Nova Scotia Energy Research and Development Forum 2012

Richard Karsten

Biography

Dr. Richard Karsten is an associate professor of Mathematics at Acadia University in Wolfville, Nova Scotia. He has a BMath from the University of Waterloo and a PhD. in Applied Mathematics from the University of Alberta. He spent three years as a Postdoctoral Researcher at the Massachusetts Institute of Technology before joining Acadia in 2001. His early research focused on fluid dynamics and physical oceanography. In recent years, Dr. Karsten and his colleagues at Acadia have been working on examining tidal power in the Bay of Fundy. Their work resulted in the first published assessment of in-stream tidal power in the Minas Passage based on a theoretical estimate of extractable energy and a numerical simulation of in-stream turbines. Recently, he has been extending this analysis to the smaller passages of Digby Neck and focusing on detailed site assessment and the analysis of turbine arrays. He has also worked on examining the tidal resonance in Hudson Strait and the coupling of resonant shallow basins with the Atlantic Ocean. Dr. Karsten is a founding member of the Acadia Tidal Energy Institute, a subcommittee chair for FERN, and was a steering committee member for Canada's Marine Renewable Energy Technology Roadmap.

Presentation Abstract: Tidal Energy Resource Assessment in the Bay of Fundy: Community and Commercial Projects

Tidal power development in Nova Scotia is making considerable progress with the continued development by FORCE and the approval of tidal power Community-Feed-in-Tariffs for passages along Digby Neck. While all locations under consideration for the development have strong tidal currents, the specific details of the sites can greatly affect the power that can be extracted. For example, Digby Gut and Petit Passage are two similar passages approved for COMFits. Petite Passage has stronger tidal currents, 4 m/s to 5 m/s compared to 2 m/s to 3 m/s in Digby Gut, but the volume flow through the passages is almost equal. There is one critical difference. Altering the flow in Digby Gut directly affects the tides in Annapolis Basin, while altering the flow in Petit Passage has little impact on the surrounding tides. Surprisingly, this difference means that the theoretical extractable power for Digby Gut is over 200 MW but for Petit Passage is only 40 MW! Is Digby Gut really a resource 5 times as large as Petit Passage?

In this talk, we provide an updated assessment of the Nova Scotia's tidal energy resource in the Bay of Fundy. Using both analytical and numerical models of the tides and currents, we examine the power generation potential of a number of passages from Minas Passage to Grand Passage. Our analysis moves beyond the theoretical maximum power to the power generated by realistic arrays of turbines and includes predictions of the impact power extraction will have on the tides and currents.