YOU

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