



# FERN

FUNDY ENERGY RESEARCH NETWORK



Annual Newsletter

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## Issue 3

Fall 2013

### Message from the FERN Coordinator

On behalf of the FERN Executive Committee, I am pleased to present the Fall 2013 issue of the FERN Newsletter.

This year has marked some notable milestones for FERN. This past spring commemorated the network's three year anniversary. In March, the FERN Governance Policies/By-laws came into force upon approval by the Executive Committee and Subcommittees. FERN underwent a structural change with the merging of the Biological / Ecological Effects and the Hydrodynamics / Geophysics Subcommittees into one Natural Sciences Subcommittee. In May, we held our first 'official' Executive Committee election and Annual General Meeting (pg. 2). We also co-hosted Nova Scotia's first major research symposium focused on tidal energy (pg. 4).

We welcome Peter Smith in his new role as Executive Co-chairperson. Peter is Scientist Emeritus, Fisheries and Ocean Canada, and formerly the co-chair of the FERN Hydrodynamics / Geophysics Subcommittee. FERN also welcomes newly elected Subcommittee co-chairs: Dean Steinke (Engineering), Brent Law (Natural Sciences) and John Colton (Socio-Economics). With much appreciation, we extend thanks to former co-chairs — Ken Lee, Mo El-Hawary, Graham Daborn, Gerhard Pohle and Kay Crinean — for their leadership contributions (2010-2013) to FERN's Executive and Sub-Committees.

The coming year promises to be exciting for tidal energy research & development in the region! Stay tuned for e-news from FERN.

*Lisa Isaacman*  
([lisa.isaacman@acadiu.ca](mailto:lisa.isaacman@acadiu.ca))

### Fostering Collaboration in Tidal Energy Research



Photo Credit: Greg Trowse

*Humpback whale tail breach near Brier Island, whale-watching cruise vessel in background*

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# FERN Activities and Accomplishments

## Report from the 2013 Annual General Meeting

The FERN AGM was held on the evening of May 14 in conjunction with the NS Tidal Energy Research Symposium & Forum poster session and reception at Acadia University. Members attending heard Dr. Anna Redden, the Executive Committee Co-chair, present a review of FERN's history, membership and structure, and activities and accomplishments over its first three years of existence.

### Network highlights:

- FERN member representation on regional, national and international MRE committees (IEC TC-114, OES-Annex IV, MRC, FORCE, OERA, EMAC, etc.)
- Contributions to national and international conferences and research and monitoring workshops & symposia
- Large project funding from regional and national agencies
- Numerous completed projects and reports (site assessments, tidal energy maps, toolkit, etc.); see pages 6-7
- Training of students and young professionals
- Publications, newsletters, website, FTP site, etc.

### Next steps for FERN and tidal energy research

- Information and data sharing events (e.g. webinars and workshops).
- Growth in partnership building with researchers and institutions regionally, nationally and internationally, including MOUs for tidal energy research.
- Planning meetings for an application to NSERC for the establishment of an NSERC funded Strategic Research Network for in-stream tidal energy (and possibly river and wave). FERN will provide support in preparing the application. Academic members of FERN will be sought for leadership roles under proposed strategic network themes.

The new **FERN Governance Policies/By-laws** were presented (see FERN website). These came into force in March 2013 upon approval of the Executive Committee and endorsement by the Subcommittees. Prior to the AGM, a motion was proposed to merge the Biological/Ecological Effects and Hydrodynamics/Geophysics Subcommittees into one '**Natural Sciences**' Subcommittee. This motion was passed via email and endorsed by those attending the AGM.

Membership of the 2013/2014 FERN Executive Committee, following elections for a new Executive Committee co-chair and three new Subcommittee co-chairs, is as follows:

## FERN 2013/14 Executive Committee

### Executive Co-Chairpersons:

Anna Redden, Acadia University  
Peter Smith, Fisheries and Oceans Canada (BIO)

### Natural Sciences Subcommittee Co-Chairs:

Richard Karsten, Acadia University  
Brent Law, Fisheries and Oceans Canada (BIO)

### Engineering Subcommittee Co-Chairs:

Sue Molloy, Glas Ocean Engineering / Dalhousie University  
Dean Steinke, Dynamic Systems Analysis Ltd.

### Socio-Economics Subcommittee Co-Chairs:

Dana Morin, Fundy Tidal Inc.  
John Colton, Acadia University



*Measuring and tagging fish at intertidal weirs in Minas Basin*  
(Credit: Monica Reed)

## About FERN

FERN is an independent non-profit organization initiated by academic and government researchers as a forum to coordinate and foster research collaborations, capacity building and information exchange to understand the environmental, engineering & socio-economic implications of tidal energy development in the Bay of Fundy.



FERN was initiated in 2010. **Membership is FREE** and open to all those involved or interested in tidal energy-related research, including universities & colleges, government agencies, environmental NGOs, consultants, and the private sector.

For more information about becoming a member, please visit our website, <http://fern.acadiau.ca>.

# FERN Activities and Accomplishments

## Report on the FERN Subcommittees

At the heart of FERN are our three standing Subcommittees representing the core tidal energy research themes: **Natural Sciences (biological and physical), Engineering, and Socio-Economics.**

The role of the Subcommittees is to bring together diverse interests and expertise to identify and resolve priority issues related to tidal energy by:

- Strengthening relationships between academia, government and industry;
- Identifying potential project ideas and research teams; and
- Developing communication and information sharing tools to foster and facilitate research within and among FERN's research theme areas.

Each Subcommittee consists of two co-chairs and up to 15 members representing core academic, municipal, provincial and federal government, and private sector research groups and institutions involved in tidal energy research of relevance to Fundy.

Over the past 3+ years, the Subcommittees have been involved in research priority identification and knowledge scoping exercises; they have served as a source of expert advice for fund-



Credit: Anna Redden

*A meeting of the Socio-economic Subcommittee (others present via phone)*

ing, policy and industry decision-makers; and have spearheaded various data sharing initiatives. A key outcome of these subcommittees has been the generation of new research ideas, insights and opportunities. In fact, a number of the collaborative research and monitoring initiatives formed over the past few years can be traced back to exchanges occurring within one or more of the subcommittees.

In 2014, the Subcommittees plan to engage with the broader FERN community to foster cross-pollination of expertise, data and disciplines through small, focused data sharing and analysis workshops, expert working groups and seminars and webinars on pressing topics in tidal energy research in the Bay of Fundy.

## FERN Membership at a Glance

Internationally, our 134 members include individuals and organizations from 74 institutions in 6 nations

- Canada, US, UK, Spain, Ireland and Australia

Within Canada, membership spans 6 provinces

- Nova Scotia, New Brunswick, PEI, Quebec, Ontario and British Columbia

Members serving on FERN Executive and Sub-Committees

- 30+ individuals from Canada (Nova Scotia, New Brunswick and Ontario) and the US (WA)



**FERN**  
FUNDY ENERGY RESEARCH NETWORK



## 2013 Nova Scotia Tidal Energy Research Symposium & Forum

The Nova Scotia Tidal Energy Research Symposium and Forum was held on May 14 - 15, 2013 at the KC Irving Environmental Science Centre, Acadia University, Wolfville, NS. The purpose was to provide a forum to share and discuss activities, findings and insights among those engaged in ongoing and recently completed environmental, technological / engineering and socio-economic research and activities related to tidal energy development in Nova Scotia.

The event was co-hosted and co-organized by FERN, the Acadia Tidal Energy Institute, the Offshore Energy Research Association and the Nova Scotia Department of Energy. The OERA and NSERC (via the Atlantic Regional Opportunities program) provided funding support; in-kind venue support was provided by Acadia University. The symposium was facilitated by Dr. Graham Daborn, Acadia University.

Over 100 people from Nova Scotia, New Brunswick, British Columbia, Washington and Massachusetts attended the 2 day event, with delegates representing academia, government, and public and private sector organizations involved in tidal energy research. The symposium and forum included:

- Updates on Marine Renewable Energy developments and related activities in Nova Scotia;
- Overviews of recently funded research projects and associated technical needs;
- Oral and poster presentations on results and lessons learned from ongoing and recently completed research and technical work related to Nova Scotia's tidal energy resources and its practical relevance to development and regulation;
- Focused break-out sessions with facilitated discussions on:
  - collaboration and engagement in tidal energy Research and Development (R&D)
  - information/technology gaps and challenges
  - technological solutions to address industry challenges;



*Stephen Dempsey, OERA, presenting to a full house at the 2013 Tidal Energy Research Symposium at Acadia* (Credit: Monica Reed)

- A panel session featuring tidal energy R&D, financing (including Feed-in-Tariffs) and regional and national priorities and opportunities; and
- Networking opportunities to foster dialogue, understanding and cooperation among the research community, industry and regulators.

The symposium provided a timely, focused forum on research results during a period of growing interest and activity in tidal energy. Research dissemination and networking by academia, industry and government attendees helped to generate energetic discussions about current and future collaborative research opportunities and innovative ideas for solving priority questions and challenges.

Emerging out of the group discussions were several key recurring ideas for actions to foster tidal energy R&D in NS, including:

- Build a central repository for information and data on tidal energy in NS/Canada;
- Establish a central organization (preferably derived from one that currently exists) responsible for overseeing a coordinated long-term research and monitoring program;
- Coordinate timely and incremental R&D activities among low, moderate and high energy sites to permit scaled learning and cross-comparison;
- Focus on regional strengths and expertise, especially environmental monitoring and sensors for high flow environments;
- Leverage expertise and knowledge from other regions and marine industries;
- Build international collaborative research relationships and opportunities;
- Build stronger industry involvement in research and monitoring projects;
- Recognize the importance of community engagement and communication for building social license; and
- Create a national strategic research network in support of in-stream tidal energy developments in Canada.

**The Symposium Proceedings and oral presentation slides are posted on the [FERN website](http://fern.acadiau.ca).**



# FORCE: 2013 Highlights



*FORCE Visitor Centre & nearshore area*

## Turbines

The year began with developments from FORCE's technology partners: Alstom acquired TGL from Rolls Royce and began testing their new one

megawatt turbine at the European Marine Energy Centre (EMEC); Atlantis, Lockheed Martin Canada and Irving Shipbuilding were awarded \$5M to reengineer their turbine technology for the Bay of Fundy.

## Equipment

FORCE continued its program of monitoring and site characterization, collecting high frequency data from berth sites and installing new equipment, including:

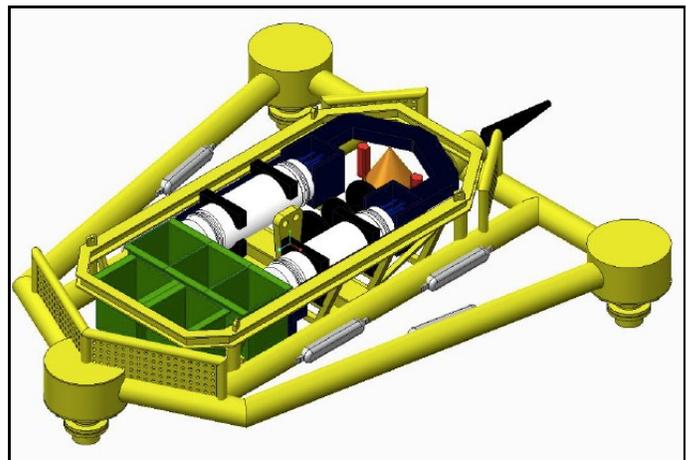
- a digital tide gauge – installed initially just below low water mark then moved further seaward to a semi-permanent location – now operating effectively and providing useful data;
- an X-band radar system – a joint project with Acadia University – to generate maps of surface currents and wave fields;
- a weather station – a cooperative project with NSCC – providing site specific data from the FORCE demonstration area; and
- 3.2 km of subsea data cable installed in the FORCE test area (see pages 14-15 for details).

## Monitoring

FORCE's independent Environmental Monitoring Advisory Committee (EMAC) turned its attention to reviewing monitoring data collected to date, assessing progress and gaps, to help define the design of future monitoring programs. A new environmental effects monitoring report is expected in spring 2014; it will cover activities during 2011-2013. This will include final data analyses for several 2012 studies, and the initial data analysis for a 2013 weir fisheries study.

## Research

FORCE began design and operational planning work on the **Fundy Advanced Sensor Technology (FAST) platform** – a recoverable seabed mounted platform designed to advance our understanding of the FORCE site and the instrumentation required to measure it. FORCE struck a science advisory team to develop the platform's initial research program and instrumentation package, and announced the development of its first breakthrough technology – the **Vectron** – the first instrument to provide high-resolution, real time measurements of turbulent water flow at turbine hub height. The Vectron will be able to capture highly accurate measurements of turbulence at a specific height above the seafloor over long periods of time - critical to understanding turbine performance, and vastly improving developers' odds of successful and efficient operation. This technology will also meet a need for more accurate, site-specific data at high flow sites worldwide.



*Fundy Advanced Sensor Technology (FAST) Platform*

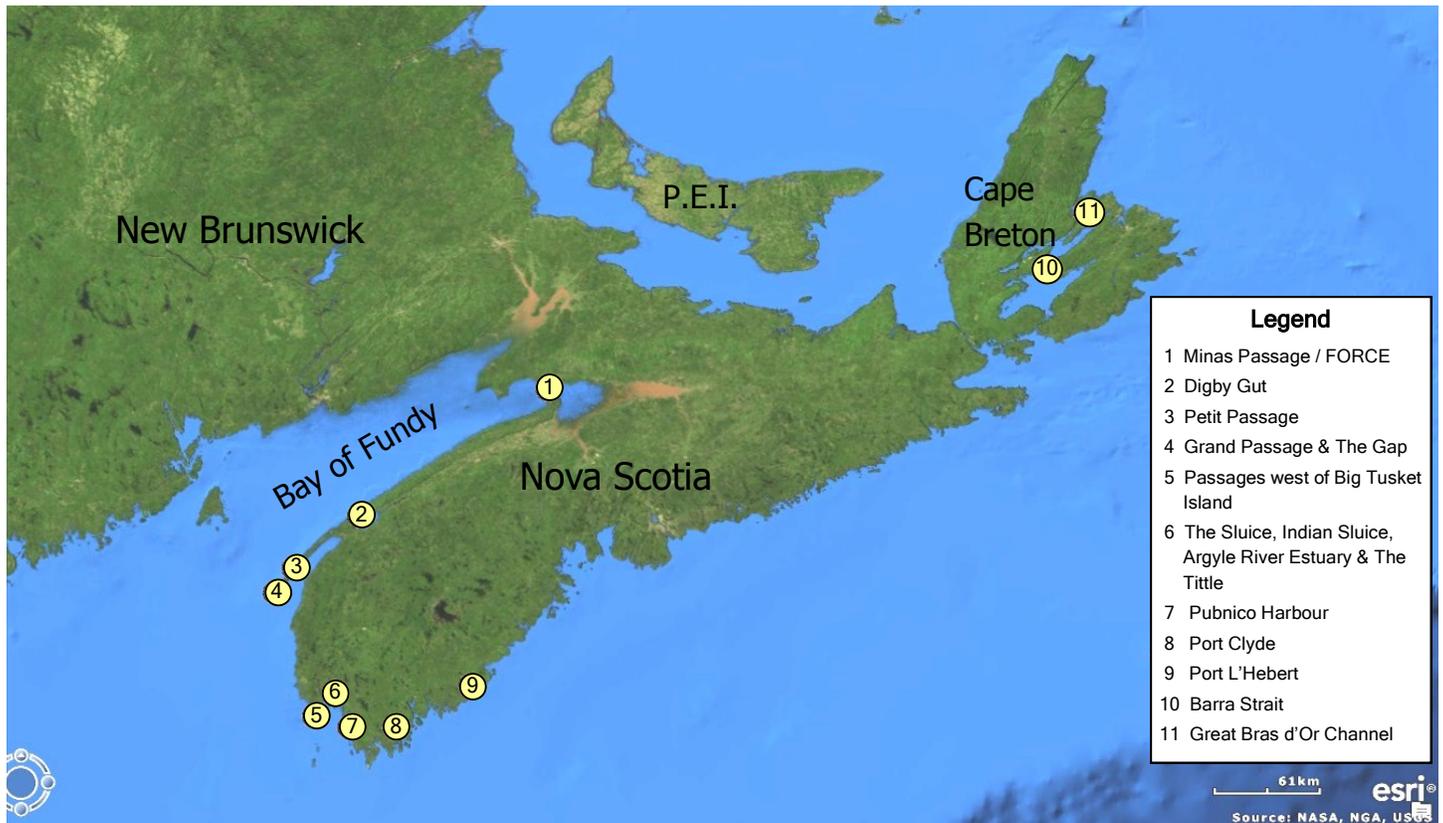
## Other Activity

FORCE advanced offers for sensor platform trials, marine excursions, and positions for a new director of operations and facilities and a new board director. FORCE also increased its engagement efforts, welcoming 4300 people to the FORCE Visitor Centre, and reaching over 70,000 viewers via a new [live webcam](#).

*Matt Lumley, FORCE Communications Director  
([Matt.Lumley@fundyforce.ca](mailto:Matt.Lumley@fundyforce.ca))*



# Nova Scotia Tidal Energy



Sites under investigation for in-stream tidal energy development in Nova Scotia. Basemap taken from ESRI maps.

## Projects & Activities 2010 –2013

### Natural Sciences

- Energy resource assessment involving current profiling in high speed tidal channels (see points on map above)
- Development, testing and refinement of instrumentation and techniques for environmental monitoring in high flow areas (DI, MP)
- Collection and analysis of hydrodynamic data, including seasonal surface and subsurface currents, wave fields and turbulence patterns, to characterize baseline site conditions and estimate extractable energy potential (MP, DI, CB)
- Evaluation, validation and improvement of hydrodynamic modeling techniques for resource assessment and tidal turbine siting (DI, MP, BoF)
- Near-field and far-field effects of energy removal on currents, tides, waves, temperature and salinity distribution, and sediment dynamics (MP, DI, BoF)
- Collection of data on sediment erosion and deposition and
  - suspended matter concentration using multiple techniques to feed development and validation of sediment dynamics models for intertidal and tidal inlet environments (MP)
  - Oceanographic measurements of water column temperature, salinity and suspended sediments (MP)
  - Testing and analysis of acoustic and sampling methods for monitoring benthic habitats and change in seafloor conditions (BoF)
  - Collection and analysis of video, still photographs and grab samples to characterize the seabed and its biological communities (MP)

NS – Nova Scotia-wide  
 BoF – Bay of Fundy-wide  
 CB – Cape Breton  
 DI – Digby Neck Passages  
 MP – Minas Passage, Basin and/or Channel



# Projects & Activities 2010-2013

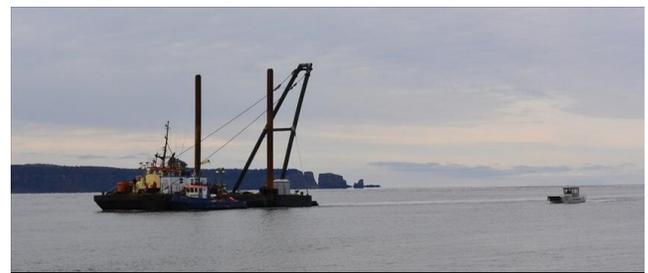
- Collection and analysis of bathymetric and sediment transport data to characterize seabed sediment stability, movement and benthic habitat (MP)
- Bathymetric mapping of surface geomorphology and texture using multibeam sonar and LiDAR surveys (BoF)
- Characterization of bedrock and subsurface sedimentation layers using seismic profiling techniques (BoF)
- Observational surveys of marine mammals and seabirds (MP, DI)
- Assessment of passive acoustic technologies (icListen, C-PODs) for detecting marine mammals in high flow sites (DI, MP)
- Passive acoustic monitoring (C-PODs) of cetacean (Harbour porpoise, dolphins) presence and activity (MP)
- Acoustic tagging of Atlantic sturgeon, striped bass, American eel and Atlantic salmon smolts for tracking fish movements, habitat use and migration (MP)
- Assessment of monitoring methods to identify fish species composition using netting and 3D sonar technologies (MP)
- Investigation of fish diversity and abundance in intertidal weir catches (MP)
- Determination of lobster distribution and seasonal migration patterns via trapping and acoustic tagging (MP)
- Analysis of the density, porosity and melt rate of sediment-laden ice (MP)
- Design and assessment of hydrophone systems to detect ambient noise signatures and marine mammals in high flow environments (MP, DI)
- Literature review on the potential ecosystem effects of electromagnetic fields (MP)
- Wetland, intertidal and terrestrial surveys in relation to the FORCE facilities (MP)

## Environmental Assessment

- Mi'kmaq Ecological Knowledge Study of biodiversity and land use (DI, MP)
- Strategic Environmental Assessment (CB) and SEA Update (BoF)
- Science-based environmental risk assessment and decision-making framework for the developing in-stream tidal energy industry (NS)

## Engineering

- Deployment and recovery of OpenHydro turbine (MP)
- Numerical modeling of FORCE cable laying operations (MP)
- Development of subsea cable monitoring technology (MP)
- Study of electrical characteristics in submarine cables (MP)
- Numerical modeling of the deployment method and performance of the Clean Current turbine (DI)
- Installation of a weather station to monitor meteorological conditions at the FORCE site in support of deployment, retrieval and maintenance activities (MP)
- Design of passively adaptive turbine blades through the use of composite materials (NS)
- Modeling and analysis of an energy storage system for tidal devices (BoF)
- Turbulence modeling in the flow around a 3-bladed horizontal axis turbine (NS)
- Investigation into the use of small-scale in-stream tidal turbines for powering aquaculture operations (DI)



*Cable lay sea trials at FORCE, Dec 2013* (Credit: FORCE)

## Socio-Economics

- Value proposition study to estimate the economic value of tidal energy for Nova Scotia (NS)
- Review of the socio-economic benefits and challenges associated with in-stream tidal energy (CB, NS)
- Investigation into the engineering, construction and operational costs associated with different berth sites and tidal technologies (DI)
- Community and Business Toolkit for Tidal Energy Development (NS)
- Guide to community engagement for tidal energy stakeholders (NS)



## Tidal Energy at the Nova Scotia Department of Energy



*Cape Sharp Lighthouse* (Credit Colin Buhariwalla)

An electricity transformation is taking place in Nova Scotia as the province moves toward cleaner, renewable energy supplies to diversify our sources of electricity, protect the environment, manage costs and help create jobs.

A key tool in this transformation is in-stream tidal development, which the Department of Energy is growing with the help of its federal and provincial partners, the Mi'kmaq community and stakeholders across Nova Scotia.

### Projects and Regulatory Processes

A **Strategic Environmental Assessment** (SEA) is underway in the Cape Breton Coastal Region, inclusive of the Bras D'Or Lakes. An update of the 2008 Bay of Fundy SEA is also taking place and nearing completion. Both SEAs are expected to be completed by the end of 2013 and will be posted publicly once finalized.

The SEAs look broadly at the social, environmental and economic impacts and benefits of marine renewables. This includes gathering information from the local community and stakeholders across the province and learning more about Nova Scotians' views of marine renewable energy development.

The Department of Energy released a discussion paper on a Developmental Tidal Feed-in-Tariff (FIT) for public comment in August. The paper covered amendments to the current regulations for the FIT program. These amendments represent a major step in developing a robust regulatory program that will guide industry growth and development.

The Provincial Utility and Review Board (UARB) heard evidence on the proposed rates for the Developmental Tidal FIT on September 16. A decision on the FIT rates was announced in November.

There is considerable interest in Berth D at the Fundy Ocean Research Centre for Energy (FORCE). The requests for proposals for Berth D will close 30 days after announcement of the FIT rates (December 16) and the Department looks forward to announcing the successful applicants in early 2014. Existing berth holders will be updating their project plans following the FIT announcement.

### Business Development

The Department hosted a workshop with ocean technology firms interested in the province's tidal energy supply chain in March. Local companies learned of the many opportunities in the tidal energy field, while identifying what they need to enter this exciting and rapidly expanding industry.

The Business Connector Tool, which connects domestic and international organizations involved in the energy sector, was recently introduced by the Department. The Tool can be found at [nsrenewables.ca/feed-tariffs/business-connector-tool](http://nsrenewables.ca/feed-tariffs/business-connector-tool).

In June 2013, the Department participated in Oceans Week, facilitating a panel presentation and business-to-business meetings with those working in areas related to in-stream tidal energy. Halifax will host the International Conference on Ocean Energy in 2014, marking the first time a North American city hosts the biennial conference.

### Technical Work

The Department of Energy participates in the **Technical Committee 114: Marine Energy Committee**. TC114 was created in 2007 by the International Electrotechnical Commission (IEC) to prepare international standards for marine energy conversion systems.

To learn more about the electricity transformation taking place in Nova Scotia, please visit <http://www.gov.ns.ca/energy/renewables>.

*Alan Howell*

*Policy Analyst, Department of Energy (HOWELLAA@gov.ns.ca)*



## Update from the OERA

The Offshore Energy Research Association (OERA) continues to advance the research agenda and make important contributions to building the body of knowledge that will enable the incremental and sustainable development of Nova Scotia's offshore energy resources. Recent OERA initiatives are highlighted below.

### Strategic Environmental Assessments

In 2008, the **Strategic Environmental Assessment** (SEA) for the Bay of Fundy was completed and featured a detailed environmental and socio-economic assessment for the Bay of Fundy, a comprehensive community consultation process, and 29 summary recommendations, that collectively as a study, has been used to plan, implement and guide marine renewable energy development in the region. Five years on, OERA is currently managing an **update** to this original work. The SEA Update is being prepared by AECOM Canada Ltd. and Acadia University. The 2013 edition will provide new insights, changes, and updates to the social, economic and environmental issues to further guide the incremental development of commercial tidal energy for the Bay of Fundy. The Update will be completed in December 2013.

Additionally, OERA is overseeing the completion of a SEA for the Cape Breton Region. This SEA comprised two phases, the background study phase, completed by AECOM in December 2012, and the community consultation phase, that is in the final stages of completion by Stantec Ltd. The consultation report will highlight issues and recommendations concerning offshore renewables development for both the Bras d'Or Lakes and coastal Cape Breton. Report submission is in late 2013.

### R&D Forum 2014

OERA, in partnership with the Department of Energy, will be hosting its 6<sup>th</sup> biennial NS Research & Development Conference on May 21 -22, 2014 in Halifax. The two day event will feature industry, government and academic presentations from local and international speakers. OERA has several opportunities for organizations to become sponsors for the event. For more details please visit <http://www.oera.ca/meetingevents/nova-scotia-energy-research-development-forum-2014/>

*Jennifer Pinks*

*Research Manager, OERA (jpinks@oera.ca)*

### New OERA Initiatives

**Unsolicited Proposals Program:** OERA is now accepting modestly budgeted unsolicited proposals three times a year for project concepts that align with its research priorities.

**Student Travel Research Program:** This new program is open to senior undergraduate and graduate students enrolled at a Nova Scotia university and interested in travelling to research facilities out-of-province to complete short term research assignments in marine renewables or marine geosciences.

**Tidal Value Proposition:** OERA released an Expression of Interested (EOI) seeking qualified applicants to develop a value proposition to estimate the economic value of tidal for Nova Scotia, the region and Canada. Final decision on selecting the successful proponent is expected in December 2013.

**Please visit the OERA website for more details on these new programs. [www.oera.ca](http://www.oera.ca)**

## Recently Completed Projects

### **Southwest Nova Tidal Resource Assessment**

*Lead: Dr. Alex Hay, Dalhousie University*

- Assessing tidal currents and resource potential in key locations in Digby, Yarmouth and Shelburne Counties.

### **Acoustic Tracking of Fish Movements in the Minas Passage**

*Leads: Dr. Anna Redden & Dr. Michael Stokesbury, Acadia University*

- Monitoring fish movements and behaviour using tracking technology to assess potential risk of interaction with tidal devices.

### **Cross Coupling between Device Level CFD and Oceanographic Models Applied to Multiple TISECs in Minas Passage**

*Lead: Mavi Innovations Inc.*

- Numerical modeling innovation to improve tidal resource assessment and turbine siting.

### **Community & Business Toolkit for Tidal Energy Development**

*Leads: Dr. Shelley MacDougall & Dr. John Colton, Acadia University*

- Comprehensive reference and guide combining science, technology, business and community aspects of tidal energy.

## Tidal R&D in Maine

### Update from Ocean Renewable Power Company

In September 2013, Maine-based Ocean Renewable Power Company (ORPC) officially unveiled a new division of the company called **ORPC Solutions**. Launched in response to inquiries received by ORPC about its multiple areas of expertise, ORPC Solutions offers a range of development, regulatory and strategic services to colleague companies in the ocean and river energy industry internationally.

unit (TGU) was retrieved from the Project site for forensic inspection of its components as required by a U.S. Department of Energy (DOE) grant.

In August 2013, DOE awarded ORPC two new grants totaling nearly \$5 million to help advance TidGen® Power System technology thereby facilitating ORPC's plans for volume production and entry into global markets.

ORPC is also continuing development of its **RivGen®** and **OCGen® Power Systems**, both of which utilize the core com-



*ORPC and its marine contractor, CPM Constructors, have streamlined their on-water operations to reduce costs. One example is the successful use of this newly designed catamaran-type barge (Credit: ORPC)*

In 2012, ORPC began operation of the first federally licensed, grid-connected tidal energy project in North America. This is the only ocean energy project, other than one using a dam, which delivers power to a utility grid anywhere in North, Central and South America. In addition, ORPC secured the first U.S. power purchase agreement for tidal energy for its **Cobscook Bay Tidal Energy Project**.

At the Cobscook site ORPC has been collecting performance and environmental interaction data from its TidGen® Power System. In March 2013, ORPC submitted its first annual environmental monitoring report to the Federal Energy Regulatory Commission (summary available at [http://www.orpc.co/permitting\\_doc/ORPC\\_CBTEP-2012-Environmental-Monitoring-Summary.pdf](http://www.orpc.co/permitting_doc/ORPC_CBTEP-2012-Environmental-Monitoring-Summary.pdf)). Monitoring efforts have continued into 2013, and with the Project's Adaptive Management Team, ORPC has evaluated results and made appropriate modifications to ongoing data collection. In July 2013, the TidGen® turbine generator

ponent of ORPC's proprietary and proven TGU technology.

ORPC's RivGen® Power System is designed for use at river and estuary sites, especially those on isolated grids that depend on diesel for electrical generation. Through a partnership with the Village of Igiugig, Alaska, the company will demonstrate the commercial viability of the system on the Kvichak River in 2014.

ORPC will also deploy a prototype mooring and anchoring system for its OCGen® Power System, designed for use in deep tidal and offshore ocean current sites. This work will be done in Maine in 2014.

To read more about ORPC, visit [www.orpc.co](http://www.orpc.co).

*Nathan Johnson  
Director of Environmental Affairs, ORPC  
([njohnson@orpc.co](mailto:njohnson@orpc.co))*

# Acadia Tidal Energy Institute (ATEI)

ATEI was established in 2011 and was formally launched in the Fall of 2012. This multi-disciplinary research group is focused on science-related issues and socio-economic dimensions of tidal energy. Its mission is to *"to advance knowledge of tidal energy that respects the environment and promotes socio-economic prosperity by leading and disseminating collaborative and objective research"*.

## Site Characterization and Risk Assessment

Recent ATEI scientific research includes tidal energy site and resource assessment and modeling (e.g. ecoENERGY funded project, pg 12), risk assessment of turbine-ice interactions, and use of acoustic technology to assess potential impacts of tidal turbines on fish (primarily species-at-risk), lobsters and marine mammals (see pp 6-7). Sites of primary research focus are Minas Passage (FORCE) and Digby Neck.

## Community & Business Toolkit for Tidal Energy Development

Released in March 2013, the **Toolkit** was developed to assist communities and businesses in better understanding the opportunities stemming from tidal energy while encouraging responsible harvesting of tidal energy resources. The Toolkit contains a series of modules that describe the resource and how to measure it, tidal energy technologies, environmental risk assessment, the regulatory regime, financial evaluation, and stakeholder engagement. It highlights the opportunities and strategies for communities and businesses to become involved in tidal energy development.



Left: ATEI Founders. L-R. John Colton, Shelley MacDougall, Richard Karsten, Anna Redden, Graham Daborn (Credit: Mike Dembeck)  
Right: ATESA members. Monica Reed (L), Kaycee Morrison (top-R), Freya Keyser (bottom-R) (Credit: Amanda Loder)

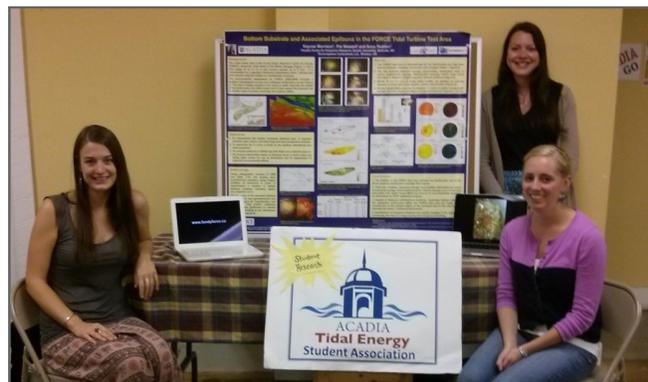
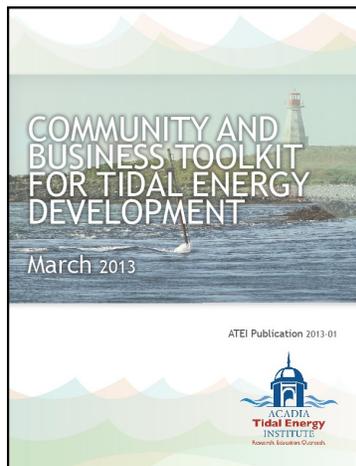
## Community Engagement

An addendum to the Toolkit, the **Tidal Energy Community Engagement Handbook** was released in July 2013 to support community and stakeholder engagement for tidal energy development and to specifically support those projects under the Community Feed-in-Tariff program. The Handbook is a comprehensive step-by-step guide to community engagement, for use by all stakeholders involved in tidal power development. To download the **Toolkit and Handbook**, go to <http://tidalenergy.acadiau.ca/>.

ATEI assisted Fundy Tidal Inc. in creating the **Islands Tidal Power Advisory Group**. This committee will provide guidance on on-going community engagement related to tidal energy development and broader sustainable economic development objectives on Brier Island, Long Island and Digby Neck.

## Other Activities

- Research on achieving cost reductions and increased energy yield in tidal energy
- International collaboration in research & teaching with institutions in the US, UK, Iceland and Asia
- Partnership with AECOM to prepare the 2013 Bay of Fundy Tidal Energy Strategic Environmental Assessment Update
- Hosting and organizing, with partner organizations, tidal energy workshops and symposia
- Public information sessions and community presentations
- Teacher's Institute for science teachers exploring how to incorporate tidal energy into school curriculum
- Gulf of Maine Institute Summer Workshop
- Sponsorship of the Acadia Tidal Energy Students' Association (ATESA)



## Tidal Research in Digby Neck

### Reducing the Cost of In-stream Tidal Energy Generation through Comprehensive Hydrodynamic Site Assessment

On May 3, 2013, the Government of Canada announced funding through its ecoENERGY Innovation Initiative for a three-year, \$3.3 million research project led by Acadia University. Project partners are Fundy Tidal Inc. (Fundy Tidal), Dynamic Systems Analysis (DSA), Clean Current Power Systems (Clean Current), Dalhousie University and the University of New Brunswick (UNB).



*ecoEII funding announcement at Acadia University. L-R: Terri Thibodeau, Richard Karsten, Dana Morin, Sen. Kelvin Ogilvie, Doug Bertram, and Bruce Cameron*

This project involves site assessments at Fundy Tidal's three Community Feed-in-Tariff tidal energy sites in Digby Neck. The site assessments will examine energy potential, interference with other water users, and the engineering, construction and operational costs associated with different berth sites and tidal energy converter technologies. The results will be used to optimize the design of tidal arrays and to estimate the maintenance and operational costs for each site.

In the first 6 months, the research has focused on gathering data required for deployment of a Clean Current turbine in Grand Passage. Over a very busy summer, Dalhousie and Fundy Tidal deployed a tide gauge in Westport, completed ADCP deployments, conducted an initial seabed survey, conducted a surface flow assessment using drifters, and completed a two week study using a suite of turbulence-resolving instruments -- 2 ADCPs, 3 AD2CPs, 2 ADVs, 2 Aquadopps and a Rockland Scientific Microrider and Microprofiler. Select instruments were mounted on a streamlined buoy to measure turbulence at hub height, a project made possible through collaboration with Rockland Scientific, and additional funding from OERA and NSERC. This fall, Fundy Tidal also conducted a surface flow

assessment in Digby Gut and deployed a tide gauge in Digby Harbour.

The gathered data are currently being analyzed and will be compared to both oceanographic and Computational Fluid Dynamics (CFD) models of the region to determine how the flow,

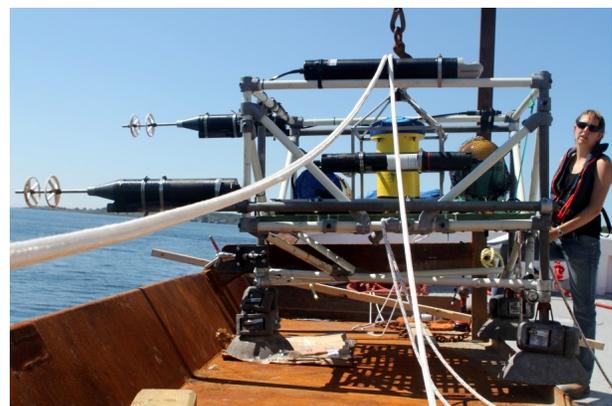


*Deployment of streamlined buoy with instrumentation in Grand Passage (Credit: Justine McMillan)*

and in particular the turbulence, vary over potential turbine berth areas and longer time periods. As well, DSA and UNB have been working to numerically model the deployment method and performance of the Clean Current turbine. The observed/simulated flow will be used to determine appropriate in-flow conditions for these models.

In the coming year, we will be extending our analysis to Digby Gut and Petit Passage, as well as to other turbine technologies. We will also examine how the choice of location affects the cost of deployment and maintenance. The project partners will continue to look for opportunities to collaborate with other researchers to examine other aspects of site assessment.

*Richard Karsten, ATEI (richard.karsten@acadiu.ca)*



*Preparing instrumentation for deployment in Grand Passage (Credit: Greg Trowse)*



## 2013 Hudson Cruise in Minas Basin & Passage

Researchers from Bedford Institute of Oceanography (BIO) as well as from Acadia, Dalhousie and Queens Universities joined forces aboard the CCGS Hudson in June 2013 to investigate aspects of the dynamic environment of the Minas Basin and surrounding area.

The chief scientists, Brent Law and Dr. Ed Horne, worked closely with Dr. Anna Redden (Acadia), Dr. Alex Hay and Dr. Paul Hill (Dalhousie), and Dr. Ryan Mulligan (Queens) to organize a mission to study sediment dynamics, benthic biology and the effects of the high tidal currents and sediment loads on ice melt dynamics. The Hudson left BIO on June 4<sup>th</sup> and returned on the 13<sup>th</sup>, providing the 24 scientists, technicians and students onboard six days of around the clock sample collecting. Ice blocks were deployed and samples collected from the Hudson while the landing craft PackCat rode piggyback on the vessel being deployed by crane to collect sediment samples from near-shore areas where the Hudson could not go.

The objective of the mission was to collect water column and seabed data from the Upper Bay of Fundy. More specifically, it was to make measurements of the hydrodynamics and sediment dynamics in the Minas Basin area in support of the advancement of tidal power and to document baseline conditions. Measurements collected from this research will be used to parameterize and validate coupled hydrodynamic and sediment models and to increase the predictive capacity of models in forecasting possible future environmental impacts of tidal power development and expansion.

In all there were 312 deployments from a combination of Moorings, Video Grab, Slo-Corer, CTD Rosette, Camera/LISST 100x package, BOB and vertical plankton net tows. Video Grabs and Slo-Cores were completed during the day and CTD Rosette casts, BOB, Camera/LISST and vertical net tows were completed while the ship was at anchor at night, all in the Minas Basin area. The exact breakdown of deployments were as follows: 3 Moorings, 101 Video Grabs, 15 Slo-Cores, 70 CTD's, 42 BOB, 44 DFC/LISST 100x, 20 net tows, 12 ice-block, and 5 optics buoy. An additional 109 grab samples and 15 cores were collected via the PackCat.

The **Cruise summary report** is available on the FERN website.

*Brent Law, Fisheries and Oceans Canada, BIO  
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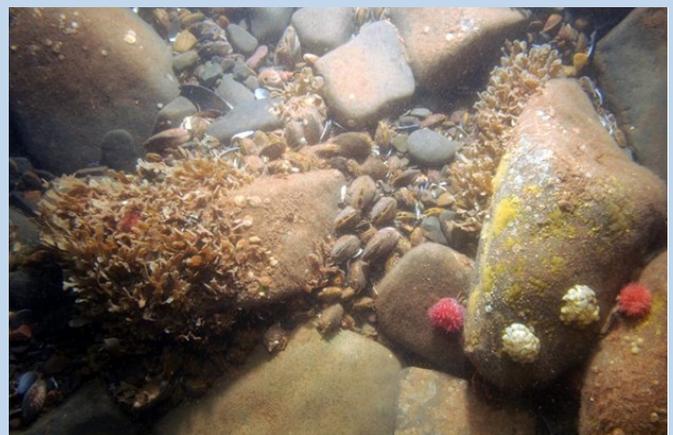


*Small boat, called PackCat, taken on Hudson to do sampling in shallow water*

### Collecting Data in Minas Basin / Passage



*Video Grab deployed from CCGS Hudson which was used to take bottom photos and to collect sediment samples*



*Bottom picture taken in Minas Basin with Video Grab*

Photo Credits: Kelly Bentham



# First Submarine Cable Installed

In December 2013, an all Atlantic Canadian team, lead by FORCE, successfully and safely installed the first ever submarine cable at the FORCE tidal energy development site in the Minas Passage.

Seaforth Geosurveys Inc. (Dartmouth) provided precise survey support, International Telecom (Halifax) contributed cable equipment and deployment expertise and lead contractor, R.J MacIsaac Construction Ltd. (Antigonish) supplied barge and tug vessels.

The 50 mm diameter data cable will allow continuous, real-time data to be transmitted from an instrument platform to shore, for the purposes of monitoring and characterizing the FORCE site.

Preparations to deploy the data cable in the energy rich, challenging waters of the Minas Passage began in mid 2013. An abandonment termination unit, fitted to the cable in early October, will allow the subsea cable to connect to a newly developed bottom mounted environmental sensor platform, known as the Fundy Advanced Sensor Technology (FAST) platform.

Cable trials began on December 5th, 2013 with the team mobilizing at the Parrsboro Wharf, Nova Scotia. Traditional vessels that are normally involved in dynamic positioning for cable lay for deep sea applications are not suitable for the near shore operations around Black Rock. FORCE engaged a 28 m barge due to its ability to be beached on its flat bottom. Spuds (long rigid posts) were placed on the two corners in the aft end of the barge and lowered to the bottom to hold the barge in place.



**8 October**

Fitting cable abandonment termination



**6 December**

An A-Frame is positioned on the barge



**5 December**

Mobilization: team begins to assemble in Parrsboro for cable trials



**8-10 December**

Station keeping trials continue with barge, three tugs and a safety boat



# at FORCE, Minas Passage - Dec 2013

Three tugs provided station keeping to the barge during operations, while a safety boat kept station nearby, ready to provide assistance if required.

After months of planning and over a week of mobilization and trials, the data cable was loaded onto the barge and operations to deploy the cable commenced. Operations continued through imperfect weather conditions, including a blizzard. Installation of the 3.2 km long data cable was completed on December 13<sup>th</sup> and the onshore burial of cable took place on December 14<sup>th</sup> 2013.

Initial testing of the data cable, including survivability, will provide valuable information on cable-environment dynamics in the Minas Passage prior to the data cable being connected to the FAST platform.

The successful deployment of the data cable in the Minas Passage represents a major milestone in the development of FORCE. It has provided valuable experience in reducing operational risk for the more robust, 150 mm diameter, power cable deployments planned for 2014. The power cables will transmit electricity from tidal turbines to the power grid, as early as 2015.

To view a video and more photographs of the data cable sea trials and installation process please visit the FORCE website at:

<http://fundyforce.ca/cable-lay/>



## 12 December

Data cable is loaded onto the barge



## 13 December

Snowstorm hits Minas Passage, but does not delay cable installation



## 14 December

Trench dug for onshore burial of data cable

*First submarine cable has been successfully and safely installed!*



Thumbs up from Tony Wright, project lead and FORCE Director of Marine Operations

Photo credits: FORCE



## Upcoming Tidal Energy Events

### 2nd Annual Marine Energy Technology Symposium (METS)

Held in conjunction with the Global Marine Renewable Energy Conference.

Seattle, WA, April 15-18, 2014

<http://ocs.sfu.ca/mets/index.php/mets/mets> / [www.globalmarinerenewable.com/](http://www.globalmarinerenewable.com/)

### Environmental Interactions of Marine Renewable Energy Technologies (EIMR) Conference

Stornoway, Scotland, April 30 - May 1, 2014

Call for Abstracts Deadline January 10, 2014

[www.eimr.org](http://www.eimr.org)

### Nova Scotia Energy Research & Development Conference 2014

World Trade and Convention Centre, Halifax, NS, May 21 – 22, 2014

[www.oera.ca/meetingsevents/nova-scotia-energy-research-development-forum-2014/](http://www.oera.ca/meetingsevents/nova-scotia-energy-research-development-forum-2014/)

### 33rd International Conference on Ocean, Offshore and Arctic Engineering (OMAE)

San Francisco, CA, June 8-13, 2014

<http://asmeconferences.org/omae2014/>

### Coastal Zone Canada 2014 Conference & 10th Bay of Fundy Ecosystem Partnership Science Workshop

World Trade and Convention Centre, Halifax, NS, June 15 - 19, 2014

Call for Abstracts Deadline December 16, 2013

[www.czca-azcc.org/czc-zcc2014/home.htm](http://www.czca-azcc.org/czc-zcc2014/home.htm) / [www.bofep.org](http://www.bofep.org)

### 5th International Conference on Ocean Energy (ICOE)

World Trade and Convention Centre, Halifax, NS, Nov 4-6, 2014

Call for Abstracts Deadline March 15, 2014

[www.icoe2014canada.org](http://www.icoe2014canada.org)



**FERN**  
FUNDY ENERGY RESEARCH NETWORK

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This newsletter was designed and edited by Lisa Isaacman, Meghan Swanburg and Anna Redden.

We welcome your feedback on this issue and any suggestions for future issues of FERN's annual newsletter.

