NOVA SCOTIA TIDAL ENERGY SYMPOSIUM SMALL TIDAL WORKSHOP – JULY 7, 2011

Workshop Facilitation Support

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1.0 Introduction

As part of a two-day Nova Scotia Tidal Symposium: Getting Power to Market held on July 7th and 8th, 2011 the Province of Nova Scotia hosted a half day small-scale tidal workshop. This workshop was initiated by the Offshore Energy Environmental Research Association (OEER) and the Offshore Energy Technical Association (OETR) as part of their mandate to advance small scale tidal power in Nova Scotia. One of the projects being undertaken by OEER and OETR is to support the design and development for small-scale in-stream technology in Nova Scotia. Phase 1 of this work is to identify gaps in knowledge to further advance small scale tidal in-stream technology design, and identify key components that need to be addressed. The July 7th workshop was intended to support phase 1. The information gathered from the workshop will feed into phase 2 of the project which will support the design and development in Nova Scotia for in-stream tidal technology.

Each day, billions of tones of seawater flow in and out of the Bay of Fundy, offering significant energy potential. Nova Scotia is perfectly positioned to take advantage of this free energy. As oil, gas and coal prices increase and our understanding of the importance of alternative energy sources increases, tidal power becomes increasingly attractive.

However, harnessing and converting this energy is not a simple task. Nova Scotia is in the unique position of having excellent tidal resources however, there are engineering, environmental, technological, market and socio-economic barriers to bringing tidal energy to reality. To take advantage of Nova Scotia's existing resources we need to identify the barriers and work to understand how we can address them in order to advance this increasingly important resource.

2.0 Workshop Design

Through expert panel presentations and round table discussions the workshop brought together industry, government and academia to discuss issues specific to small, community-scale development and commercialization. The workshop agenda can be found in **Appendix A**.

The intent of the workshop was to address the key components required to further advance small-scale in-stream tidal technology development, such as device demonstration sites and facilities, a regulatory framework and institutional structure.

The key objectives of the workshop were to:

- identify knowledge gaps to further advance small-scale in-stream tidal technology design; and
- identify the key components that need to be addressed such as barriers, testing protocols, governance/organizational structure, and capacity building; etc.

Panelists were selected to present information on one of four key areas:

- Technology development;
- Research and development;
- Service Supply and Development; and
- Developing Tidal Power, the Industry and the Community.

After the panel presentations, the workshop participants were divided into working groups. The group discussions were guided by a series of questions focusing on the four key areas.

1. Research and Development

   What are the immediate priority areas for research and development?

2. Technology Development

   What are the current barriers to proving small-scale technology?

3. Service and Supply Development

   What should our supply chain focus on to support a small scale tidal industry in Nova Scotia? Are there actions we should be taking to grow in this area?

4. Developing Tidal Power, the Industry and the Community

   - *What are the current barriers to developing small-scale in-stream tidal projects?*
   - *What are the most important first steps for building a small-scale tidal industry in Nova Scotia?*
   - *How should these projects be structured to provide for community involvement and/or community benefits?*
   - *Are there existing competing uses for tidal/ocean resource in communities that need to be considered? How can these issues be addressed?*

After the working groups completed each question, each group shared their thoughts in plenary session. Full results of the round table discussions can be found in **Appendix B**.

3.0 Panel Presentations

The biographies and presentation material for the speakers can be found in **Appendix C** and **D** respectively.

3.1 WORKSHOP INTRODUCTION

Presenter: Jennifer Matthews, Research Manager, Offshore Energy Research Association (OEER) and Offshore Energy Technical Research Association (OETR).

Ms. Matthews' presentation provided an overview of the Offshore Energy Research Associations which are comprised of the OEER Association and the OETR Association. Both of these associations were established in 2006 and are independent, non-for-profit corporations funded by the Nova Scotia Department of Energy. The mandate of these associations is to support the research and development of provincial offshore energy issues.

The recent accomplishments of the associations were outlined including the implementation of a collaborative research program for marine renewable energy development in the Bay of Fundy. As a result, research is currently underway in the following areas:

- tidal resource assessment;
- sediment dynamics;
- animal behavior;
- near and far field effects;
- potential effects of ice and debris; and
- potential effects of tidal lagoons.

To date, 10 projects have been funded and another 13 are under review.

One of the areas of focus and of particular interest to the workshop is the mandate to advance small scale tidal. It was noted that this is considered a key component to a diversified energy portfolio. OEER and OETR have received funding from the Nova Scotia Department of Energy for four new projects to advance small scale tidal development:

- detailed gap analysis;
- South West Nova Scotia tidal resource assessment;
- Strategic environmental assessment – phase II; and
- Mi'kmaq Ecological Knowledge Study – phase II.

The goal of the detailed gap analysis is to support the design and development for small-scale in-stream technology. Phase 1 is the delivery of the small-scale tidal workshop to identify gaps in knowledge to further advance small-scale in-stream tidal technology design and identify key components that need to be addressed. Phase 2 will involve development of a timeline, activities and work plan for the development of a detailed gap analysis for small scale tidal development.

The South West Nova Scotia tidal resources assessment is intended to develop a resource assessment for in-stream tidal resource opportunities in South West Nova Scotia. The first step will be the development for an acoustic doppler current profiler (ADCP) and developing the rationale for the selection of the area of study and identifying the main study area. The second step in this assessment will be to conduct a resource assessment that will incorporate all phases of a small scale ocean renewable energy development for South West Nova Scotia for both pilot and commercial scale development.

Phase II of the strategic environmental assessment (SEA) will apply the existing SEA framework used in Phase I for the Bay of Fundy. The Phase II SEA will assess areas off the Nova Scotia Atlantic coast and the Northumberland coast including Cape Breton.

In 2008 the SEA final report recommended that the Province of Nova Scotia conduct a Mi'kmaq Ecological Knowledge Study (MEKS) prior to the commencement of marine renewable energy projects in the Bay of Fundy. This was completed in 2008. Phase II of the MEKS has been proposed for Brier Island and Long Islands including Grand Passage and Petit Passage. The Department of Energy has proposed that OEER and Fundy Tidal Inc. work jointly to complete the Phase II MEKS.

Nova Scotia is uniquely positioned to take advantage of small and large scale tidal energy research initiatives. With its diverse tidal locations (Bay of Fundy to Petit Passage), extensive tidal researcher expertise and infrastructure, and diverse portfolio for completed research projects and those underway, Nova Scotia has a promising future for continued research and collaboration and becoming a leader in small scale tidal power.

3.2 TECHNOLOGY DEVELOPMENT

Presenters: *John Ferland, Vice President Ocean Renewable Power Company*
Chris Sauer, President and CEO, Ocean Renewable Power Company

Ocean Renewable Power Company (ORPC) is a developer of hydrokinetic power systems and commercial projects for tidal, river and ocean current power generation. ORPC has project sites in Nova Scotia, Maine, and Alaska with up to 300MW installed capacity. ORPC is partnered with Fundy Tidal Inc. for community-based tidal energy projects in Nova Scotia. During his presentation Mr. Sauer elaborated on the projects that ORPC has in the Bay of Fundy.

Mr. Sauer described the internal resources required for supply chain needs such as engineering of unique power systems, environmental evaluation and licensing, marketing and communications, project management, fundraising and financial management. Some of the regional resources required for supply chain needs include manufacturing and fabrication, marine assets and services, marine supplies, environmental and scientific expertise, and academic research and development. Mr. Sauer discussed the economic impacts of ORPC projects noting the benefits to partners, contractors, service providers and vendors. As a result of ORPC projects there have been statewide impacts in the United States through job creation and investment. Some of these benefits have included:

- Creation and/or retention of more than 100 jobs;
- The creation of 21 full-time employees in Maine;
- $8 million spent on goods and services in thirteen counties in Maine; and
- Creation of research and development and professional opportunities for young people.

It is anticipated that in the next 7 to 10 years the tidal energy industry in Maine will create 400-500 direct jobs, attract an estimated 1 billion dollars in investment, and create new sustainable markets for Maine's world class composites industry.

The link to the ORPC website is http://www.oceanrenewablepower.com/home.htm.

Presenter: Professor Chul H. Jo, Inha University, Korea

To be summarized.

3.3 RESEARCH AND DEVELOPMENT

Presenter: Anna Redden, Director Acadia Centre for Estuarine Research (ACER) and Co-Chair, Fundy Energy Research Network (FERN)

Ms. Redden spoke about the operational challenges of small tidal power. Some of these challenges include the deployment and retrieval of equipment, maintaining position and turbine and cable maintenance, and inspecting devices while working under high flow conditions. She also spoke about the engineering needs required such as suitable moorings and foundations/fixings, cable connectors and umbilical cables, and cable protection and longevity. When considering small tidal power environmental implications must also be considered which can include:

- Near and far field effects;
- Fish avoidance of turbines;
- Impacts on marine mammals; and
- Effects of the environment on turbines.

There was a discussion of various monitoring priorities such as fish detection and sampling using multiple methods and technologies such as sonar/trawls, multi-beam sonar, acoustic tracking of fish and passive acoustic monitoring for marine mammals. It was noted that the monitoring activities can be challenging in a high flow environment. As well as potential impacts on the marine environment there are also potential risks of damage to the tidal energy infrastructure. The example of the potential for sediment laden ice blocks to damage devices was provided. Far-field effects can have implications for tidal ranges, sediments, and animal distribution.

Ms. Redden also discussed the concept of the overlap of resource assessment and modeling, technology and gird integration and environmental issues.

Ms. Redden concluded her presentation with a brief overview of the Fundy Energy Research Network (FERN). FERN is an independent non-profit organization initiated by academic and government researchers as a forum to "Coordinate and foster research collaborations, capacity and information exchange to understand the environmental, engineering & socio-economic factors associated with tidal energy development in the Bay of Fundy."

Tidal energy research areas include: biological and ecological effects, hydrodynamics and geophysics, socioeconomics, and engineering challenges, all requiring collaboration across many institutions.

The links to the Acadia Centre for Estuarine Research (ACER) and Fundy Energy Research Network (FERN) websites are: http://acer.acadiau.ca/ and http://fern.acadiau.ca/.

3.4 SERVICE SUPPLY AND DEVELOPMENT

Presenter: Clayton Bear, President and CEO New Energy Corporation

New Energy Corporation is a developer of in-stream hydro power generation equipment. They are commercializing the EnCurrent vertical axis hydro turbine in fresh and salt water environments. The current size range is 5 kW to 250 kW per unit; the size range may increase in the future. The EnCurrent Turbine is an economical hydroelectric generating product that has an extremely small environmental footprint and can be used in a large variety of settings where traditional hydroelectric plants are not practical or possible.

In particular, this system has application for rivers, canals, industrial outflows and tides.

The EnCurrent model availability was presented along with photographic examples of a 5 kW turbine genset, trailer mounted 5kW system, 5kW floating system, and 25 kW system being deployed and in operation.

Aspects of the manufacturing process were discussed including the use of off-the-shelf components, machined components, and fabricated assemblies.

Mr. Bear shared several case studies to illustrate the various equipment, systems and processes deployed to harness tidal and hydroelectric energy by New Energy Corporation.

The case studies presented included:

- Point du Bois, Manitoba;
- Ruby, Alaska;
- Duncan Dam, British Columbia;
- Canoe Pass, British Columbia;
- Fort Simpson, NWT;
- Eagle, Alsaka;
- Chilla Canal;
- India; and
- the All American Canal, California.

Grand Passage, Nova Scotia

In Nova Scotia, New Energy Corporation has partnered with Fundy Tidal Inc. to install and operate several tidal turbines in Grand Passage. The companies have worked together to customize the EnCurrent System focusing on the mooring and anchoring equipment required for the strong tidal currents in the area. The initial system will be 25kW and will be deployed as a pilot leading to the development and customization of a 250kW system. This follows a short trial of a 5kW system in 2010.

Some of the key lessons learned from these projects include:

- Proper resource assessment is required;
- Knowledge and understanding of the local infrastructure available is crucial;
- Service and support from a distance is expensive;
- Local expertise is a key factor; and
- Critical mass is essential to successfully support projects.

The link to the New Energy Corporation website which includes detailed information on the case studies presented is http://www.newenergycorp.ca/.

3.5 DEVELOPING TIDAL POWER, THE INDUSTRY AND THE COMMUNITY

Presenter: *Dana Morin, President Fundy Tidal Inc., co-chair FERN Socio-Economic Committee, Secretary/Treasurer of the Ocean Renewable Energy Group*

Fundy Tidal Inc. (FTI) was established in Westport, Brier Island in 2006 to harness the economic potential of the tidal currents of the Grand and Petit Passages of the Bay of Fundy and similar opportunities throughout the region. FTI is seeking to secure multiple small-scale tidal Community Feed-in Tariffs (COMFITs) with multiple technology partners and financial interests.

Mr. Morin described the criteria for small scale tidal COMFIT:

- A rate of $0.652 per kilowatt feed-in tariff has been established;
- Assumes approximately 11 million per megawatt will be installed;
- Devices < 500kW will be connected to the distribution system; and
- Projects must be majority owned by eligible community proponents.

Mr. Morin outlined the following distribution opportunities in Nova Scotia on a local, provincial and regional basis, emphasizing the vast potential available in Nova Scotia and the region:

Digby County

- Grand Passage
- Petit Passage
- Digby Gut
- Brier Island
- Bear and Sissiboo Rivers

Nova Scotia

- Cape Breton
- Cobequid Bay (Burnt Coat Head)
- Cumberland Basin
- Minas Passage/Parrsboro
- Yarmouth County

Regional

- New Brunswick
- Maine/Eastern Seaboard

It was noted that in Digby County has considerable potential as a resource for tidal power. This region has been identified as a primary location for the development of tidal energy.

The presentation included a discussion of the community, infrastructure, research and development and technology, service and supply, and financial chains.

Mr. Morin's presentation also included a discussion of the various inputs required for the Digby County tidal development network. These include:

1. Community and Socio-Economics;
2. Business and Human Resources;
3. Infrastructure;

4. Marine Resource and Site Characterizations;
5. Marine Environment;
6. Marine Systems Technology;
7. Data Systems Technology;
8. Power Systems Technology; and
9. Operations.

A copy of the visual presented is in **Appendix D**.

The link to the Fundy Tidal website is www.fundytidal.com.

4.0 Results of the Working Group Discussions

Following panel presentations workshop participants were organized into working groups. The input gathered from the individual working group sessions can be found in its original format in **Appendix B**.

The information gathered from the working group discussions was organized and summarized into three key areas to identify knowledge gaps.

Area 1: Research and Development/Technology and Development
Gap/Recommendations • Establish international standards • Understand environmental impacts (marine mammals, sediment, acoustic monitoring) • Develop a risk management practice • Design characteristics (velocity, turbine design, material, aray, life span, ice) • Develop control and integration systems • Select sites for optimal deployment and operation • Create suitable demonstration sites • Develop experience in the water (deployment, mooring, underwater connection issues) • Coordinate research activities • Develop grid connection/energy storage and usage • Develop cable technology suitable for environment • Develop energy storage technology • Engineering to convert tidal energy into useable energy in a cost effective way • Build cooperation among developers, researchers and government

Area 2: Supply Service and Development

Gap/Recommendations

- Develop fabrication locations
- Develop local resources
- Build knowledge in local communities regarding required services
- Develop the trades (fabrication)
- Identify services required
- Identify suppliers

Area 3: Developing Tidal Power, the Industry and the Community/Socio-Economic Factors

Gap/Recommendations

- Determine economic impacts on communities
- Research social factors on communities
- Conduct stakeholder consultation and management
- Build resources to support municipalities (economic development officers)
- Improve coordination among business and economic researchers
- Generational integration, young human resources to support the vision
- Promote Nova Scotia tidal resources internationally
- Export technology internationally
- Shortage of funding for projects, technology development, research facilities
- Develop infrastructure (wharfs, boats, cranes)
- Improve understanding of regulatory requirements
- Engage regulatory authorities to identify opportunities to improve regulatory framework
- Develop markets for energy during off peak hours
- Create access to financing for small/medium businesses
- Create training opportunities
- Build incentives (feed in tariffs)
- Attract investment
- Consider the competing resources for the tidal/ocean resource (shipping lanes, whale watching, fishers, recreational groups)
- Increase participation in COMFIT program
- Create opportunities for community participation in the programs (public/private partnerships)
- Encourage community engagement
- Develop cost effective devices
- Create a competitive business model

5.0 CLOSING REMARKS AND NEXT STEPS

The workshop concluded with closing remarks provided by Bruce Cameron, Executive Director Sustainable and Renewable Energy. Mr. Cameron thanked the participants for their time and interest in working to advance small tidal energy in Nova Scotia. He noted the considerable potential that Nova Scotia has to offer the world with respect to tidal power opportunities and knowledge.

Many ideas emerged from the working groups with a significant number of similar opinions. The emergence of this common vision makes the identification of gaps straightforward as clearly there is agreement amongst those in attendance regarding the direction to be taken for the development of tidal energy in Nova Scotia. The next step in advancing tidal energy is to take the results from this workshop and further investigate the validity and applicability of the identified gaps specifically to the Nova Scotia environment. The gaps should be reviewed in detail and prioritized for development into specific research plans. This will be addressed in phase II of OEER's work plan.

APPENDIX A
Workshop Agenda, July 7, 2011

1:30 p.m. – 5:00 p.m.	**Small-Scale In-Stream Tidal Workshop** **Harbour Suite B** *(Limited space)* This workshop will bring together industry, government, and academia to discuss issues specific to small, community-scale development and commercialization. A primary focus will be determining the scope and options for future small scale technical research. Participants will help identify gaps and priorities for the advancement of small-scale tidal development in Nova Scotia.
1:30 p.m. – 1:45 p.m.	**Introduction** Jennifer Matthews, Research Manager*, Offshore Energy Research Associations (OEER & OETR)*
1:45 p.m. – 3:00 p.m.	**Panel Discussion** Technology Development - Chris Sauer, President & CEO, *Ocean Renewable Power Company (ORPC)* - Professor Chul H. Jo, *Inha University* • **Research & Development** - Anna Redden, Director, *Acadia Centre for Estuarine Research (ACER)* and Executive Committee Co-Chair*, FERN* • **Service Supply & Development** - Clayton Bear, President & CEO, *New Energy Corp.* • **Developing Tidal Power, the Industry and the Community** - Chris Campbell*,* Executive Director, *Ocean Renewable Energy Group (OREG)* - Dana Morin*,* President, *Fundy Tidal Inc.*
3:00 p.m. – 3:15 p.m.	**Networking Break**
3:15 p.m. – 4:30p.m.	**Identifying small-scale tidal energy development gaps** Brainstorming break-out groups session
4:30 p.m. – 5:00 p.m.	**Group Discussion and Closing Remarks**

APPENDIX B
Round Table Notes

Identifying Knowledge Gaps and Priorities for Small-Scale In-Stream Tidal Technology

Research & Development:

What are the immediate priority areas for research and development?

- Determining Site location
    - Research exploration and development in these sites
- Aray affects (its interactions with the environment)
    - Blade and supporting structure all have different effects. What are they and how can they be mitigated.
    - Being able to project the effects are important. Research is being done but more work is needed to determine aray effects. Korea suggested that they are able to predict some aray effects using their model with an error of +or- 10-15%
    - To determine effects a model needs to be develop for a specific device and site location
- Coordination of research
- There needs to be a standard code of practice. International standards are needed. Standards are important for insurance reasons
- Understanding the socio economic impacts
    - Currently a GAP analysis is under way. It will be complete over the next few months
    - Economics issues are late being addressed. What are the economic impacts on the community?
    - The community can end a project so it's important to understand what they are thinking about. We need to educate them. We need to understanding their perspective on tidal energy and it's impacts on their lives. We also need to understand the industry (example fisheries) perspective. Need to understand the perspective of all community interests groups
    - Need to understand the social factors and how this technology will effect the community
    - Need to understand how villages/communities work. If we know how a particular community works (primary employers, public interests, and recreational activities) then we can work with them to allow tidal energy to become part of their community.
    - Money for municipalities to hire a economic development officer
    - Right now the sciences are coordinated but the business and economic researchers are not working together yet. Need better coordination among the business and economic researchers.

Technology Development:

What are the current barriers to proving small-scale technology?

- The cost of the research facilities.
- Funding for technology development
- No place to test new tidal energy devices (more places)

- Need to stop talking about this and get them into the water
- Government regulations can be a barriers
- Grid connection
  - Need to have the demonstration site connected to the grid (Interconnection)
- Energy storage
  - Having a stable energy supply (batteries) Being able to provide a stable energy supply to the grid
  - Tide comes at night when no energy is needed or demanded
  - Finding markets for the energy during off peak hours(ferry boats, greenhouses etc.)

Service Supply & Development:
What should our supply chain focus on to support a small scale tidal industry in NS?

- Need to change the ferries, municipalities, houses and greenhouses etc so they use tidal energy. Need to develop new markets for tidal energy ones that can use the energy in off-peak hours.
  - The province needs to use smart grid technology
  - Devices need to be connected to the grid

Are there things we should be doing/not doing to grow in this area?

- Put machines in the water
  - We can't learn anything without tidal energy devices in the water
  - We need to learn how to get tidal energy devices in and out of the water
  - We need to learn more about how to engineer these devices so they can effectively convert tidal energy into usable energy in a cost effective way.
- Digby needs about 2 MW of tidal energy to create a tidal energy industry
  - Need to develop a tidal energy development timeline. This timeline would give people a better understand of what the industry has accomplished and what it still needs to accomplish. This timeline would assist in the development of an industry and supply chain. It would provide a guide to what products and services are need and when they are needed.

Developing Tidal Power, the Industry and the Community (The group started running out of time so we didn't really finish discussing the answers to this question)
What are the current barriers to developing small-Scale in –stream tidal projects? What are the most important first steps for building a small-scale tidal industry in NS? (These 2 questions were answer together)

- Need a tidal energy converter (Tidal turbine) that effectively converts energy from the tide into usable energy. The best way to develop this device is to get machines into the water.
  - The device needs to be cost effective

  - It also needs to be have a minimal impact on the environment (environmentally friendly)
- The industry needs to set goals. This will assist them in determining what they are competing against. The industry needs to understand what it's competing against. Small scale tidal will need to compete with offshore wind. While large scale tidal needs to be competitive with onshore wind.
  - Value of tidal energy. Cost to produce tidal energy per kwh. At what price is tidal energy competitive with other green energy sources ($0.20)
  - Need proven tidal technologies. Need 12 months of operating data this could provide investors with security about the technology. Investors need some security and having technology that is proven might provide this security and thus attract more investors.
- Facilities (Complex) on land and in the water are needed. The facilities need to provide a variety of services to assist tidal energy developers.
- Need communication capabilities like high speed internet (important)
- Nova Scotia universities have excelled knowledge of the marine environment but the province's universities need to improve their expertise on marine energy engineering.

How should these projects be structured to provide for community involvement and /or community benefits? (Group did not have time to answer this question)
Are there existing competing uses for the tidal/ocean resource in communities that need to be considered? How are these issues being addressed?

- Competing interests
  - Fishing, aquaculture, ferries and other transportation, and environment/ecotourism
  - Shipping lanes
  - People want to be compensated when they are effected by development (example fishing boats driving around sites need to be compensated for extra fuel costs for driving around site)
  - Need to understand how the community is being inconvenienced by the tidal energy development and the value of this inconvenience. The tidal energy development needs to be win win for everyone.
  - First a vision is needed then begins negotiation/working with communities. Need to present to the community how they will benefit from the new development (tidal energy). How it will positively impact their lives.

Identifying knowledge gaps and priorities for small-scale in-stream tidal technology

Research & Development

What are the immediate priority areas for research and development? (Top 3-5 priorities) Responses can include types of information or data that should be collected now to help inform future technology and project development.

- Marine mammals – acoustic monitoring (passive and active)
- Quantifying turbulence/waves and impact on the devices including reduction in lifespan of turbines - need for bathymetry data
- Current profiles, predictions/anomalies and developing devices appropriately (Potential for 50 rpm is significant)
- Accuracy of resource assessment
- Deployment and mooring issues
- Sediments (depending on the location)
- Ice (also depending on the location)
- Community level grid connection/energy storage and usage
- Not a lot of work on arrays thus far

Technology Development

What are the current barriers to proving small-scale technology?

- Funding $$$
- This the transition from Research to Development
- Deployment infrastructure needed (wharfs, boats, cranes, etc.)
- Suitable sites for deployment (small scale demonstration and commercial)
- Requirements for site-specific technology (not universal)
- Cable technology suitable for environment
- Underwater connection issues

Service Supply & Development

What should our supply chain focus on to support a small scale tidal industry in NS? Are there things we should be doing/not doing to grow in this area?

- Support local – must support from within, NS capabilities taken advantage of
- Communication between developers, manufacturers and service supply sector (identifying what is needed and who can provide it)
- Education for the local communities service and supply sector – must work together
- Take advantage of local knowledge

Developing Tidal Power, the Industry and the Community

What are the current barriers to developing small-scale in-stream tidal projects?

What are the most important first steps for building a small-scale tidal industry in NS?

How should these projects be structured to provide for community involvement and/or community benefits?

Are there existing competing uses for the tidal/ocean resource in communities that need to be considered? How can these issues be addressed?

- Participation in COMFIT program **-** COMFIT criteria/eligibility requirements has covered much of this
- Competing uses - Navigation, whale watching groups, fishermen, recreational – best way is to keep all others involved and educated (not competing instead collaborating)
- Opportunities for community participation and benefit mitigates opposition (ie CEDIFs)
- Regulatory regime clarity

Research and Development:

What are the immediate priority areas for research and development?

Establishing international standards, site specific (ex. met ocean data, weather data, geotechnical study, turbulence, climate input, pinned bases, gravity bases – sonar information alone is not enough) that allow industry to have confidence that they are investing in viable business opportunities and reduces the cost associated with investing in a project. It also allows them to access the financing they need to bring the project to life. Even basic standardized met ocean data would allow industry to understand the available resource before further investing in a project.

International working groups are working to develop standards but these are not widely accepted, usable for industry. To achieve this we would suggest investing in exploration and research. This could be developed on a regional basis by governments as a service in an effort to attract investors.

Further research and development around marine mammal studies also needs to be conducted. Developing risk management practices also need to be researched and development.

Technology and development:

What are the current barriers to proving small-scale technology?

Materials research, for example lowering the overall weight of products. Research and development of electrical products is very expensive. Going modular is one way to get around this problem of being able to certify design and parts.

Also developing control systems and grid integration systems (interface could being ignored) is also important.

Service supply & development

What should out supply chain focus on to support a small scale tidal industry in NS? Are there things we should be doing/not doing to grow in this area?

Developing Tidal Power, the Industry and the Community

What are the current barriers to developing small-scale in –stream tidal projects?

It takes a long time to develop environmental standards. One year or longer. In Europe 1-3 years. The first few sites will take longer to develop but perhaps future projects will move faster.

What are the most important first steps for building a small-scale tidal industry in NS?

Developing environmental standards. Making the feed-in tariff a success, streamlining bureaucracy – data collection, aggregation, access to research facilities. A bridge to help entities develop there projects to qualify for FIT.

The stability and existence of programs for investment, identifying entrepreneurs, community engagement, community knowledge provided by government, cooperation among government and FORCE, developers, research. Information should not come from developers, people from the community they have confidence in.

Developing the expertise in the field within Nova Scotia is also important. Building the competency at the community based level is also important and will deliver community benefits. Will also facilitate entrepreneurial spirit.

Ensuring that we have the facilities for assembly is also an important consideration.

How should these projects be structured to provide for community involvement and/or community benefits?

PPP projects can encourage, provide guarantees, know-how necessary to bring project to life.

Are there existing competing uses for the tidal/ocean resource in communities that need to be considered? How can these issues be addressed?

Small-Scale Tidal Energy Workshop – July 7

Presentations

Technology Development:

- Chris Sauer – ORPC
  - No difference between small vs. large scale
  - Cost is the issue for small-scale because no economies of scale like large-scale
  - Important to have site development progress in parallel with project development

- Professor Jo – Inha University, South Korea
  - Key issue: device interaction
  - In Korea, less than 100 kw considered small-scale
  - Problem: how to maintain small scale
  - Need to maximize low tide and high tide
  - Many technical challenges to overcome

- Clayton Bear – NEC
  - Shipping/transportation issues (difficult to build equipment far away from application)
  - What's needed:
    - Test and demo site
    - Resource and environmental assessment
    - Access to marine expertise
    - Local fabrication
- Chris Campbell – OREG
  - Need to build a market
  - In Canada: 75 MW – 2016; 1 GW – 2030
  - Think small-scale tidal that will move on to community/industry development

Research and Development – gaps, actions that need to be taken

- Design characteristics (velocities and impact on turbine design)
- Understanding of sediment effects/ repair and damage
- Maintenance and supply services required
- Development of first units need to be done in a cost effective way
- Optimal location in worse places for operation/maintenance, need to find best place for optimal operation
- Site assessment and resource characterization, pinpointing of location in Petit Passage and Grand Passage
- CNSOPB approach: how they are characterize resource to attract development
- Need experience in the water
- Challenges for small-scale = environmental effects monitoring: will the province be able to support this? This issue is currently being addressed at FORCE
- Why are we treating this as a two-tiered system (ie. Small and large scale) – seems that small scale issues are the same as large-scale

Technology Development

Barriers:

- Finance: finding the right technology investment funds and right academic institutions to partner
- Timelines: as small/medium business don't have a lot of time to get financing
- NS can take lead on environmental monitoring/site characterization
- Same problems as offshore wind
- Government has control to determine what is needed for small businesses to grow small-scale projects

Service and supply chain development

- Flat rate/fees
- Things happening with supply chain that we didn't envision
- Put something in place to stimulate growth
- On environmental side need environment/first generation support to drive
- Policy side: identify training opportunities, career development
- Fabricate locally
- Government can play a role in technology transfer
- Local content to ensure local servicing
- Education/more workshops/outreach
- Knowing what is needed and required for supply chain/service will require knowledge and communities/businesses know there is a need
- Incentives: feed-in-tariff (need to be obtainable for small businesses that are involved at small-scale)

Developing tidal power, industry, community

Barriers:

- Regulation (commensurate with scale; regulatory alignment)
- Information (not enough information-sharing)
- Important first steps: need more financial support, take advantage of existing expertise in NS, raise visibility of local/economic activities
- Structure for community involvement: COMFIT a good first step

Issues with existing competing uses:

- Needs to be a lot of dialogue
- Communicating things up front
- Close monitoring of effects
- Get buy-in from other users (show how economic benefits can be realized)
- Monitoring effects communicated
- Put advice in and put it into play

Question One: Research & Development

- Understand the system from a long-term point of view, scale of resolution that makes sense (tidal cycles affecting sediment), seasonal research → long-term needed to understand long-term affects of tidal power.

Priorities:

- Issue: lack of youth engagement with this industry in Atlantic Canada. Expertise "brain drain" due to retirement in this industry. Wind energy brought in scholarships in order to promote youth engagement/interest; go into high schools to talk of career paths in renewable energy. This industry will be competing with other industries for these talented young people. Must attract them via long term career paths. This will allow for the sustainability of this province's renewable energy sector. Must communicate these visionary goals. = generational integration
- Better communication of ocean industry. We are not capitalizing and pushing our ocean resource—we are not only the *OCEAN PLAYGROUND*, but also the *OCEAN WORKPLACE*—we are "Fort McMurray with lobsters." A way to do this is to through accessing our youth. Remember our ocean history—teach oceans engineering at NSCC in a foundation year program (teach how to utilize and capitalize on the resource)
- Export the clean technology to the globe, especially developing nations such as China and India (who are utilizing coal extensively, but are open to new technologies). Emerging global leadership in technology, research, development, implementation, industry
- Feed-In Tariff as a great start in the right direction: grass roots, a good start to get off coal

Question Two: Technology Development

- Fabrication can be developed outside the Fundy area to support the development of the research and implementation industry in the province

Barriers:

- Not taking industry seriously enough to justify the costs of associated with it.
- Must ask if it is worth the time and effort?
- No longer a barrier: the Province of NS now supports the renewable industry and tidal industry rather than coal and other non-renewables. Better than carbon trading. Acknowledgement of this is helping to get better and off fossil fuels; however, the offshore petroleum's growth counters the renewable energy strategy.

Question One: Service Supply & Development

Challenges:

- How do we attract the attention and capacity in the industry that already exists and have pre-existing success (offshore oil and gas, fabrication, building)? Success Ex: EnCana lending ~$3 million to help get the industry started
- Misconceptions of Risk: risks associated with petroleum exploration are (perhaps) equal to investment in renewable energy technologies (with all of their uncertainties)
- TED Presentation by James Baylaw (sp?): glacial melt as a way to motivate selves away from GHGs.
- The story is changing: good PR matters to get people excited about it. This will help people to shift their mindsets from traditional to newer, more (future-oriented) secure industries (i.e., from fisheries to tidal energy)
- Green is the way of the future. The only way to <u>secure the future</u> is through renewables. We must reduce GHGs in order to have and provide a future for the next generation
- Development of trades in the province, not just in areas where the technology is implemented, but where it is developed, fabrication (spinoff effects: housing, tourism, economy→some things need to replace forestry, fishing (traditional) industries.
- Once reaching scale, it's easier to produce internally (at home) rather than elsewhere and import
- Stewardships: NS as an effective recycling community (a cultural phenomenon). Renewable energy goes right along side it (although garbage pays. Use methane for internal combustion. Ex: Cirque du Soleil Montréal) as the two are complementary culturally, ethically (public perception) → "a story of sustainability"
- Renewables/Tidal: *A story of sustainability and career paths*

Question One: Developing Tidal Power, the Industry, and the Community

Location Matters:

- There is no real place to do any research. If you want to do research in NS, you need a place to go. Which FORCE will be.
- It doesn't seem as though there is one focused area. FORCE is supposed to be the one? Acadia? Digby/Brier Island? FORCE too far by land from these areas (in Parrsboro)
- FORCE to be research centre and development centre
- NS: rural NS doesn't exist. The centre of research is in Halifax. We need to move out of the centre and into the rural and peripheral areas. Renewables is a rural sector and will empower these areas.
- Bay of Fundy has to be the centre for NS tidal research. SW Nova has nothing to offer this industry. In this way, it makes sense for the centre (FORCE-like) to be located at Acadia

Job Creation:

- Having such a centre becomes tourist-related (=economic spinoffs); children following parents in career (employment sustainability). This will help bring people back from Alberta (this people will buy houses, etc. Again, spinoffs). Job creation matters: things must be in place in order to create that long-term job creation (infrastructure, projects, etc, and there must be more than just one project as that would be insufficient to entice those who are away to come back). Job creation will eliminate the 'brain drain'
- More work than there are people now = encouraging
- Need to cooperate with other jurisdictions (NL, Atlantic Canada, Maritimes)
- Opportunities for skill-set utilization: attract via these industries
- The insurance industry was not represented here: project-specific risks that the industry has not yet thought of, but need to. Insurance needs to look at facilities, but won't until the experience and facilities are built. Part of the reason why tidal energy is so expensive is because the risks are so high (because insurers aren't participating/looking at the industry). NEED: draw the insurance industry in (a lack of knowledge on their part about the industry).
- opportunity to coordinate
- Opportunity: these technologies are exportable
- Emerging as a leadership threat spurs competition, investment, innovation (ex: NS and Scotland to Chile)

Contact: bob.hutchins@atlanticenergyclaims.ca (for presentations)

Sandra's Group

Q1

- Socio-economic research is the top priority

Q2

- Need to get devices in the water!

Q3

- Regional inventory of all requirements for the supply chain (communicate): regional database
- Publicize individual requirements
- US-Canada (NS-Maine) Memorandum of Understanding to facilitate collaboration. How to get over international/border issues and differences?

Q4

Barriers:

- Lack of environmental knowledge about the sites (whole ecosystem)
- Integrate knowledge of fisheries, community, First Nations with tidal developers and scientific community
- Community understanding
- Capital investors and risk: returns are long-term
- Lack of infrastructure and access

First Steps

- Identify characteristics of sites
- Starts planning and needs analysis (comprehensive)
- Financing mechanisms for early stage, risky projects, studies, etc
- Both at the private and public sector financing
- Targeted research: need a mechanism to communicate a research needs and identify research capabilities (FERN helps)

Structure

- COMFIT and CEDIFs help to create community involvement and benefits

Competing Users

- “Fight over our bottom space” BIG ISSUE (fisheries, aquaculture, tidal, tourism, boating, marine life)
- Early communication and involvement (take 3-4 years)
- Openness, fairness, willing to consider territory

APPENDIX C
Panelist Biographies

Panelist Biographies

Jennifer Matthews, Research Manager Offshore Energy Research Association

Jennifer Matthews is the Research Manager for the Offshore Energy Research Association (OEER) and the Offshore Energy Technical Research Association (OETR) Associations (the Associations). In addition to her work at the Associations, Jennifer is also the Director of Operations and Research at the Fundy Ocean Research Center for Energy (FORCE). As the Research Manager for the Associations, Jennifer manages all research projects, develops calls for proposals, reviews research proposals and reports, and research strategy. Most notably Jennifer is managing projects in marine renewable energy, the Play Fairway Analysis and a variety of other renewable and nonrenewable research initiatives. As the Director of Operations and Research for FORCE, Jennifer develops all requests for services and calls for proposals, manages research projects, and assesses the research needs of FORCE.

Chris Sauer, President and CEO, Ocean Renewable Power Company

Christopher R. Sauer is President and CEO of Ocean Renewable Power Company, an industry leading developer of technology and projects that generate clean, predictable power from ocean and river currents. He has more than 30 years of experience in the facility development, power generation, cogeneration, renewable energy and energy efficiency industries. He has a proven track record of success in executive management, engineering / construction, technology development, transaction structuring, marketing and sales and start-up company formation and management. He has held senior management positions with two major U.S. corporations and has been President and CEO of three startup energy/environmental technology companies. He has been in the energy transaction business since 1977 and, since that time, has played an instrumental role in the development of more than $2 billion in energy assets and companies. Chris is a registered professional engineer and a lifetime Member of the American Society of Civil Engineer.

Chul Hee Jo, Professor, College of Engineering Inha University

Professor Jo has finished his Mater degree in Stevens Institute of Technology, USA in 1985 and Ph.D in Ocean Engineering in Texas A&M University in 1991. He has worked for Intec Engineering, Houston and Hyundai Heavy Industries, Korea from 1992 to 1997 being involved in the design and engineering on various offshore structures such as pipeline, riser, mooring, Arctic structure, etc. From 1997 to present, he has been with Inha University in Korea with his major research area in tidal current power. He has been involved in many government advisory bodies and committees in ocean and tidal current energies. His school is one of the five consortium members for the development of the 200MW Incheon tidal current power farm project. He is very active in tidal current research since 1997 with around 50 research papers and about 30 patents on tidal current power.

Anna Redden, Director, Acadia Centre for Estuarine Research and Executive Directive Committee Co-Chair Fundy Energy Research Network

Anna Redden is an Associate Professor in Biology at Acadia University, the Director of the Acadia Centre for Estuarine Research, and a Director on the Board of the Fundy Ocean Research Center for Energy (FORCE). She has 30 years of experience working on a broad range of environmental issues and effects monitoring in coastal waters. This includes environmental studies at North America's only Tidal Power Plant, at Annapolis Royal, contributions to modelling workshops on the consequences of an Upper Bay of Fundy tidal barrage (early 1980s), and research with tidal energy project developers at the FORCE tidal energy demonstration facility. Anna is Co-Chair of the Environmental Monitoring Advisory Committee for tidal energy developments in Minas Passage and is founder and co-Chair of the Fundy Energy Research Network (FERN), the office of which is housed at Acadia. FERN was established to assist the emerging tidal energy industry and the research community in addressing a range of environmental, engineering and socio-economic issues.

Clayton Bear, President & CEO, New Energy Corporation

Mr. Bear is a professional engineer with over 20 years experience in engineering, product development and the application of leading edge technologies. Mr. Bear was one of the founders of New Energy Corporation Inc. and has been in his present role since its inception in 2003. He worked for 11 years in the oil and gas industry primarily on the implementation of new technologies in pipeline and gas compression equipment. In 1993, Mr. Bear co-founded Revolve Technologies Inc. where, as the VP of Engineering, he directed the development and commercialization of the company's magnetic bearing and dry gas seal technologies. After leaving Revolve, Mr. Bear worked with a high tech products company directing the development of new concepts into products, as a consultant in the rotating equipment and energy efficiency fields, and as VP of Engineering for a renewable energy company.

Chris Campbell, executive Director, Ocean Renewable Group

Chris is a marine scientist and leader in development of Canada's ocean economy. He has a B.Sc from Wales, a PhD from Newfoundland, and has worked in France, Newfoundland and British Columbia. Trained in biology, he worked in aquaculture and seafood industry development as a leader in research, education and consulting. In recent years he has worked to cluster BC's ocean technology sector and to create Ocean Industries BC as an industry association to focus on economic opportunities from British Columbia's maritime activity. Since 2004, he has focused on building an alliance of industry, governments and utilities to ensure that Canada is a leading player in the emerging renewable ocean energy opportunity. The 120-member Ocean Renewable Energy Group has succeeded in attracting government and utility attention toward this important clean electricity resource and low-carbon economic opportunity. Chris now serves as Executive Director for this national association - Lewis Conference Services International Total conference management by Lewis Conference Services International.

Dana Morin, President, Fundy Tidal Inc.

Mr. Morin is a key figure in the development of community renewable energy initiatives in Nova Scotia and is the founder and president of Fundy Tidal Inc. (FTI), a community tidal power developer rooted on Brier Island at the entrance to the Bay of Fundy, home of the world's highest tides and strongest currents. He is the founder and past president of several community economic development investment funds (CEDIFs) referred to as the ``Scotian WindFields``. Collectively, community investment has been instrumental in the creation of FTI, Fourth Generation Capital Corporation and Scotian WindFields Inc. which he co-founded with community power pioneer, Brian Watling. This network has also been directly involved in the development of Nova Scotia wind turbines operated by Renewable Energy Services Ltd, Shear Wind Inc, and at Emera's Digby Neck Wind Farm. Fundy Tidal Inc. is developing tidal power projects in the Digby Gut, and Grand and Petit Passages of the Bay of Fundy under the small-scale tidal power community feed-in tariff (COMFIT). Dana currently serves as the secretary/ treasurer of the Ocean Renewable Energy Group (OREG) and is co-chair of the Fundy Energy Research Network (FERN) Socio-Economic Committee.

APPENDIX D
Panel Presentations

Small-Scale In-Stream Tidal Workshop

July 7, 2011

Jennifer M. Matthews

Research Manager, Offshore Energy Research Associations

Outline

- OEER/OETR Overview
- Accomplishments to date
- Advancing Small-Scale In-Stream Tidal Energy
- Summary
- Questions

Who We Are

- The Offshore Energy Research Associations are comprised of two organizations:
  - OEER Association (Offshore Energy Environmental Research)
  - OETR Association (Offshore Energy Technical Research)
- Established March 2006
- Independent, not-for-profit corporations
- Funded by the Nova Scotia Department of Energy
- Mandate is to support the research and development of provincial offshore energy issues.

Accomplishments

- Strategic Environmental Assessment (SEA)

- The Province of Nova Scotia facilitate the development of a collaborative research program for marine renewable energy development in the Bay of Fundy.

- This recommendation has been implemented & research is underway in the following categories:

  - Tidal resource assessment;
  - Sediment dynamics;
  - Animal behaviour;
  - Near- and far-field effects;
  - Potential effects of ice and debris; and
  - Potential effects of tidal lagoons.

  – **10 projects funded to date with a further 13 under review**

Accomplishments

- SEA recommendation to create legislation relating to renewable energy in the BoF.
- Mi'kmaq Ecological Knowledge Study (MEKS) of the Bay of Fundy area.
- Tidal Interpretative Displays
- Workshops and Symposiums

Advancing Small Scale tidal

- A key component to a diversified energy portfolio
- Not a "*one size fits all*" approach
- Development of a gap analysis
- Funded research plan
  - **Site assessment (s)**
  - **Environment**
  - **Technology**
- ***HOW DO WE GET THERE!***

Advancing Small Scale Tidal

- OEER and OETR has received funding from the Nova Scotia Department of Energy for 4 new projects to advance small scale tidal development:

  - Detailed Gap Analysis
  - South West Nova Scotia Tidal Resource Assessment
  - Strategic Environmental Assessment – Phase II
  - Mi’kmaq Ecological Knowledge Study – Phase II

Advancing Small Scale Tidal

OETR Detailed Gap Analysis

- The goal is to support the design & development for in-stream small scale technology
- **Phase 1:** Via small scale tidal development work shop
  - Identify gaps in knowledge to further advance small scale tidal in stream technology design
  - Identify key components that need to be addressed
  - Develop recommendations to address gaps in knowledge
- **Phase 2:** Develop a timeline, activities and work plan for the development of a detailed Gap Analysis for Small Scale Tidal development

Advancing Small Scale Tidal

SWNS Tidal Resource Assessment

- The goal is to develop a resource assessment for in-stream tidal resource opportunities in SW Nova Scotia.
- Step 1:Planning for an ADCP deployment :
  - Rationale for the selection of the area of study
  - Identify main area of study
- Step 2: Develop a RA that will incorporate all phases of small scale ocean renewable energy development for SWNS for both pilot and commercial scale development

Advancing Small Scale Tidal

Phase II of the Strategic Environmental Assessment

- Applying the existing SEA framework for the development of Phase II.
- Areas included in the SEA include: areas off the NS Atlantic Coast and Northumberland Coast including Cape Breton.

Advancing Small Scale Tidal

Mi’kmaq Ecological Knowledge Study – Phase II

- In 2008, the SEA final report recommended that the Province of NS ensure that a Mi’kmaq Ecological Study (MEKS) be carried out before marine renewable energy projects proceed in the Bay of Fundy.
- Phase II of the MEKS is now proposed for the Brier Island and Long Islands area including Grand Passage and Petit Passage.
- Dept of Energy has proposed that OEER and Fundy Tidal Inc. work together to complete a MEKS for the Brier and Long Island area.

Summary

Nova Scotia is uniquely positioned to take advantage of small and large scale tidal energy research initiatives:

- Diversity of tidal locations – Bay of Fundy to Petit Passage (range of design research capability)
- Extensive tidal researcher expertise & infrastructure
- Track record – diverse portfolio or research projects underway
- Promising future for continued research and collaboration

Questions

Ocean Renewable Power Company

Community scale tidal energy projects: Successful integration with the regional supply chain community

Getting Power to Market Conference, Halifax, Nova Scotia
July 7, 2011

Christopher R. Sauer, President & CEO

Ocean Renewable Power Company

- Developer of hydrokinetic power systems and commercial projects for tidal, river and ocean current power generation
- Project sites in Maine, Alaska and Nova Scotia with up to 300 MW of Installed Capacity
- Superior, adaptable, scalable technology resulting in competitive power systems
- Founded in 2004 – now 28 employees
- $39 million (U.S.) committed capital - $19 million in state and federal funding, including $10 million award from U.S. Department of Energy
- Partnership with Fundy Tidal Inc. for community-based tidal energy projects in Nova Scotia

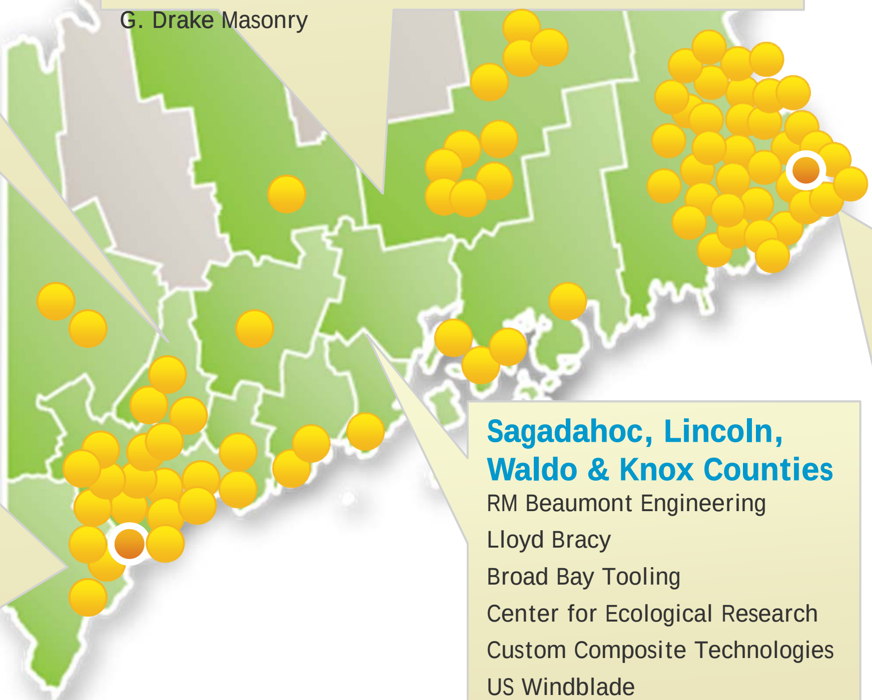
Supply Chain Needs – Internal Resources

- Management of concurrent technology and project development
- Engineering of unique, first-of-a-kind hydrokinetic power systems
- Site assessment
- Project development – commitment to community
- Environmental evaluation and licensing
- Marketing and communications
- Project management (execution)
- Fundraising and financial management
- Pioneering grit

Supply Chain Needs – Regional

- Manufacturing and fabrication
- Marine assets and services – deployment, retrieval and maintenance
- Marine supplies
- Engineering, geotechnical, benthic and other expertise
- Environmental and scientific expertise
- Legal, accounting and other professional services
- Academic R&D

Statewide Economic Impact *Maine Partners, Contractors, Service Providers and Vendors*



Androscoggin, Kennebec & Oxford Counties
Affordable Office Solutions
Connectivity Point
Northland Industrial Truck Co.
Second Street Consulting
Small Hydro East
The Barn

Cumberland & York Counties
ORPC Corporate Headquarters
Bonney Staffing Center
Casco Bay Frames
Edison Press
Exhibit Source
Flotation Technologies
Writer, Camryn Hansen
Harbor Technologies
HDR/DTA Engineering
La Capra Associates
LMGi
MER Assessment
George Monaco
Nelson & Wright
Pierce Atwood
W.B. Mason
Winter People

Penobscot, Somerset & Hancock Counties
Aerohydro Inc.
Alexander's Welding and Machine
Blue Hill Hydraulics
Burton G. Fisheries
CES, Inc.
Downeast Marine Resources
G. Drake Masonry
Land-Air Express of New England
Maine Maritime Academy
MariSources
NES Rentals
SGC Engineering
Stillwater Metalworks
University of Maine

Sagadahoc, Lincoln, Waldo & Knox Counties
RM Beaumont Engineering
Lloyd Bracy
Broad Bay Tooling
Center for Ecological Research
Custom Composite Technologies
US Windblade

Washington County
ORPC Eastport Office
AD Pottle Trucking
Archi-CHECK, LLC
Brayden's Future
Brewster Construction
Cobscook Bay Resource Center
Cooke Aquaculture
D&B Marine Salvage
DiCenzo Crane
Diving Services
Eastern Plumbing
City of Eastport
Eastport Port Authority
ECR Refrigeration
Federal Marine Terminals
Captain Butch Harris
H&H Marine
Jamieson Diving
Jason Leighton
Kilby House
Town of Lubec
Maine Marine Technology Center, *The Boat School*
Milliken House
Moose Island Marine
Morrison Manufacturing
The Motel East
Murphy's Electric
Newell Construction
Perry Marine & Construction
Preston's Septic & Portables
Ricker Electric
Stanhopes Trucking
Dennis Turner
Turner Signs
Weston House B&B
Woodland Machine Works

Statewide Economic Impact *Job Creation and Investment*

From 2007 to 2011, ORPC has:

- Created or helped retain more than 100 jobs statewide
- Grown from 0 to 21 fulltime employees in Maine
- Spent over $8 million on goods and services in thirteen of Maine's sixteen counties
- Created new R&D and other professional opportunities for young Mainers
- Jump started the ocean energy industry in Maine, setting the standard for coastal community relations

In the Next 7–10 Years, the Tidal Energy Industry in Maine will:

- Create 400 to 500 direct jobs, including new working waterfront jobs
- Attract investment of up to $1 billion in Maine
- Create new, sustainable markets for Maine's world class composites industry

ORPC OCEAN RENEWABLE POWER COMPANY

Bay of Fundy Projects

ORPC OCEAN RENEWABLE POWER COMPANY

Thank you!

ORPC
OCEAN RENEWABLE POWER COMPANY

Small –scale Tidal Power COMFIT Projects & Supply Chain

2011 Nova Scotia Tidal Symposium

Personal Introduction

- President- Fundy Tidal Inc.
  - Co-Chair- FERN SocioEconomic Committee
  - Secretary/Treasurer- Ocean Renewable Energy Group
- Founding member of a number of CEDIFs and Operating Companies in "The Scotian WindFields" network

Fundy Tidal Inc. (FTI) Introduction

- Established in Westport, Brier Island in 2006 to **harness the economic potential of the tidal currents** of the Grand and Petit Passages of the Bay of Fundy and similar opportunities throughout the region.

- Seeking to secure **multiple small-scale tidal COMFITs** with multiple technology partners and financial interests

Fundy Tidal Inc.
~ Current Thinking.

Small-scale Tidal COMFIT

- Rate of $0.652 per kilowatt Feed-in Tariff Established
- Based on ~11 million per megawatt installed
- Devices < 500kw connected to Distribution System
- Majority owned by Eligible Community Proponents
- Based on ~11 million per megawatt installed

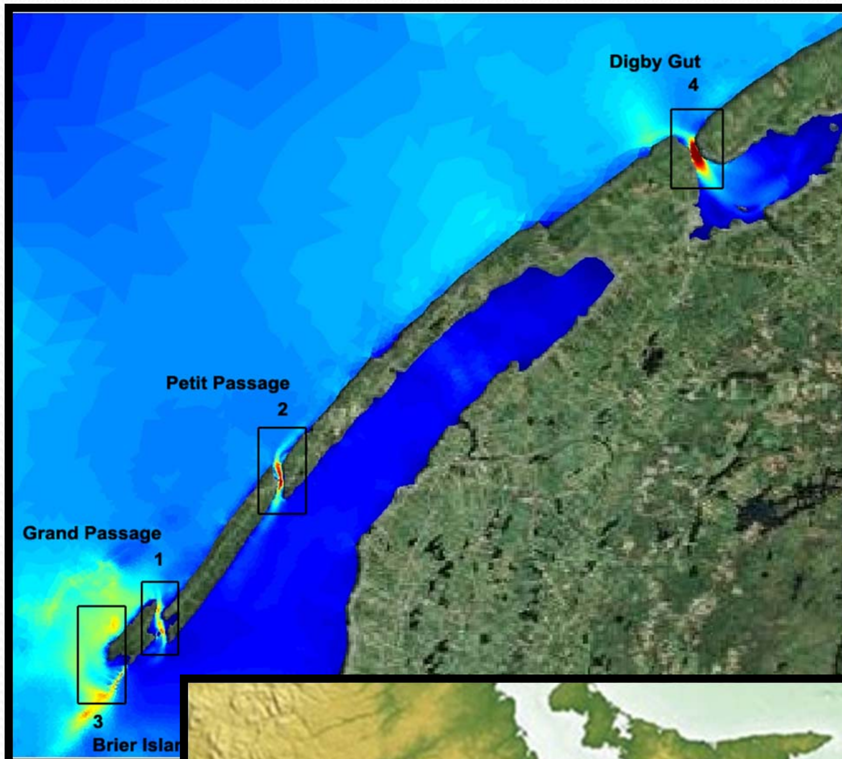
Fundy Tidal Inc.
~ Current Thinking.

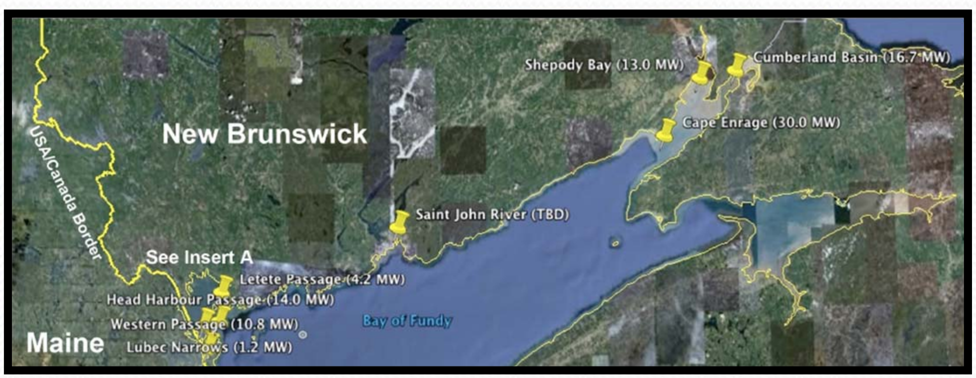
COMFIT Requirements (The Big 12)

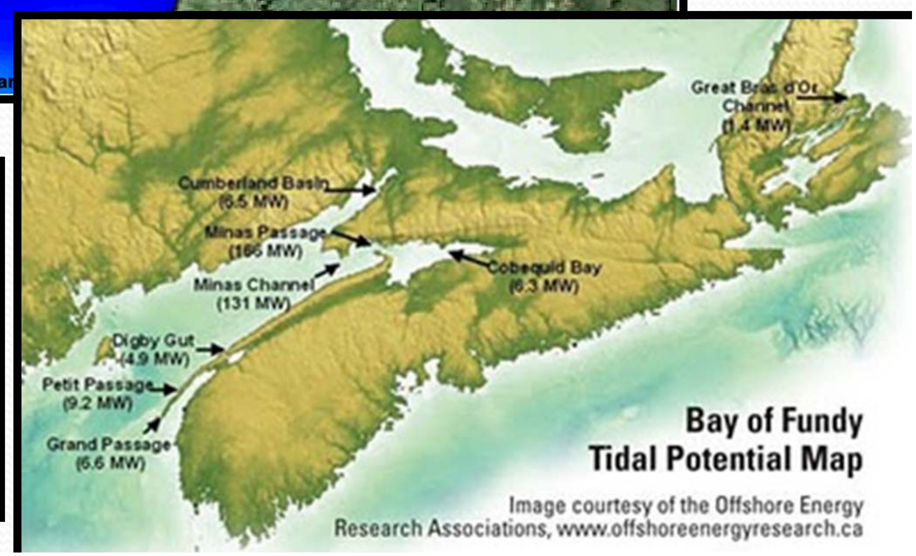
- Eligibility: CEDIF Status
- Business Case & Financials
- Project Ownership Structure
- Resource Assessment
- One Window Steering Committee (Regulatory)
- First Nations Consultations (MEKs)
- *Application Process being finalized for July 2011*

The Distribution-Connected Opportunity

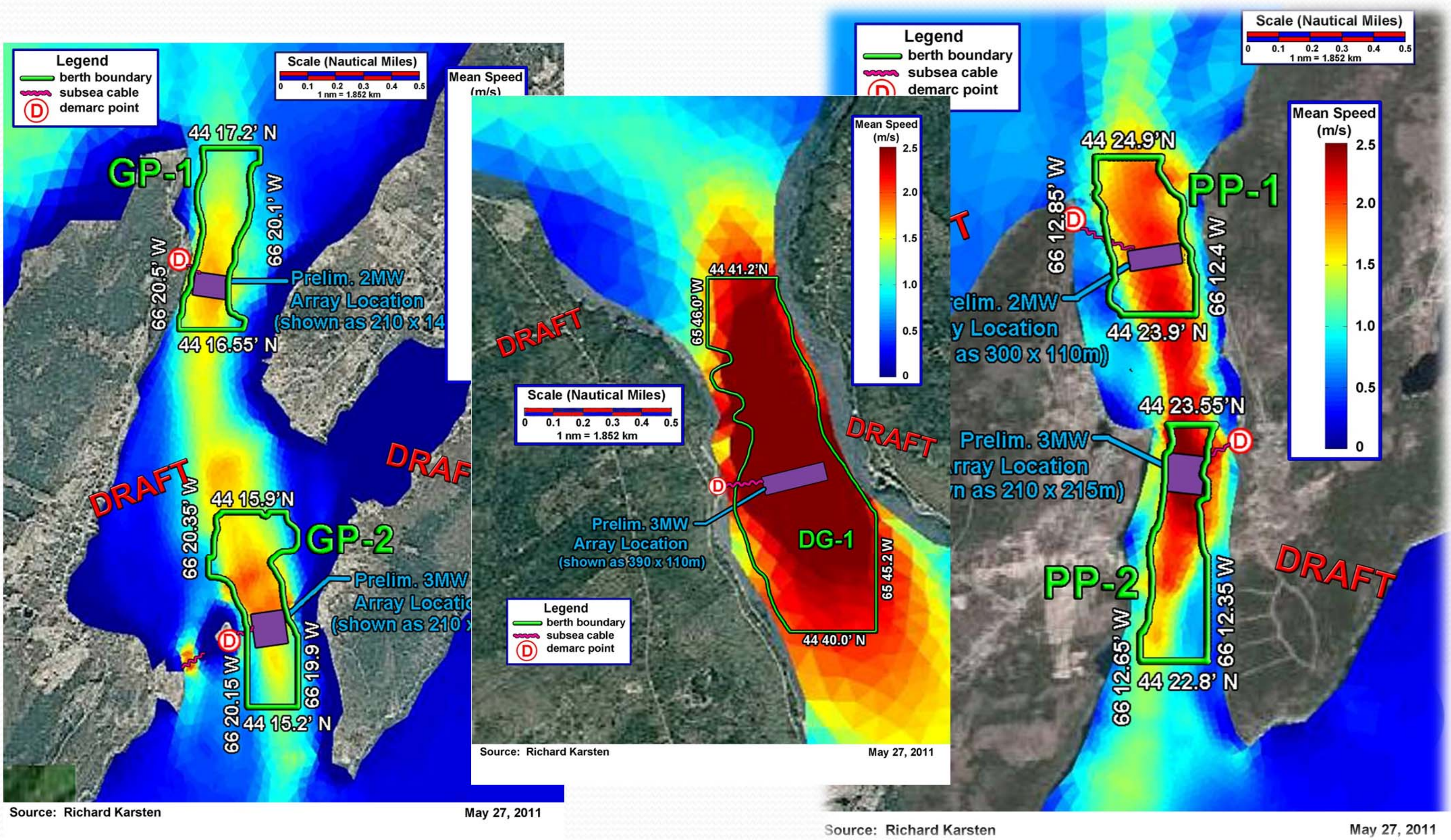
- Digby County
  - Grand Passage
  - Petit Passage
  - Digby Gut
  - Brier Island
  - Bear & Sissiboo Rivers
- Provincial
  - Cape Breton
  - Cobequid Bay (Burnt Coat Head)
  - Cumberland Basin
  - Minas Passage/Parrsboro
  - Yarmouth County
- Regional
  - New Brunswick
  - Maine/Eastern Seaboard







The Digby County Resource



Community Supply Chain

- The Villages of Long & Brier Island & Town of Digby, Municipality of Digby
- Community Economic Development Investment Funds & Community Investors
- Annapolis Digby Economic Development Association (ADEDA)

Infrastructure Supply Chain

- Port of Digby
- Port of Westport
- Port of Tiverton
- Port of Saulnierville

Fundy Tidal Inc.
~ Current Thinking.

Research & Development Supply Chain

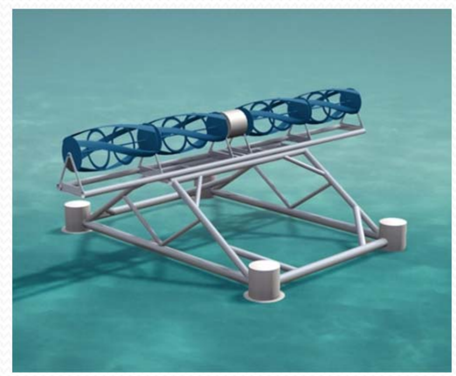
- Fundy Energy Research Network (FERN)
- Acadia Department of Mathematics & Statistics
- Dalhousie Department of Oceanography & Marine Biology

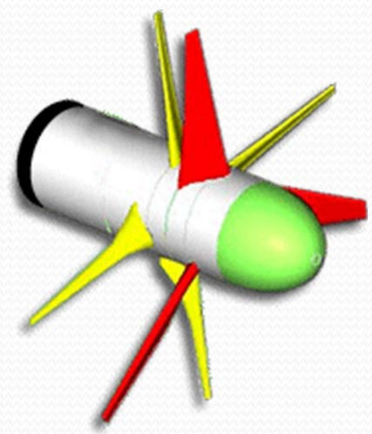
- OEER
- NSERC
- NSDF&A
- FORCE
- OREG

Technology Supply Chain

- New Energy Corporation
- Ocean Renewable Power Corporation

- Under Discussion:
  - Nautricity
  - Tocardo

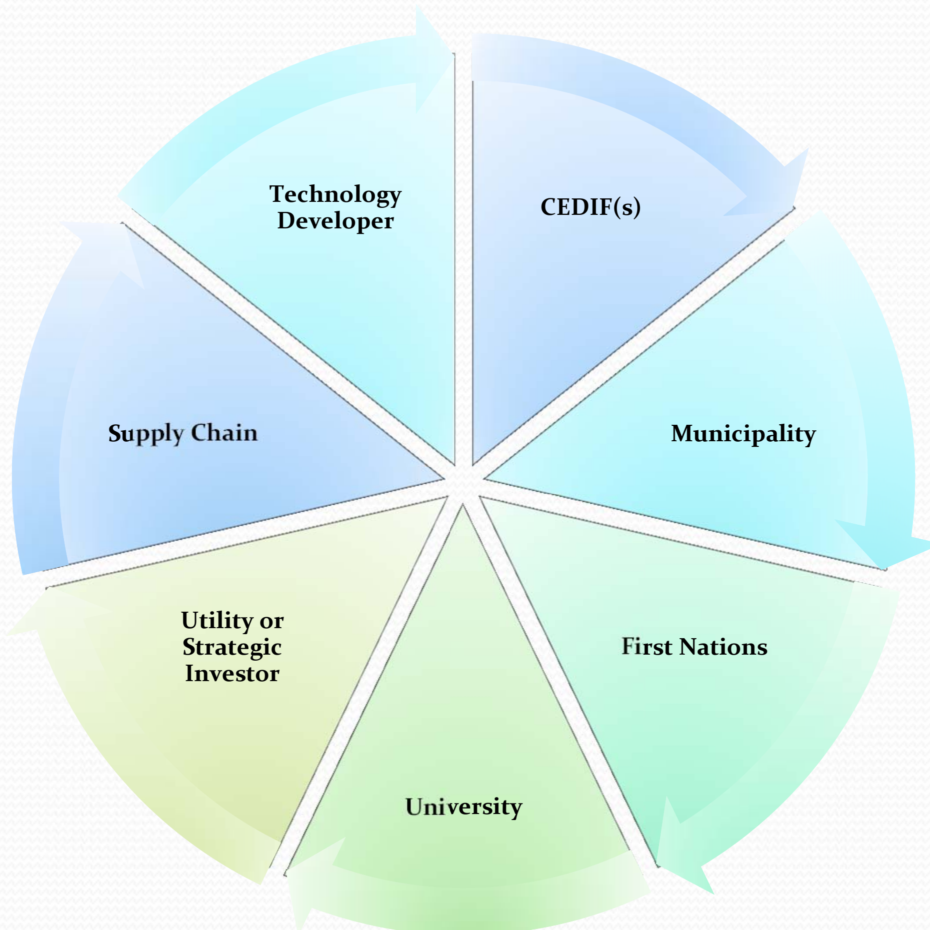




Service & Supply Chain

- Clare Machine Works Ltd
- Innovative Fishery Products
- Bear River Plastics Welding
- Comeau Marine Rail
- ROMOR

Financial Supply Chain

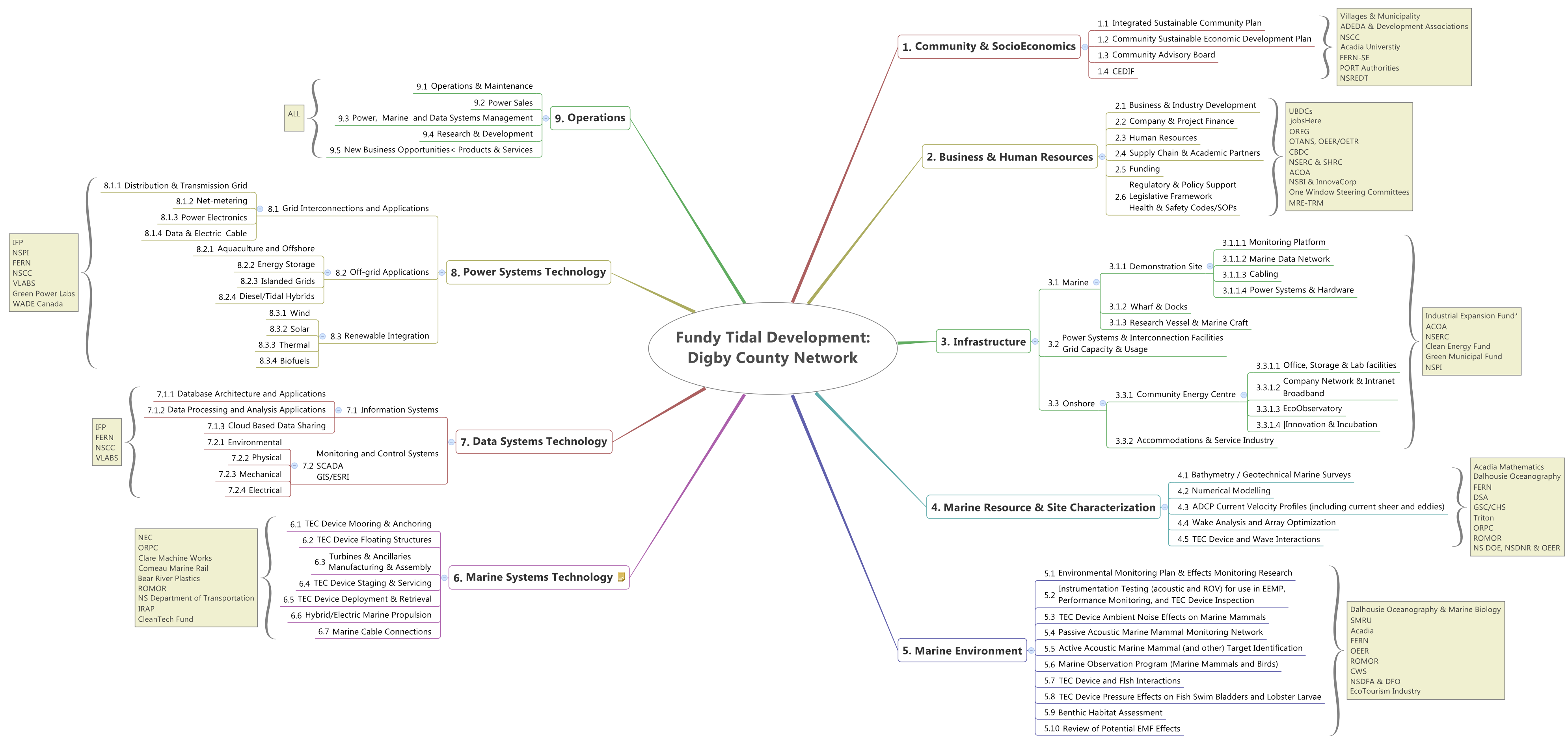


- Requirement of 51% Ownership by 1 or more eligible proponents

Thanks!

Invest in your local community renewable energy project!

DRAFT FOR DISCUSSION PURPOSES ONLY



Fundy Tidal Inc. Summer 2011