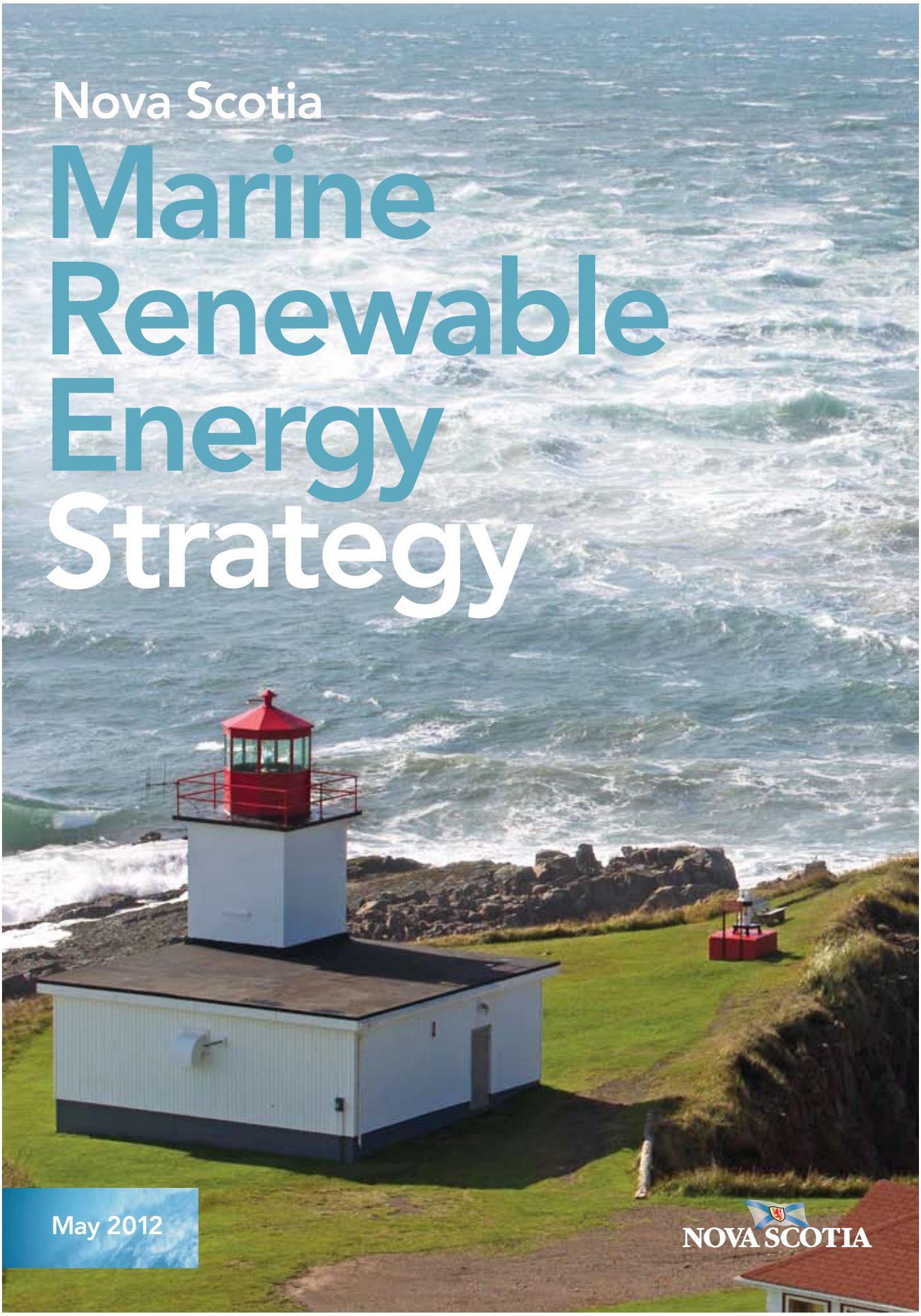

Nova Scotia

Marine Renewable Energy Strategy

May 2012

NOVA SCOTIA

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This document is available on the Internet at: www.gov.ns.ca/energy

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Executive Summary

Nova Scotia has a natural advantage in an innovative, emerging renewable energy resource: the ocean. Surrounded by the ocean, we have abundant marine renewable energy resources from offshore wind, waves and tides—particularly tides. Our Bay of Fundy has more than 160 billion tonnes of water flow with each tide, delivering a commercial potential of approximately 2,400 megawatts of power. Since 2006, considerable attention and resources have been focused on researching and developing in-stream tidal energy in Nova Scotia. The tidal energy industry is still in its infancy and many technical challenges remain before large-scale commercial development will take place.

Nova Scotia is already among the world leaders in tidal energy development and is well-positioned to become a global player in this emerging energy industry with its rich heritage of marine research, knowledge and innovation, and its natural advantages.

This Strategy is driven by opportunity and need. It is part of the Province's Cleaner Energy Framework that serves as an umbrella for several cleaner energy and sustainable energy plans. The Strategy sets out broad policy, economic and legal conditions for renewable energy projects, technologies and services from the ocean, in anticipation of commercial development and the establishment of a new industry.

The implementation of the Strategy will provide the opportunity to deliver cost-competitive renewable electricity to serve Nova Scotia's need for more diversified and stable energy sources. It will also provide the opportunity to apply local knowledge and skills to export to global markets in the future. This Strategy is about securing global opportunities for economic growth and investment. If successful, tidal energy will mean good jobs, a cleaner environment and more stable electricity prices in the long-term.

This Strategy is consistent with feedback received by stakeholders, the public and the Mi'kmaq of Nova Scotia through various consultations conducted by the Nova Scotia Department of Energy since 2007. The Province is committed to an incremental, adaptive approach to the development of in-stream tidal that protects the interests of all Nova Scotians.

The Strategy consists of three main plans to address Research, Development, and Regulatory initiatives that have been established to achieve Nova Scotia's vision to be *a global leader in the development of technology and systems that produce environmentally sustainable, competitively priced electricity from the ocean.* Wave and offshore wind power are part of the mix in the strategy, but tides are the primary focus, given Nova Scotia's unique advantage in developing and growing a new tidal industry.

Research Plan

Research is crucial to creating commercially viable, sustainable technologies that will foster a competitive industry in Nova Scotia. The province's role is to foster partnerships and multi-disciplinary research projects that address knowledge gaps, and develop an integrated, long-term research plan that brings key players together. In particular, this strategy is introducing a new research body—Tidal Energy Research Forum—that will contribute to sharing information on current research projects underway. It will also help in establishing research priorities and bringing together key organizations engaged in tidal.

Development Plan

While there is a measure of consensus around design elements of in-stream tidal energy devices, there is no one proven technology. We will encourage tidal development in the Province by ensuring that the design, installation, and operation of in-stream tidal energy are environmentally sustainable; the costs are ultimately competitive with other renewable energy sources; and that Nova Scotia takes maximum economic advantage of this opportunity. Developing new technology, creating a market, and building a supply chain are essential to the growth of a tidal power industry in Nova Scotia.

A key area of focus for the province's Marine Renewable Energy Strategy is on technology incubation, a mechanism that can speed development and foster entrepreneurship.

Nova Scotia is well-positioned in the development of both small-scale and large scale tidal technologies. The Fundy Ocean Resource Centre for Energy has already established a key role for large-scale development. Small-scale devices are not normally designed to operate in strong and fast-moving currents like the Minas Basin. The development of small-scale tidal energy projects at the community level can bring new economic opportunities to rural Nova Scotia and help to develop the knowledge-base for large-scale, commercial tidal development. Learning and knowledge can be shared and transferred between small-scale and large-scale sectors.

Partnerships between technology developers, power companies, and investors will be a strong factor in making commercial tidal power a reality. The ultimate goal is to develop the technology and retain the intellectual property in Nova Scotia while deploying that technology locally and exporting it worldwide.

Regulatory Plan

The marine environment supports many users and uses. Multiple public interests in a shared, public resource requires the involvement of multiple federal and provincial regulatory authorities. A legislative framework and regulatory system is required to ensure that projects and development proceed with appropriate licensing, environmental protection, community benefits, and provincial revenue. It is important to ensure that the public, stakeholders, and the Mi'kmaq are fully apprised and engaged in issues related to planning, development, environmental effects, economic opportunities, and regulatory oversight. The regulatory plan includes a robust and effective regulatory and environmental protection system as well as a public and stakeholder engagement plan founded on accountability and transparency.

The development of MRE technologies will help to reduce the province's reliance on foreign sources of fossil fuels, reduce harmful greenhouse gas emissions, and create new wealth and jobs here at home. Research, collaboration, and testing to-date have positioned Nova Scotia to take advantage of this opportunity. This Strategy outlines a vision for the future of tidal energy in Nova Scotia and timelines to move forward.

Introduction

The sun, the wind, crops, forests, even heat deep inside the earth itself are all increasingly recognized as energy sources. Worldwide, people are seeking renewable energy to replace fossil fuels. The most natural place for Nova Scotians to look is the place that has always provided a livelihood and an economic mainstay—the ocean.

The thriving heritage of shipbuilding excellence recently won Nova Scotia the biggest single shipbuilding contract in Canada's history. Now the heritage of ocean know-how and innovation, along with the natural advantage of tides that rise higher and rush faster than any others on the planet, opens opportunities for new sources of power that are as dependable as the tides.

How much energy do tides have to offer? Hydro power has been around a long time, and most of it comes from the power of a rushing river. The Bay of Fundy moves more than 160 billion tonnes of water with every tide. That 160 billion tonnes is more water than the combined flow of every fresh water river on earth—four times more!

That is massive power. It will take time for new technologies and innovation to harness that power, but given the depletion of traditional global energy sources and the toll that burning them is taking on the planet, it's only a matter of time. Tidal power development has great potential to create new wealth and support jobs here in Nova Scotia.

Expertise in marine renewable energy (MRE) development will be in demand globally. The technology will be new, but Nova Scotian companies are already leading the nation and becoming global players in innovative marine technologies. Marine renewable energy is next.

The pages that follow map out a strategy—not a how-to guide, but a high-level plan to maintain and build on the momentum that has already begun to develop in the MRE sector in the province. Think of the prospects: a new, dependable source of power; expertise that will be in demand worldwide; and new economic opportunities in parts of the province. Marine renewable energy is a natural fit for Nova Scotia, and Nova Scotia has the natural advantages to be the world leader.

Marine renewable energy is more than tides—waves pack some power too, and offshore winds are stronger and more constant than onshore wind. Wave and offshore wind power are part of the mix in the strategy, but tides are the primary focus, at least initially. Nova Scotia has a unique advantage in developing and growing a new tidal industry. The high current velocities and extreme tidal range of the Bay of Fundy create an opportunity to address the many challenges of working in such a harsh environment by establishing improved standard operating procedures, and best practices for designing and deploying monitoring platforms and instruments in high-flow areas. Technology developed to survive in the Bay of Fundy is expected to work in any strong tidal environment, thus meeting the "Fundy Standard."

Development of renewable energy from the ocean can be a critical element in the provincial agenda for the future, specifically by helping to

- contribute to Nova Scotia's longer-term renewable electricity mix
- reduce emissions of greenhouse gases and other pollution
- provide a diverse and more secure mix of energy
- support new and good jobs that build wealth and exports

FORCE beach aerial.

Nova Scotia has legislated targets to replace power generated from fossil fuels. By 2015, 25 per cent of the province's electricity will come from renewable sources, and by 2020, the target is 40 per cent.[1] It is expected that tidal energy would make a longer-term contribution to Nova Scotia's electricity mix post-2020. In addition, Nova Scotia is committed to a reduction in greenhouse gas emissions to 10 per cent below 1990 levels by 2020, under the requirements of the Environmental Goals and Sustainable Prosperity Act. Also, the federal government is proposing new regulations on greenhouse gas emissions, which will add further requirements in the decade to come. The province intends to reduce energy consumption and ensure the energy we use comes from fuels that emit reduced levels of harmful greenhouse gases, or none at all.

This is an ambitious program of energy security and environmental responsibility. The province has undertaken initiatives such as Strategic Environmental Assessments, the creation of small- and large-scale Feed-in Tariffs, and the development of a world-class tidal demonstration centre (Fundy Ocean Research Centre for Energy—FORCE) to drive success (these initiatives are described later in the document). FORCE was created as a hub of tidal power research and development. Community engagement and environmental research and monitoring are part of the mandate of the Offshore Energy Research Association of Nova Scotia, the offspring of two previous provincial creations: the Offshore Energy Environmental Research and Offshore Energy Technical Research associations.[2]

The province is putting together a regulatory framework to protect Nova Scotians' interests and environment, and forging formal and informal alliances to invent, design, test, and develop the right technology to harness the tides' power while protecting other marine interests and the natural environment.

The Marine Renewable Energy Strategy is part of the province's Cleaner Energy Framework, which will serve as an umbrella for many initiatives and identify areas that require further investigation and research. The Cleaner Energy Framework promotes using less and shifting the composition of our energy supply, focusing on four elements:

- energy efficiency and conservation
- natural gas
- renewable energy (for electricity, heat, and transportation)
- research, innovation, and investment

[1] The Renewable Electricity Plan and Renewable Electricity Regulations under the Electricity Act established these requirements.

[2] The Offshore Energy Research Association of Nova Scotia (OERANS) is an amalgamation of OEER Association and OETR Association. OEER and OETR Association were established in March 2006 as independent, not-for-profit corporations whose mission is to lead environmental, renewable and geoscience energy research that enables the sustainable development of Nova Scotia energy resources through strategic partnerships with academia, government and industry.

It is noteworthy that Nova Scotia's plan for a cleaner energy economy also includes enhanced natural gas use as well as renewable sources. While natural gas is still a fossil fuel, it burns more cleanly and costs less than other fossil fuels, and is available in abundant local supply. Natural gas and hydro sources such as the Muskrat Falls hydro project on the Lower Churchill River are also excellent back-up for renewable energy sources that are produced intermittently according to natural variations in wind, sun, and tides.

Based on consultation to date, marine renewable energy is predominantly viewed positively by Nova Scotians as a clean, renewable resource that could contribute to the province's energy needs, help reduce greenhouse gas emissions, and provide local economic opportunities. As well, the new energy industry offers the promise of good jobs and a strong economy.

A Window of Opportunity

Marine renewable energy is in its pioneering stage worldwide. Many technologies are in development, but there is no clear leader in the race for the most efficient or cost effective. There are just a small number of wave and tidal energy deployments in the world. The cost of electricity from marine renewable energy resources is not yet competitive with other sources, and while there is a growing body of technical and research knowledge, there is also much to learn about how the technology will interact with the environment. Incremental deployment and growth will allow researchers, academics, the industry, and governments to answer critical questions while working together as commercially viable technology is developed. They will learn by doing, gain expertise in efficient technology, reduce the cost of the electricity, and mitigate any adverse environmental effects.

Rising oil and coal prices and a growing demand for clean energy are making renewable energy more attractive worldwide. The European Union has significant experience in developing, deploying, and testing MRE devices. Member states have set an ambitious target to deploy 1.95 GW of marine renewable energy by 2020.[3]

The worldwide effort to develop commercially viable tidal power offers a window of opportunity for Nova Scotia to invent solutions and gain expertise that can be exported to other jurisdictions. Building on local and global experience, Nova Scotia can play a major role in the creation of new technologies and approaches. There are multiple locations across the province where both small- and large-scale projects can be developed and contribute to both the local economy and to global energy know-how.

Building on Sound Advice

Before preparing this strategy, the province commissioned renowned oceanographer Dr. Robert Fournier to lead public consultation on options to guide development of the MRE sector and associated legislation and regulations.[4] Dr. Fournier found significant interest and enthusiasm in Nova Scotia for marine renewable energy.

The "Fournier Report," titled *Marine Renewable Energy Legislation: A Consultative Process,* offers 27 recommendations, one of which is that a strategic plan for marine renewable energy, with an emphasis on in-stream tidal energy, be developed.

[3] www.bwea.com/pdf/marine/Wave_Tidal_energy_UK.pdf

[4] www.gov.ns.ca/energy/resources/spps/public-consultation/marine-renewable-energy/Fournier-Report-English.pdf

The government also consulted potential developers and suppliers through the 2011 Tidal Symposium and related workshops, and Nova Scotia played a leading role in the creation of Canada's Marine Renewable Energy Technology Roadmap.[5] That advice and experience plus local research went into this practical, yet ambitious, strategy to develop an industry that will create new opportunities for Nova Scotia and energy solutions here and around the world.

Strategy: The Mission and the Goal

Research, collaboration, and testing have positioned Nova Scotia to move to the next level of MRE development. An adaptive, staged approach to development will ensure that energy projects are economically sound and that environmental, social, and community interests are protected and advanced.

The Marine Renewable Energy Strategy's mission is for Nova Scotia/Canada to be a global leader in the development of technology and systems that produce environmentally sustainable, competitively priced electricity from the ocean.

The goal of this strategy is to support the growth of the marine renewable energy industry in order to

- secure a safe, stable, and diversified supply portfolio of affordable electricity for Nova Scotia
- develop marine renewable energy technology and expertise for domestic and export markets that will support jobs and wealth here at home

Guiding Principles[6]

The province is committed to the safe development of marine renewable energy resources in the best interests of Nova Scotians. Development will be guided by these principles:

- Protect the marine ecosystem
- Embrace collaboration and consultation
- Employ an adaptive and staged approach to development
- Ensure that health and safety are top priorities
- Ensure environmental protection and conservation of natural resources
- Recognize and respect other uses and users of the ocean and balance interests
- Develop the industry in a sustainable manner
- Maintain and ensure community sustainability

In addition to the principles listed above, the province will continue to consult with the Assembly of Nova Scotia Mi'kmaq Chiefs under the Mi'kmaq-Nova Scotia-Canada Consultation Terms of Reference on the development of Marine Renewable Energy Legislation.

[5] Source: www.oreg.ca/web_documents/mre_roadmap_e.pdf

[6] The first and second recommendations from the Fournier Report are (1) Create a strategic plan for the development of the MRE sector with an immediate emphasis on tidal in-stream energy; and (2) [Adopt] a set of guiding principles for the MRE sector. Also, the Fournier Report advised continued engagement with the Mi'kmaq on the MRE sector (Recommendation 7: Need for continued consultation with First Nations).

The Potential for Marine Renewable Energy in Nova Scotia

Realizing Our Potential

Marine renewable energy has the potential to make a significant contribution to Nova Scotia's cleaner, greener electricity future. A large in-stream tidal project with a capacity of 300 MW could replace approximately 10 per cent of Nova Scotia's current power supply. That is roughly equivalent to one of NS's existing coal-fired generators. Power from in-stream tidal devices is expected to start contributing electricity around the middle of this decade and could make a significant contribution to electrical generation post-2020.

Tidal energy is an ideal renewable energy source because it is more predictable than wind and solar power, reducing the requirement for back-up capacity. That advantage makes tidal a valuable addition to a diverse mix of electricity that, over time, will improve reliability and potentially reduce power costs.

In 2009, Nova Scotia enacted Greenhouse Gas Emissions Regulations under the Environment Act and became the first province in Canada to cap power plant emissions of greenhouse gases and air pollution. More stringent emission reductions are expected in the coming decades.

Power from MRE sources does not emit greenhouse gases, and will move Nova Scotia closer to its greenhouse gas and air pollution reduction targets by displacing electricity from fossil fuels.

Cap d'Or.

As an emerging energy sector, this has immense potential for economic growth alongside the development of a new power source. The opportunities for advances in technology and innovations in engineering, marine fabrication, marine operations, project development, financing, and other service and supply industries are considerable. Nova Scotia's strategic advantage is not limited to the height or force of the tides, but includes skills and expertise gained from a tradition of offshore work and a multitude of marine industries.

Tidal energy can help fill a growing global demand for renewable energy. The International Energy Agency in 2010 estimated that 800 TWh/year[7] would come from in-stream tidal energy. By comparison, the Muskrat Falls portion of the Lower Churchill project is expected to produce 4.9 TWh/year of electricity.

[7] Source: www.iea-etsap.org/web/E-TechDS/PDF/E08-Ocean%20Energy_GSgct_Ana_LCPL_rev30Nov2010.pdf

State of the Marine Renewable Energy Sector

3

Globally, the MRE sector is evolving. The ocean holds vast energy potential. Waves, offshore wind, and tidal energy are energy sources that offer opportunities.

Wave Energy

Ocean waves produced by winds passing over the surface of the water can be converted into electricity when energy is extracted from the surface motion of waves or from pressure fluctuations below the surface. There are approximately 50 competing designs being tested around the world in search of commercially viable wave-energy technology. The cost of wave energy is estimated by the International Energy Agency (IEA) in the range of $0.20 to $0.75 per kWh. Power generated by onshore wind is presently priced at $0.07 to $0.09 per kWh in Nova Scotia.

Nova Scotia's best wave resources are far from land, making testing and development expensive. Other parts of the world with better waves closer to shore have a competitive advantage. Wave technology is, therefore, a lower priority for Nova Scotia, but this could change with technology advancement.

Canso Coastal Barrens.

Offshore Wind

Offshore wind is the most mature MRE technology and the first to achieve commercial viability. The biggest advantage of the offshore wind is that winds blow faster over the ocean, so offshore turbines produce more electricity. Today, offshore wind is building upon well-established technology used onshore and is, therefore, currently the lowest-cost MRE. A 2011 report by the International Energy Agency put the current costs between $0.17 and $0.35 per kWh. Nevertheless, offshore wind is currently less economical than onshore wind, due to the significantly higher construction and maintenance costs associated with these projects. As the technology matures, there are fewer opportunities to innovate than those afforded by tidal power.

There is considerable interest in exploring offshore wind projects in Canada. The Naikun offshore wind project off Vancouver Island received a positive environmental assessment last year. Three commercial-sized projects are currently under consideration for the Great Lakes.

The United States, the United Kingdom, and Norway have developed policies, regulations, and legislation to support offshore wind development. The offshore wind sector is growing, and projects are being planned farther from land in deeper water, requiring bigger machines and technological improvements. Alternative design concepts, including floating bases, are also under consideration.

In Nova Scotia, offshore wind faces challenges. In order to minimize impact on coastal communities, especially given the importance of the scenic shoreline in Nova Scotia, care should be taken over the location of these projects.

Tidal Energy

Harnessing energy from tides is not new. It started with water wheels and later moved to the development of tidal barrages and tidal dams. There are two methods for capturing tidal energy—from the rising water or from the speed of the tidal current.

Tidal Range (Tidal Height)

One way to extract energy is from the rise and fall of the tide, called tidal range or tidal height. This approach uses a holding basin and a dam, barrage, or lagoon structure. Water flowing from the high side to the low side drives a turbine, much like a river hydro dam.

Barrages: Barrages are essentially dams across a full tidal estuary. When the tide comes in and out, the water flows through tunnels in the barrage and generates electricity.

Lagoons: Tidal lagoons use a walled impoundment like a breakwater to enclose an area of shallow coastal sea. Tidal water is trapped and released through turbines built into the impoundment walls.

Tidal reefs and wings: There are other emerging tidal-range technologies around the world, such as tidal reefs and tidal wings. Tidal reefs use new technology with floating concrete caissons, maintaining a constant height difference of 2 meters. Tidal wings are built in segments and are sited along the shore of an estuary rather than across the opening, which preserves free passage for marine mammals, fish, and shipping.[8]

The Annapolis Royal Generating Station.

Tidal dams and barrages are mature technologies that have been in use for many years and are less costly; however, there is concern about silt build-up, and models have shown that the resulting blocked bays and river mouths can cause adverse environmental effects. Preliminary studies indicate that tidal lagoon technology and the other emerging tidal range concepts noted above may have less of an environmental impact than a traditional barrage design.

Nova Scotia led the country in tidal range deployment when the 20 MW Annapolis Royal Tidal Power Plant was commissioned in 1984. It remains the only tidal barrage plant of its kind in North America. Electricity produced from tidal range technology costs from $0.14 to $0.27 per kWh.

[8] *Offshore power: building renewable energy projects in U.S. waters,* 2009

Tidal Current (In-stream Tidal)

Tidal current (or in-stream) technology extracts the kinetic (free-flowing) energy from tidal currents. These currents are generated when water moves through natural constrictions, such as bays and inlets. Initial modeling and research shows that in-stream tidal development has fewer adverse environmental effects than the older barrage and dam technology.

In general, three technologies are used to convert tidal currents into electricity: horizontal axis turbines; vertical axis turbines; and oscillating hydrofoils. They can be deployed on the surface, on the sea bottom, or in between. There are no known environmental concerns related to in-stream tidal devices, but if problems are detected, the devices can be re-oriented, relocated, or removed.

In Canada, in-stream tidal technology was first installed in 2006 at Race Rocks on southern Vancouver Island. Another project near Campbell River on Vancouver Island is currently under regulatory review. A number of similar technologies have been deployed in rivers throughout Canada and may offer lessons for tidal power in Nova Scotia. Between 2006 and 2008, six in-stream tidal energy devices, each with the capacity of 35 kW, were installed in New York's East River (Roosevelt Tidal Energy Project). During this period, they delivered 70 MWh of energy to a nearby supermarket and parking garage. In Nova Scotia, the Fundy Ocean Research Centre for Energy (FORCE), located in the Minas Passage, was created in 2009 to deploy and test in-stream technologies.

There is limited experience in assessing the costs associated with large-scale tidal energy. To date, costs have been high—in the range of $0.44 to $0.51 per kWh

Atlantis deploys at EMEC.

Nova Scotia Power OpenHydro pre-deployment, Halifax Harbour.

for initial deployments. It is anticipated that costs will decrease significantly once more devices are deployed and technological innovation improves efficiencies. Costs per kilowatt tend to be higher for smaller projects (due to economies of scale): at a community scale, smaller devices in Nova Scotia can apply to receive a Feed-in Tariff [9] of $0.652 per kWh. This price is also expected to fall once technology and methods become more mature (for more details on Feed-in Tariffs, refer to section 5).

[9] Feed-in Tariff: The price established to cover the production costs of new, renewable energy sources, and paid to the producer. The cost is spread across the distribution market. First devised in California, FIT was perfected in Germany where it is responsible for one of the most advanced and economically vibrant renewable energy industries in the world.

In-stream Tidal Energy Technologies

Small-scale tidal energy in Nova Scotia refers to community-based projects—devices producing equal or less than 500 kW and connected to the distribution system.

Large-scale tidal energy in Nova Scotia refers to single devices or arrays of devices producing more than 500 kW and connected to the transmission system.

Maximum Power with 5% Reduction in Flow

This map shows the mean power that can be extracted from the tidal currents through passages around Nova Scotia while reducing the volume of water flowing through the passage by only 5%. The values are calculated using numerical simulations of the tidal currents through the passages with power extracted by a turbine fence extending across the passage. In Cape Breton, the values are calculated using the characteristics of the flow and power extraction theory.

Strategic Objectives

4

Where Are We Headed?

A successful Marine Renewable Energy Strategy will meet key strategic objectives in Nova Scotia for economic growth and energy security. These are:

Build and maintain public trust through science, accountability, and transparency

The marine environment is complex and shared by many users. It is a public resource and as such the owners—Nova Scotians—must trust how MRE is developed and operated to ensure sustainable and beneficial growth. Public acceptance and trust must be earned and maintained. A general understanding of the science and a transparent and accountable regulatory regime will help. Environmental monitoring and protection, public reporting, maintaining the highest standards of health and safety, and providing ongoing opportunities for public and stakeholder engagement are essential.

Develop approaches and technologies that are technically, economically, and environmentally sustainable

Ultimately, tidal energy must be commercially competitive with other renewable energy sources. Advances in overall project development and technology are required. The province will promote innovation and research, establish an efficient, predictable regulatory system, and encourage the development of market-competitive technologies by promoting collaboration where expertise and other strengths exist among local and regional industry, researchers, and governments.

Build an industry in Nova Scotia

Generations of Nova Scotians have adapted and evolved their skills to seize every opportunity the oceans have offered. Marine renewable energy is next. Success will result in good jobs in the province, along with knowledge and technology that is in demand worldwide.

New Energy Corporation 5kW, EnCurrent Turbine test.

Consult and collaborate with Mi'kmaq[10]

The Mi'kmaq community has expressed interest in collaborating on the development of Nova Scotia's renewable energy sector. Continuing to build a positive relationship with the Mi'kmaq is a key priority for the province. The province has sought input from the Mi'kmaq of Nova Scotia on developments in the MRE sector since 2006.

The Mi'kmaq were consulted in the Bay of Fundy SEA process, and a Mi'kmaq Ecological Knowledge Study was conducted on the Minas Channel area of the bay to ensure that Mi'kmaq traditional use and knowledge were included in the assessment.

Through engagement with the province, the Assembly of Nova Scotia Mi'kmaq Chiefs has been continually informed on the development of the FORCE tidal demonstration project, and Mi'kmaq representatives have been participating in the Environmental Monitoring Advisory Committee and the Community Liaison Committee.

The province granted funding to the Kwilmu'kw Maw-klusuaqn Negotiation Office for the development of a Mi'kmaq-specific renewable energy strategy. The strategy will support the Mi'kmaq in successfully pursuing direct and indirect renewable energy opportunities in Nova Scotia and ensuring their participation in the renewable energy sector.

In addition to ongoing consultation conducted through the Mi'kmaq-Nova Scotia-Canada Consultation Terms of Reference, the province is committed to working with the Assembly to collaboratively develop plans for access to capital for investment and for education and training so the Mi'kmaq may participate fully in the development of the MRE sector.

NS Commitment to Mi'kmaq

- Work with the Mi'kmaq to determine potential opportunities for Mi'kmaq involvement in commercial-scale development
- Develop linkages between the Mi'kmaq's renewable energy strategy and, on a negotiated basis, their participation in MRE projects
- Encourage industry proponents to engage with the Mi'kmaq during project concept and development phases through specific guidelines established during consultations, building upon *The Proponent's Guide: Engagement with the Mi'kmaq of Nova Scotia*
- Emphasize the importance and role of traditional knowledge (e.g., Mi'kmaq Ecological Knowledge Studies) in all MRE development

[10] The Fournier Report advises continued engagement with the Mi'kmaq on the MRE sector (Recommendation 7: Need for continued consultation with First Nations).

How Will We Get There? Our Strategic Plans

This strategy is organized into three distinct but connected plans:

1) Research Plan
2) Development Plan
3) Regulatory Plan

1) Research Plan: Building the Science[11]

How do tidal power devices and the supporting infrastructure interact with the environment? How does the environment affect the devices and infrastructure? A broad range of ongoing research is necessary to answer these and many other questions. Researchers will investigate the socioeconomic impacts, health and safety standards, and other concerns, and discover technology that makes development commercially viable.

The plan to build understanding of both technological and environmental aspects and to mitigate adverse impacts will enhance public trust, particularly when key elements of the science are publicly funded and subject to peer review. Research is crucial to creating commercially viable, sustainable technologies that will foster a competitive industry in Nova Scotia.

[11] The Fournier Report emphasizes the necessity for research support to grow the MRE sector. Recommendations include (12) Work with communities to understand the needs of small scale tidal development; (14) Create a long-term research plan; (15) Continue support from Department of Energy for OEER, OETR and FORCE; (16) Enact legislation to define the ongoing role of research and funding support available; (17) Circulate research and monitoring results to the public.

Collaborative relationships—mission critical:

The province's role is to foster partnerships and multi-disciplinary research projects that address knowledge gaps, and the province is developing an integrated, long-term research plan that brings key players together.

The Nova Scotia sector has been supported by the federal government through Sustainable Development Technologies Canada, which contributed $4.6 million to Nova Scotia Power's Open Hydro device in the Bay of Fundy and $1.5 million to Clean Current for its technology. The federal Clean Energy Fund contributed $20 million to FORCE. The new national ecoEnergy Innovation Initiative (ecoEII) is expected to continue federal support and is now considering applications for important research and demonstration efforts.

Significant technical expertise and capacity will be required to advance the MRE agenda. The Department of Energy is working with academic institutions and industry to build engineering capacity and to focus efforts on common issues, including foundational and structural engineering and structural environment monitoring. Benefits to the industry and the province are evident already—the base for the Open Hydro device was constructed completely in Nova Scotia—and will grow as more engineering efforts are brought to bear on the unique Bay of Fundy challenges.

The province is supporting the Fundy Energy Research Network in a study to define the scope and scale of socio-economic issues and opportunities involved in the development of in-stream tidal power. The study will identify priorities, gaps, and funding opportunities as well as assess supply chain requirements and benefits to municipalities and rural communities.

To support a coordinated approach—especially when it comes to non-commercially sensitive research—discussions are currently underway between the Nova Scotia Department of Energy and FORCE to convene a Tidal Energy Research Forum that would be led by the Department of Energy and would contribute to sharing information on current research projects underway. It would also contribute to establishing research priorities and bringing together key organizations engaged in tidal research and development in the province including the Offshore Energy Research Association of Nova Scotia (OERANS), Ocean Renewable Energy Group, FORCE, Innovacorp, Fundy Energy Research Network (established to coordinate and foster research capacity in environmental, engineering, and socioeconomic factors associated with tidal energy in the Bay of Fundy), the Acadia Tidal Energy Institute, Cape Breton University, Saint Mary's University, Dalhousie University, Nova Scotia Power Inc/Emera,[12] and tidal developers.

[12] Nova Scotia's electricity market consists of a vertically integrated utility—NSPI (parent company, Emera)—and six smaller municipal electric utilities. As an integrated utility, NSPI has responsibility for electricity procurement, system operation, grid access, maintenance of the transmission and distribution systems, and meeting its renewable energy targets.

FORCE

One of the key drivers of both research and development in Nova Scotia is FORCE, Canada's leading test centre for tidal energy technology. FORCE collaborates with developers, regulators, and researchers to study the interaction between tidal turbines and the Bay of Fundy environment. It currently supports testing to prove the viability of single-unit in-stream tidal energy devices, and will soon progress to testing arrays of devices with the intention of developing commercially viable technology.

FORCE collaborates with other research institutions that are studying potential impacts on fish, on benthic habitat, and on issues like submarine cable deployment, device maintenance, retrieval and redeployment, and submarine power connections. This work is essential in understanding environmental interactions, and will provide the foundation for future projects.

This strategy proposes that FORCE's mandate be enhanced to have it act as the hub of knowledge for a broader range of interests including applied research, technology testing and operation for both small and large scale technologies, and environmental monitoring under demonstration or testing regimes.

As FORCE nears the completion of its facilities, it is able to concentrate more of its efforts on both its own research and research carried out in collaboration with others. FORCE has a focused interest in tidal energy research, demonstration, and operational standards development. It is through FORCE that much of Canada's public investment in research is coordinated and disseminated. FORCE will work with OERANS to collaborate, coordinate, and leverage tidal research.

The province is committed to FORCE as a model for demonstrating and testing pre-commercial tidal technologies for the purposes of making improvements to environmental monitoring, technology demonstration, and reducing electricity production costs. The infrastructure at FORCE's Minas Channel site allows for the potential future demonstration of four arrays at 16 MW each. Smaller scale test or demonstration projects that fall outside of the current FORCE lease site could be linked to FORCE under terms and conditions to be negotiated among the parties and the Department of Energy. It is envisioned that FORCE could offer their services to small-scale Community Feed-in Tariff (COMFIT) tidal developers on a contractual basis, including environmental assessment and monitoring and consulting services on regulatory issues. Tidal projects proposed in Nova Scotia would have the option of using the services of FORCE on a contractual basis to assist in their development activities.

The province may also authorize FORCE to engage in research or demonstration projects at other sites to characterize lower flow environments and the testing of monitoring equipment. If there were a commercial development project, such activities could take place at the FORCE site or elsewhere. Regardless of where commercial developments take place, the province will ensure that there is a collaborative approach and shared knowledge on public interest activities including environmental impacts.

Canada's Technology Roadmap for Marine Renewable Energy identified technology incubators like FORCE and the need to accelerate innovation through R&D as key to the success of MRE in general and tidal power in particular. Nova Scotia has the scientific, engineering, social, and economic research capacity in our universities and government organizations to accelerate R&D in collaboration with private companies working in ocean technologies. There are more than 300 ocean technology firms in the province—the largest concentration in North America.

FORCE.

Strategic Environmental Assessment (SEA)—the big picture

A Strategic Environmental Assessment is an environmental assessment process carried out before decisions are made about specific projects. By policy, the province has made SEAs a prerequisite to the development of MRE projects in Nova Scotia. They provide the framework from which future projects can be initiated by identifying the current state of knowledge on effects of the technology on the environment and the environment on the technology. SEAs involve the participation of a wide range of stakeholders and the general public and can result in recommendations to the provincial government on whether, where, and how to develop MRE projects.

Project developers, government, industry representatives, communities of interest, and other stakeholders can use the information collected from a SEA to guide future activities. The province will require a SEA before any licenses are issued in an area and will include this requirement in future legislation.

The province's first marine renewable energy SEA was completed in 2008 for the Bay of Fundy. The objective of this SEA was to assess social, economic, and environmental effects and factors associated with the potential development of MRE resources in the Bay of Fundy, with an emphasis on in-stream tidal. The 2008 SEA was led by an OERANS Technical Advisory Group in which OERANS received input through community forums, workshops, and written submissions from people around the province.

Since the original SEA was conducted, a number of advancements have been made in the MRE industry, one being the establishment of the Fundy Ocean Research Centre for Energy (FORCE), which has had one successful device deployment and retrieval at the Minas Passage location. A number of environmental research projects have been commissioned and monitoring data is being collected in the Bay of Fundy.

The province's Marine Renewable Energy Strategy's target of 300 MW of commercial tidal development means it is time to revisit the 2008 SEA to update the state of knowledge of the industry to date and re-engage with stakeholders to discuss plans to build the industry carefully in stages as we close the remaining knowledge gaps. OERANS is in the process of conducting the SEA update.

The province is currently supporting the development of small-scale tidal power growth through an assessment of the in-stream tidal power resource opportunities in Southwest Nova Scotia and in the Bras d'Or lakes region of Cape Breton. As more information is obtained about the small-scale tidal resource around Nova Scotia, there may be additional SEAs conducted for other areas of the province, particularly Southwest Nova Scotia. In 2012-2013, OERANS will manage the development of an SEA for the Cape Breton Coastal Region including the Bras d'Or Lakes.

2) Development Plan: A New Industry

Efforts continue all over the world to develop tidal, wave, and wind technologies that can successfully operate in the harsh conditions of the marine environment. While there is a measure of consensus around design elements of in-stream tidal energy devices, there is no one proven technology. Developing new technology, creating a market, and building a supply chain are essential to the growth of a tidal power industry in Nova Scotia. The province's development plan under the strategy consists of a technology development plan, a marketplace development plan, and an industry and supplier development plan.

Ensuring that the design, installation, and operation of in-stream tidal energy are environmentally sustainable, ensuring that they drive down costs and are competitive with other renewable energy, and ensuring that Nova Scotia takes maximum economic advantage of this opportunity will all help to encourage tidal development in the province.

Developing the technology in Nova Scotia and ensuring that experience and expertise reside here are critical to developing a competitive, sustainable MRE industry.

At FORCE visitor centre. Premier Darrell Dexter and the Honourable Charlie Parker, Minister, Nova Scotia Department of Energy.

Technology Development

Both research and development are essential to the commercial success of new technologies. Nova Scotia is moving beyond a focus on the design of turbines alone to focus on the design of complete tidal power systems.

Power production from marine renewable resources—including in-stream tidal—is currently three to six times more expensive than power from competing resources. But the cost of a turbine is only 25 to 30 per cent of the total project cost. In order to create competitive renewable energy, the costs for the overall project need to be reduced. Work in this area is not far advanced, but our experience—combined with cooperation internationally—will contribute to significant transferrable breakthroughs in knowledge.

The infrastructure at FORCE helps support the growing needs of the tidal industry. FORCE has a substation that can be operated up to 5 MW and is capable of being upgraded. A transmission line is also being constructed to meet immediate needs but that can also be upgraded. FORCE will also install four subsea cables at the Minas Passage test site. These cables will give Canada the largest offshore transmission capacity of any in-stream tidal energy site in the world with a total capacity of 64 MW. Technologies evolving as rapidly as in-stream tidal require a versatile demonstration facility capable of responding to future options. FORCE provides that facility.

Innovation will take several paths to build the foundation for the next generation of technology and to support commercialization of tidal energy. In Nova Scotia, this will include continued testing of single devices and small arrays through FORCE at Minas Passage,

multiple deployments of smaller devices in community projects in the Bay of Fundy and elsewhere, and the beginning of a progressive commercial licensing process. Each path has lengthy timelines, so it will be necessary to run them in parallel.

Incubation Sites

A key area of focus for the province's Marine Renewable Energy Strategy and Canada's Marine Renewable Energy Technology Roadmap is on technology incubation. Technology incubation is a mechanism that can speed development and foster entrepreneurship. Aggregating and accelerating early industrial-scale project demonstrations and technology innovation will foster entrepreneurship and development through the use of shared resources, expertise, and intellectual capital. There are other locations in the Bay of Fundy that may be more suitable for incubation sites for technology testing that have lower cost associated with deployment (e.g., closer to shore, lower tidal velocities). Options are being explored to create an incubation facility to test MRE turbines and associated technologies.

The United Kingdom has been considered a leader in MRE wave and tidal technology and had the first multi-berth tidal and wave testing centre at the European Marine Energy Centre off Orkney in northern Scotland. Nova Scotia will build upon their experience. Currently, FORCE has a plan to test individual turbines and is on track to be the first test centre in the world to test arrays of devices.

Small-scale, community power

There are differences in design and cost between small-scale and large-scale tidal power devices. Small-scale devices are not normally designed to operate in strong and fast-moving currents like the Minas Basin. While higher current speeds are expected to produce more cost-effective electricity, there may be more opportunities globally for lower current speeds, thus creating the market for both scales of technology is needed.

The development of small-scale tidal energy projects at the community level can bring new economic opportunities to rural Nova Scotia and help to develop the knowledge-base for large-scale, commercial tidal development and vice versa. Learning and knowledge can be shared and transferred between these two sectors.

The province supports small-scale development through the COMFIT program. The Department of Energy is working with Innovacorp and commercial interests to explore investment tools that support smaller scale MRE technology companies and provide economic benefits to communities while growing the small-scale tidal power industry.

Early small-scale industrial projects should be encouraged to share resources, expertise, and intellectual capital. For example, the Department of Energy is facilitating discussions between Fundy Tidal Inc. (FTI), ACOA, and Innovacorp to partner in the development of a Small-Scale Ecosystem Tidal Testing Centre. The centre would encompass FTI`s three COMFIT-eligible tidal resource sites (Digby Gut, Grand Passage, and Petit Passage) and test demonstration and commercial scale in-stream tidal devices. The multiple sites offer the additional advantage of testing various speeds of ocean currents.

Integrated grid management is a tool to balance power production and load requirements. Distribution-level energy developments that come under the Nova Scotia COMFIT program are constrained by the capacity of distribution system. Their maximum power capacity may not exceed the minimum annual load on the substation.

The province will continue to support efforts to understand how to combine tidal arrays, power storage, and smart grid control and how to demonstrate that minimum load can be met more regularly through a combination of tidal energy, storage, and integration of other variable energy sources, such as wind and solar. The province and Fundy Tidal Inc. will continue to explore innovative research opportunities to examine the integration of power distribution and community-scale renewable energy systems.

Partners in large-scale innovation

Partnerships between technology developers, power companies, and investors will be a strong factor in making commercial tidal power a reality. The goal is to develop the technology and retain the intellectual property in Nova Scotia, while deploying that technology locally and exporting it worldwide.

The incremental, scaled development and project management approach is preferred, because it will allow parallel technical and overall project innovation and will allow any emerging issues or problems to be addressed and resolved as they emerge.

Working with industry, the province will assess interest in a formal commercial partnership to accelerate large-scale tidal energy development timelines. In the event that a viable commercial project is presented to the province, the province may partner with industry on the project. This could reduce the risk for the project and may accelerate the development of efficient technologies and the creation of an in-stream tidal industry in Nova Scotia.

Marketplace Development Plan[13]

Success of a tidal energy industry in Nova Scotia depends on building a market for the electricity, which will become commercially viable over time.

Nova Scotia's opportunities to export power are limited by the 350 MW of non-firm capacity, 345 Kilovolt power line connection with New Brunswick. This line does not have firm capacity at present and is therefore of limited use in accessing export markets. It is the only power connection out of the province. Collaborative Cooperative ventures like the Atlantic Energy Gateway (AEG)—an undertaking of all four Atlantic jurisdictions—and the Muskrat Falls/Maritime Link project will likely result in new transmission infrastructure, increased transmission capacity, opportunities to use or export surplus hydro power, and flexibility to incorporate more intermittent, renewable electricity. The development of enhanced transmission infrastructure will enable, in the longer term, the use and, potentially, export of tidal power once the cost of production becomes cost competitive.

The AEG process is looking at future demand and supply issues as well as what infrastructure is required to move supply to the markets. The results of this work are expected to be reported later this year.

[13] The Fournier Report discusses issues related to the marketplace, including the export market, incentives, subsidies, royalties, and electricity infrastructure (Recommendation 13: Develop a business plan for the next 6-12 months for the MRE sector based on the availability of socioeconomic data).

The cost of MRE is currently some distance from commercial viability. Economic modeling in the United Kingdom[14] shows that energy generated from the first wave and tidal projects would cost $0.61 to $0.77 per kWh for wave and $0.46 to $0.53 per kWh for in-stream tidal. In a supportive policy climate, and with success in technology innovation, the cost of this energy should come down to around $0.51 per kWh for wave and $0.42 per kWh for in-stream tidal power by 2020. At that point, it is predicted that the in-stream tidal energy will begin to be cost competitive with offshore wind.

Recent results from the first in-stream tidal demonstration in the Minas Passage, combined with revised resource assessment numbers for the site, are providing industry with optimism that the economics of in-stream tidal in Nova Scotia may be much better than originally estimated and the tidal energy industry in Nova Scotia will become cost competitive with other renewable sources of electricity.

The table below illustrates this model:

[14] *Accelerating marine energy, the potential for cost reduction—insights from the Carbon Trust Marine Energy Accelerator,* July 2011.

UK Baseline Cost of Energy Generation from Wave and Tidal

Source of Energy Generation	Baseline Cost for Energy Production
First Wave Projects	38-48p/kWh ($0.61 to $0.77/kWh Canadian)
First In-Stream Tidal Projects	29-33p/kWh ($0.46 to $0.53/kWh Canadian)
Innovative Wave Technology Projects	32 p/kWh ($0.51/kWh Canadian)
Innovative Tidal In-Stream Technology Projects	26 p/kWh ($0.42/kWh Canadian)

Determined efforts by experienced power producers and advances in device deployment and retrieval methods are expected to achieve significant economies of scale. Technology innovation can expedite cost reduction, but tidal power will, initially at least, require market supports. New and existing tools will support MRE projects through the technology development stage.

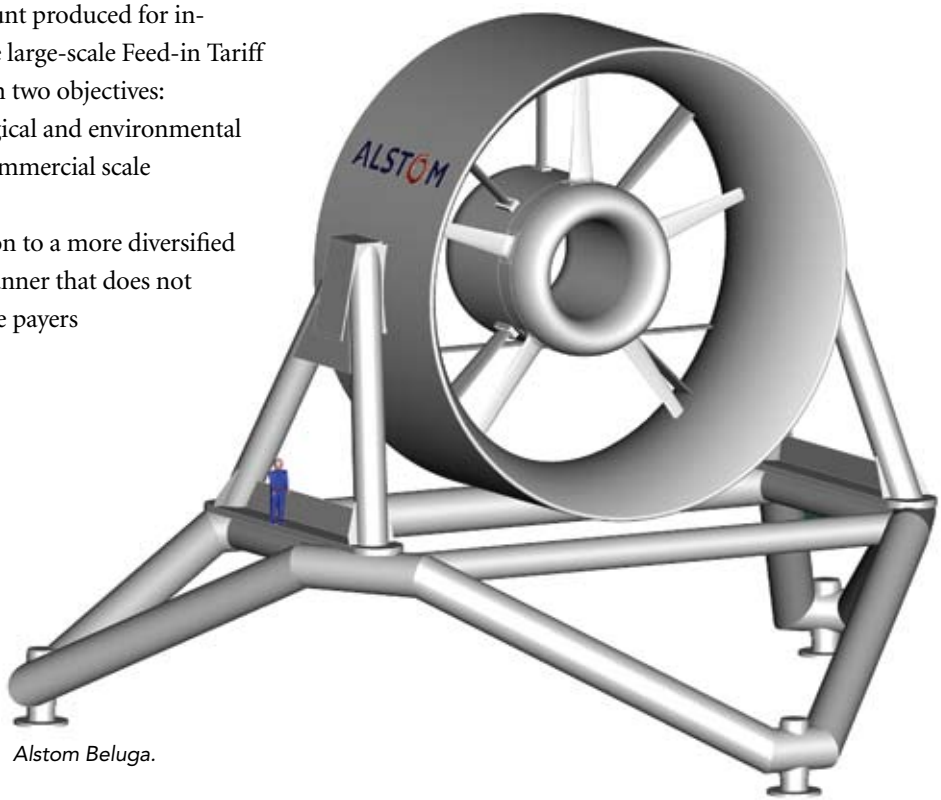
The province had the NS Utility and Review Board (UARB) set a fixed price for tidal energy through the Community Feed-in Tariff program (COMFIT) for smaller, community level projects, and will have the UARB set a limited developmental tidal Feed-in Tariff (FIT).

The rate paid and the amount produced for in-stream tidal electricity under the large-scale Feed-in Tariff will need to be balanced between two objectives:

- the need to support technological and environmental knowledge that will lead to commercial scale competitive projects
- the need to manage a transition to a more diversified cleaner energy market in a manner that does not place an undue burden on rate payers

In order to balance these objectives the province will

- continue to seek national R&D funding to support Canada's leadership role in marine energy
- limit the rate impact to a maximum total increase of 1-2 per cent on rates due to the FIT—the province will do this by setting a limit on the energy to be licensed once the UARB sets the rate



Alstom Beluga.

This direction is consistent with the International Energy Agency's recommendation[15] that jurisdictions develop "phased" tariffs, where initial prototype/pilot projects can be implemented and industry can learn from them. Later projects, presumably, will receive lower or no tariffs, reflecting improvements in technology and lower costs of producing power. The phased pricing mechanism follows:

[15] *Clean Energy Progress Report,* IEA input to the Clean Energy Ministerial, International Energy Agency 2011.

Phased Pricing Mechanism

Project Scope and Scale	Market Mechanism	Description
Small-scale Developmental	COMFIT Testing Phase 1	First rate at 65.2 cents set by UARB
	COMFIT Demonstration Phase 2	Second rate to be significantly lower based upon experience and technology development—Will be set by UARB in future
Medium-scale Developmental	FIT Testing Phase 1	First rate set at the rate established by UARB in near future for permitted facilities at FORCE, Technology Development Testing Licenses (permitted capacity of 5 MW)
	FIT Demonstration Phase 2	Second rate(s) set at a rate to be established by UARB for Demonstration arrays
Commercial	Market for commercially competitive renewable electricity production	All projects applying for commercial licenses must submit a plan to develop and deploy MRE at a rate comparable to other sources of renewable energy

Feed-in Tariffs (FIT)

The province's Renewable Electricity Plan established Feed-in Tariffs to support the development of renewable electricity projects, including small-scale and developmental tidal energy. The COMFIT and Developmental FIT for tidal energy projects provide an opportunity for developers to receive an established price per kilowatt hour (kWh) for the production of renewable electricity.

The FITs support technologies in the design and testing stage. They are not intended to be permanent, but are in place long enough to allow the technology to evolve to the point where it produces commercially competitive electricity. When LED light bulbs arrived on the market, for example, they cost up to $22 each. Today, consumers pay $2. The price reduction in technology as it moves from early design through to development and maturity is well established.

In Nova Scotia, the tool is being applied to in-stream-tidal for two reasons:

- The additional costs associated with early adoption and support will be applied to a relatively small amount of electricity so the cost to ratepayers will be minimal.
- Because Nova Scotia's competitive advantages are significant, the opportunity to create a globally competitive energy sector with significant economic benefits to Nova Scotians is real.

FITs are a model used successfully in Europe and other jurisdictions. By providing early support in the development of a new industry and taking lessons learned from jurisdictions that have had success in not only the development of intellectual property, but also in the development of domestic and export markets for renewable technologies, such as Denmark in wind and Germany in Solar PV, Nova Scotia is positioning itself to create sufficient momentum to advance the MRE sector.

Market Support

Both small- and medium-scale developmental projects will have access to market supports. The amount of support will change as technology and experience grows. All projects are currently at the testing stage (phase 1). COMFIT small-scale developmental projects have a rate of $0.652 per kWh for their devices (each device with a capacity of 500 kW or less). This rate was set in 2011 by the UARB. The rates for projects originating in 2014 and beyond are expected to be lower after being reviewed in 2014.

Medium-scale developmental projects will have a Testing Stage rate set for their existing capacity (each device with a capacity greater than 500 kW and a total capacity of 5 MW at FORCE) later in 2012. This FIT rate will reflect direct costs related to the deployment of single devices and take into account public investments already made. Testing will normally take place for limited periods (1-2 years) but the devices themselves will be considered to be amortized over a period of 20-25 years, so the rate will be set accordingly. The actual testing schedule will be driven by industry, but after three or more years, technology providers are generally expected to move to the next stage—demonstration.

The government will consult with industry and other stakeholders to determine the timing and parameters for a UARB decision on a Medium-Scale Developmental Tidal FIT. Consideration will be given to setting one rate for the first 5 MW that would be changed as the number of devices grows and efficiencies are gained, or two separate rates or a combination of similar approaches. For details on the licensing system, refer to Appendix A.

Supplier Development Plan

The MRE Strategy is designed to develop energy in a manner that ensures Nova Scotians are the primary beneficiaries in terms of employment, industrial and business activity, research and development, and technology commercialization.

When development of offshore petroleum began, Nova Scotia sought expertise and assistance (transfer of technology) from other jurisdictions. Over time, this enabled the development of a world-class supply and service community that now serves not only Atlantic Canada but the global energy sector as well. Much of this knowledge base is transferable to the demands of MRE development.

Nova Scotia's existing oceans technology companies compete in various market categories. Companies within the Nova Scotia oceans technology sector typically service broad market categories. Although a number of core companies specialize within their niche market, many offer products and services that are used across a range of market segments. Nova Scotia has room to build on its existing strengths to meet anticipated demands from MRE development; this would include market segments such as aerospace and defence, shipbuilding and marine transportation, ocean science and observation, offshore oil and gas, subsea cable work, and aquaculture and fisheries.[16]

The province has a wealth of knowledge to inform a capacity building strategy, not the least of which is direct advice from those who work in the sector. Developers, for example, note that the fabrication and assembly site for deployment of large tidal power devices must be close to the MRE installation site. Nova Scotia suppliers are the natural and most economic choice for projects located in nearby waters.

The Department of Energy commissioned a Marine Renewable Energy Infrastructure Assessment to inventory port-related infrastructure needs associated with development of the industry. The report notes that while infrastructure work is not required in the short term, major port infrastructure improvements will be required on the Bay of Fundy to support the tidal industry beyond 64 megawatts, which is the capacity at FORCE.

The province is preparing to take full advantage of the economic benefits that will accrue from MRE development. The industry has identified needs, including those related to its workforce. Educational institutions and training providers are confident they can meet the demand.

One message emerged from a recent Nova Scotia Tidal Symposium and other networking and consultation: The Nova Scotia supply chain is diverse and has a complete understanding of quality, competitive requirements, and the importance of meeting schedule requirements. Many of our companies have been, and still are, involved in joint ventures and partnerships with international firms.

[16] *Defined by the sea: Nova Scotia's Oceans Technology Sector Present and Future,* Government of NS, an initiative of jobsHere.

Business opportunities will obviously emerge from MRE developments. Evaluation of commercial proposals will include an assessment of best overall value for Nova Scotia including employment and fiscal and industrial benefits. Once activity is underway, performance will be reported to the province, which will track economic impacts.

The departments of Energy and Economic and Rural Development and Tourism are leading work on tidal energy supply chain development. A Supply Chain Committee is reviewing services, products, and functions that would be needed to support tidal energy and will inventory which of those are available provincially, regionally, and nationally.

3) Regulatory Plan[17]

As noted, the marine environment supports many users and uses. Multiple public interests in a shared, public resource means the involvement of multiple federal and provincial regulatory authorities. A legislative framework and regulatory system is required to ensure that projects and development proceed with appropriate licensing, environmental protection, community benefits, and provincial revenue. It is important to ensure that the public, stakeholders, and the Mi'kmaq are fully apprised and engaged in issues related to planning, development, environmental effects, economic opportunities, and regulatory oversight. The regulatory plan includes a robust and effective regulatory and environmental protection system and a public and stakeholder engagement plan founded on accountability and transparency.

A strong integrated regulatory system provides a sound basis for public assurance that their interests are being protected. Accountability and transparency are key elements in building and maintaining public trust. A commitment to ongoing engagement through a Tidal Energy Stakeholder Forum, having full public access to environmental data and Strategic Environmental Assessments (SEA), and the commitment to work with stakeholders through the Coastal Strategy are all important in enhancing public understanding and building trust. The licensing system and requirements are important tools in encouraging innovation and technology development and in building industrial capacity in Nova Scotia.

[17] The Fournier Report emphasizes the need for a proper regulatory framework. Recommendations: (3) Develop a licensing system; (11) Advance concept and practice of Marine Spatial Planning; (18) Develop a regulatory plan that integrates regulatory issues into the broader fabric of sectoral development; (19) Create a federal/provincial working group of regulators; (20) Create legislation that removes redundancies and increases efficiencies between federal and provincial processes; (21) Identify an individual to act as first point of contact to developers seeking information; (22) Create a position or office with administrative, decision-making responsibilities; (24) Enhance legislation requiring all technological or scientific data collected and used by all developers; (25) Engage discussion between the Department of Energy and Canadian Environmental Assessment Agency (CEAA) regarding the operative thresholds that will be used to trigger the environmental assessment process; (26) Enact legislation to require developers engaged in tidal in-stream energy extraction in the Bay of Fundy to conduct audits of their operations and submit results regarding health and safety standards for review at regular intervals to the Department of Energy; (27) Consider adaptation of relevant occupational, operational, and safety standards used by the Canada-Nova Scotia Offshore Petroleum Board.

A robust and effective regulatory and environmental protection system

One of in-stream tidal energy's key characteristics is incremental deployment, which allows potential adverse environmental impacts to be recognized and reversed through the removal of devices. The province will enact an integrated regulatory and licensing system that mirrors the incremental approach for effective environmental assessment and enhanced industrial benefits.

To date, tidal energy activities have been coordinated through an informal One Window Standing Committee of federal and provincial departments interested in, or with authority for, marine projects. This process has worked well for early project development at FORCE for the single device demonstration project approved in 2009; however, as technologies evolve and industry grows, a more customized and improved integrated regulatory system may be required. This view was reinforced through the public consultation conducted by Dr. Fournier where Through public consultation conducted by Dr. Fournier, it became clear that the current One Window Committee process works reasonably well; however, stakeholders expressed the desire to see a more robust regulatory approach developed as this industry matures.

The immediate opportunity is for in-stream tidal, but other marine renewable resources including offshore wind, waves, and tidal range will be accounted for in the regulatory and licensing system. The province will develop MRE legislation that protects the public interest as well as integrates federal responsibility for protection of as well as habitats and species.

The legislation would include the following key elements:

A Progressive Environmental Protection System

A progressive environmental protection system starts with a SEA policy as part of overall strategic planning providing a broad understanding of the ecosystem and socioeconomic issues. (For more details about SEA, see Section 5)

Nova Scotia's plan for a regulatory and environmental protection system is founded on a staged, progressive, and adaptive approach to development and deployment of in-stream tidal devices. The processes for developing in-stream tidal technology and understanding environmental effects are similar in that they both feature incremental deployments, monitoring for effects/impacts and building on previous experience to make improvements.

Development and implementation of this regulatory regime is a collaborative effort with input from governments, scientists, stakeholders, and industry. An outcome of this system will be a clear set of requirements for industry along with an effective feedback loop on environmental impacts, leading to early warnings and early action if issues arise.

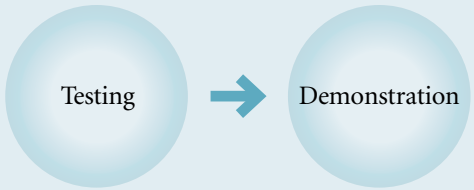
The Nova Scotia Department of Energy is working with other provincial departments and governments, the federal Department of Fisheries and Oceans (DFO), research organizations, and industry to develop a Statement of Best Practices that encompasses the adaptive approach to the growth of the industry. The statement will embed standard requirements for modeling and monitoring energy production, deployment of devices, the environment, stakeholder engagement, and transparency in data collection and dissemination. Consultation with stakeholders on the development of the Statement of Best Practice will take place in spring 2012.

Creation of a Statement of Best Practice is an opportunity to develop an innovative tool to harmonize development and environmental interests. In-stream tidal is an evolving technology where industry and environmental interests are aligned in terms of a progressive, adaptive, and reversible approach. The goal of the Statement, and the requirement that it be adhered to by license-holders, is to contribute to improved regulatory review and environmental assessment processes.

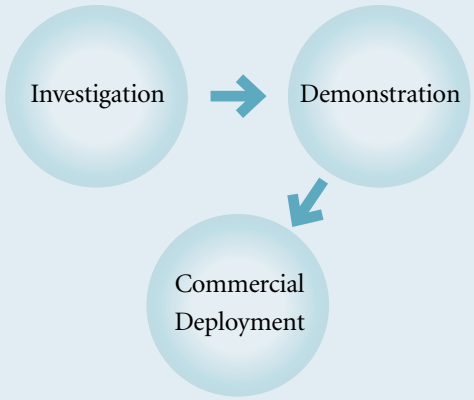
A licensing process for land and resource rights will be developed to complement the incremental nature of MRE development. The purpose, rights expectations, and the offer of market supports such as Feed-in Tariffs (FITs) will be defined by license type. (For details on how the License system would operate, see Appendix A).

Two Classes of License Proposed

Technology Development License



Power Development License



Types of License

Technology Development License

A Technology Development License has two stages: Testing Stage and Demonstration Stage. The Testing Stage involves the deployment of a single large device or an array of small devices. However, if a technology provider or developer wishes to deploy larger numbers of devices (up to 15 MW), that may trigger movement to the Demonstration Stage of the license. The Demonstration Stage will require a plan showing how the deployment of arrays will lead to technological innovation and lower electricity costs.

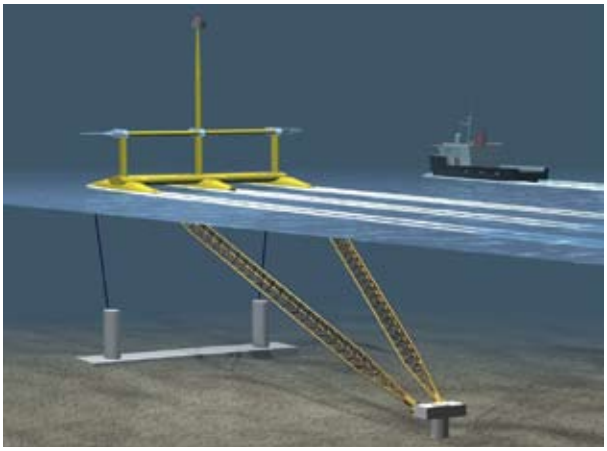
The Technology Development License would be for activities mainly focused on technology-specific improvements to drive reductions in electricity production costs. A medium-scale tidal Technology Development License will apply to companies that have developed prototypes and want to improve the technology. This license could also be of interest to small-scale technology and community development entities.

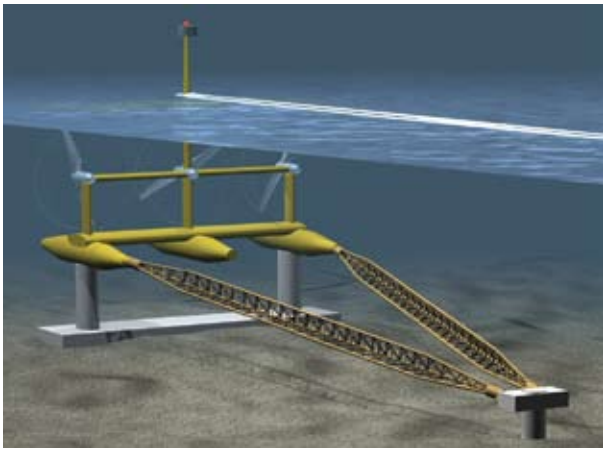
Power Development License

A Power Development License is for projects intended to result in a large-scale commercial, grid-connected power development. At this stage, the focus is on broad commercial deployment and commitments rather than on technical improvements.

The Power Development License will be awarded to large-scale project developers, likely partnerships of technology and utility or power generation companies. The province would award this type of license to support development of a project of up to 300 MW of commercially viable renewable electricity. This license will include three stages: investigation, demonstration, and commercial deployment. A proponent's willingness to commit to long-term plans and the ultimate development of a commercially viable tidal power project is a key factor in awarding the license.

Industry interest in developing a large-scale, 300 MW commercial project has grown. When the province has determined that at least one credible





Minas Basin Pulp and Power/Marine Current Turbines.

project developer is prepared to commit to a long-term commercial development project and demonstrates plans for improving technology and practices to be competitive and market-ready, a Call for Bids would be issued.

Upon completion of a successful bid process, the proponent would be granted exclusive rights to a license and Crown land lease to produce up to 300 MW of tidal power. Rights for full deployment would be granted at the outset to ensure the developer has the ability to raise project financing. Consideration would be given to the proponent's plans to conduct research in Nova Scotia and plans to enhance industrial capacity in the province, including participation in the tidal power supply chain.

Power Development License for Tidal Range Projects
For non-incremental or irreversible technologies such as barrages and lagoons, there is a requirement to clearly demonstrate that the project has no impact on in-stream tidal energy development and has no expected significant adverse environmental or socioeconomic effects or impacts. These projects could meet the first test through robust and credible numerical and physical modeling. They could meet the second test through a robust independent environmental assessment such as a panel review. If the outcomes of both processes are positive, they could then be eligible for an award of a Power Development License (for more details, refer to Appendix A).

License Fees and Royalties
MRE legislation will provide for the recovery of regulatory costs, so fees will be associated with licensing. For projects eligible for COMFIT or FIT rates, the cost of licenses and regulations will be taken into account in setting those rates. The Department of Energy will consult widely with industry on an appropriate cost recovery schedule before implementing the regulations. With respect to royalties or fiscal regimes that share in profits, the provincial policies established in the 2009 Energy Strategy remain unchanged:

> "… conditions may exist in the future where markets outside Nova Scotia value renewable energy supplies at a level that is significantly above the cost of production in Nova Scotia and if so, the Province will consider a fiscal regime similar to that for offshore petroleum where there is a sharing of such excess profits. However, those conditions do not exist today and the cost of transmission built and operated specifically for non-continuous power sources such as wind and tidal is very high so such a market may not emerge for some time."

An Independent Effective Regulator

The province believes that integration of federal and provincial regulatory responsibilities is an effective model for MRE. This may take different forms as the industry gains momentum and activities increase.

Constructing and operating renewable energy devices in a marine environment requires the coordination and integration of multiple federal and provincial interests. Once the industry begins to grow to large-scale commercial development, there may be gaps in current legislation and potential for duplication that could increase the risk of inefficient regulatory oversight and important issues being missed due to confusion over roles and responsibilities.

An ideal option for improving these gaps is the establishment of an authority to create or delegate to an independent regulator designed to oversee the industry. Oversight would include the responsibility for coordinating the work of other regulatory interests, delegation of authorities and responsibilities to or from other regulators, and managing sector-specific requirements. Until the industry has reached commercial scale development, this independent regulator may not be required. It is anticipated that the scale of the regulatory office would depend on the size of the industry, with both starting small and growing.

The Canada Labour Code requires that the Occupational Health and Safety Standards are met in the deployment and management of marine devices and permanent installations. The province will determine if there are any gaps in the current legislation that may apply to this industry, and the Department of Energy is working with the Department of Labour and Advanced Education to examine the Technology Safety Act to see how it may be amended to better suit this sector. In the meantime, the Department of Energy is also working with FORCE as FORCE develops internationally consistent industry-recommended Health and Safety standards specific to the MRE sector.

Public and Stakeholder Engagement Plan[18]

Transparent open development of resources begins with planning and consultation processes that engage and inform the public and stakeholders. Public and stakeholder engagement has been promoted through activities such as the 2008 Bay of Fundy SEA, FORCE's establishment of a Community Liaison Committee (CLC), and the Marine Renewable Energy legislation consultation process.

The Public and Stakeholder Engagement Plan will provide continued opportunities to share information and receive important input and ensure transparency in decision making through the following mechanisms:

[18] The Fournier Report provides advice for continued public engagement, accountability, and transparency. Recommendations: (4) Produce a clear statement of its intentions regarding the degree of transparency and public involvement with respect to the MRE sector; (5) Develop a communication/outreach strategy; (6) Provincial and Federal government departments' collaboration in the modification of existing environmental assessment regulations; (8) Province's Coastal Strategy should address the MRE sector; (9) The Department of Energy should seize the opportunity to play the role of "champion" within the Provincial Oceans Network (PON) to integrate the immediate issues related to the MRE Development Framework; (17) Circulate research and monitoring results to the public; (23) Conduct a Strategic Environmental Assessment in the Bay of Fundy when industry is operating and expanding and at regular intervals as well as review the 2008 SEA.

Strategic Environmental Assessments (SEA)
As explained above, SEAs allow for broad stakeholder engagement and identification of issues that would need to be addressed in project-specific Environmental Assessments. SEAs are conducted by the province, but federal agencies and departments are involved and consulted. A SEA is also a way for the province to identify areas where resource potential is strong and where other marine interests are active.

Tidal Energy Stakeholder Forum
The Tidal Energy Stakeholder Forum is a new body that will serve as an advisory council during the formative stages of the industry. It will provide public access to information on tidal energy activities, education, and scientific analysis of tidal development. Representatives from industry, academia, government, Mi'kmaq, and communities will participate. The Forum will receive all science and environmental/resource monitoring information and will foster relationships among stakeholders.

Communication, Education, and Outreach
MRE devices may affect tourism, landscapes, seascapes, habitats, and ecosystems. The development and operation of MRE projects will require an integrated management approach and coordinated efforts of governments, and many departments and agencies within those governments.

To facilitate the government's new approach to coastal management, a Provincial Oceans Network (PON) has been established, which is composed of representatives from provincial departments and agencies with responsibilities and interests in coastal and ocean management. Chaired by the Nova Scotia Department of Fisheries and Aquaculture, the Provincial Oceans Network serves two core functions: to provide advice and expertise in implementation of the Coastal Management Framework, and to facilitate coordination on coastal and ocean management issues and initiatives within the provincial government.

As recommended in Dr. Fournier's 2011 report, the Department of Energy will continue to participate in PON to ensure that MRE activities and the Coastal Strategy are aligned and meeting the expectations and needs of Nova Scotians.

What We Will Do: Implementation

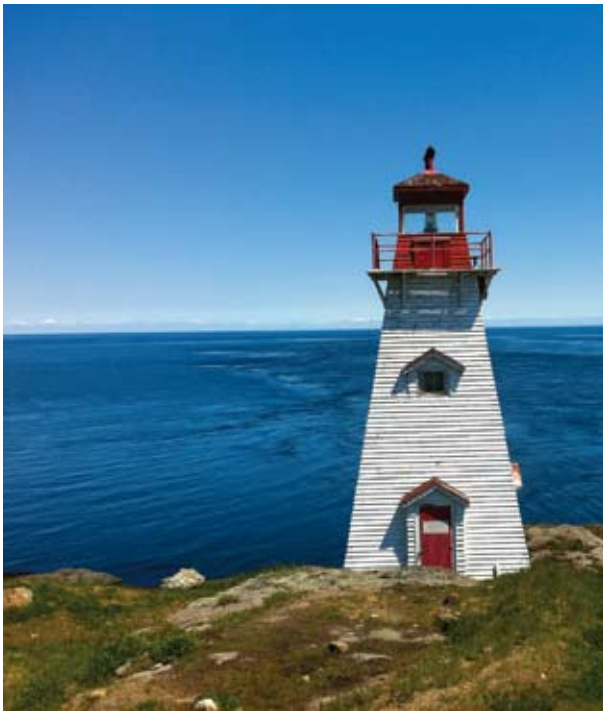
The Future of Tidal Energy in Nova Scotia

This strategy focuses on a phased and progressive MRE development over the next 5-10 years with a goal of producing 300 MW of power from in-stream tidal energy projects in the longer term. During that time the province will be able to examine key issues affecting the future development of tidal energy, such as

- What is the full resource potential?
- Has testing led to viable technology and commercially competitive electricity?
- Has a market been created for in-stream tidal?
- Has the development of the resource benefited Nova Scotians?
- Has the regional supply chain realized new opportunities in this sector?
- What are the interactions with the environment and how are they addressed?

Answering these questions will help Nova Scotia to develop a better understanding of the ultimate potential of the Bay of Fundy tidal resource. This is crucial to ensuring that a future beyond 300 MW is sustainable and in the best interests of Nova Scotians.

The province will review this strategy to determine if the objectives are being met, make corrections as needed, and build our knowledge and findings for the future development of the industry.



Boar's Head, Nova Scotia.

Work Plan Timelines

	Regulatory System Development	Research	Development
2012-2013	• Statement of Best Practice—ongoing • Marine Renewable Energy Legislation • Resource Assessment South West Nova Scotia • Updated SEA for Bay of Fundy • SEA for Cape Breton • Environmental Assessment begins for small tidal devices in Digby area	• Ecosystem baseline—ongoing • Environmental effects pathways—ongoing • Tidal Research Forum established • Nova Scotia R&D Forum May 2012 • Identify methods to maximize Nova Scotian participation in the tidal energy supply chain	• FORCE infrastructure upgraded (cables in place) • Work begins on small demonstration sites and renewable electricity integration studies—ongoing • COMFIT and Developmental Feed-in Tariff Rates and generation caps set
2013-2014	• Tidal Energy Stakeholder Forum established • Tidal Regulatory Authority established or delegated to manage small number of deployments • Environmental Assessment for FORCE expansion • Potential for Environmental Assessment to begin on Commercial Project	• Ongoing technical and environmental research	• Deployment of large-scale single devices at FORCE • Deployment of small-scale test devices in Digby area
2014-2020	• Continued work with the federal government on the regulatory system and tidal regulatory authority including delegation when industry growth warrants	• Ongoing technical and environmental research	• Deployment of tidal device arrays at FORCE • Deployment of tidal devices arrays on a staged basis at commercial site
Post-2020	• Commercially competitive in-stream tidal technology		

Appendix A:
Proposed Licensing System

What Licensing Will Look Like

General License Purpose and Approach

Currently, in order for project developers to proceed with developing their projects on submerged provincial Crown land in the Bay of Fundy, a Letter of Authority or Crown Land lease is issued by the province, which would be awarded under certain terms and conditions. However, once marine renewable energy legislation is in place, a Marine Renewable Energy License will be the primary tool for defining project- or company-specific opportunities and obligations.

The licence will define the territory to be covered and in most cases will come in advance of any specific Crown land lease. Working collaboratively with the Nova Scotia Department of Natural Resources, the intention is to make the award of land leases or options to lease an integrated part of the detailed license process.

All licenses will have specific data collection and disclosure requirements with a general requirement in legislation for release of all data with respect to environmental monitoring and research. Release of resource information will be required at a level that balances public interest in understanding the value of the resource and location of future opportunities with the commercial interests of those who invested in the creation of detailed data sets. Recent work in the petroleum sector for the Nova Scotia Play Fairway Analysis shows how resource data can be shared without compromising commercial interests.

Types of License

The MRE Strategy proposes two types of Marine Renewable Energy Licenses: Technology Development and Power Development:

Technology Development License

A Technology Development License would be for activities where the focus is mainly on technology specific improvements with an aim to create reductions in electricity production costs. A Technology Development License could also advance community economic development. Projects eligible for this type of license would have access to the applicable FIT/COMFIT rates. These Feed-in Tariff regimes support the pathway to technology innovation and improvement.

Note: All stages may be subject to an environmental assessment at either the federal or provincial level in keeping with the project's level of risk. Due to the nature of marine projects and the associated federal regulatory authorities, there are federal regulatory triggers that result in the requirement for a federal environmental assessment for all tidal projects. Projects first require a positive conclusion from the assessment, and all license awards are subject to the conditions established during such an assessment.

A Technology Development License has two stages: testing and demonstration.

Testing Stage encompasses the following:

- The deployment of a single device or a series of small devices (devices with production capacity greater than 500 kW and small-scale devices with production capacity equal or less than 500 kW).
- The deployment of devices that measure resources to ensure the data on resources and environmental effects is available to the government and the public within the data collection and disclosure principles outlined above where information from such a device is to be relied upon in future regulatory filings.
- Market support in the form of
  - A COMFIT Testing Rate for eligible entities for electricity connected to the distribution system with devices ≤ 500 kW. The COMFIT Testing Rate is currently $0.652 per kWh and will be reviewed by the UARB in 2014.
  - FIT Testing Rates for transmission connect devices >500 kW up to 5 MW. The FIT Testing Rate for larger scale devices will be set by the UARB in 2012 following consultations by the Department of Energy with industry and stakeholders.

The Demonstration Stage encompasses the following:

- Acknowledgement of the growth of activity and experience beyond the current permitted levels under the COMFIT program (~3 MW) or deployment at FORCE (5 MW). This will include future permits for arrays of devices under COMFIT in excess of 500 kW total capacity.
- Consultation with industry on the timeline for technology improvements and the number of devices needed to be demonstrated before significant cost-reductions may occur, and the prospects for such development in Nova Scotia and opportunity to advance this strategy.
- The legislation will provide the Minister with authority to set targets for the amount of electricity to be purchased.
- Market support in the form of
  - A new COMFIT Demonstration Rate for eligible entities for electricity connected to the distribution system with devices ≤ 500 kW. The COMFIT Demonstration Rate will be established by the UARB after the Department consults with small-scale developers and receives plans to improve technology and reduce costs. It may be set separately or set as part of the UARB review in 2014.
  - A new FIT Demonstration Rate for transmission connect devices >500 kW up to a set amount. The Demonstration FIT Rate for medium-scale projects will be set by the UARB. The Department of Energy is working with industry to determine the amount of electricity required to advance industry development under a Demonstration FIT. Various options for a tariff are being examined.
  - The province will give regulatory and licensing direction to ensure there is a proper balance between the economic opportunities associated with the development of tidal energy and the interests of ratepayers.

- Plans, commitments, and requirements that encompass the following: the quantum of energy to be extracted and sold into the Nova Scotia electricity market; the path proposed for R&D that is expected to lead to lower-cost future generation; and the expected contribution to the development of the Nova Scotia Marine Renewable Energy Sector, including the achievement of MRES goals and objectives for a globally competitive NS MRE sector. The province may assist in the development of technology companies in Nova Scotia through investments by Innovacorp.

Power Development License

A Power Development License is for projects that aim to result in practices and technology that produce renewable electricity at a price competitive with other renewable electricity sources. A Power Development License will normally be awarded on a competitive bid basis to developers prepared to embark upon a clear plan to develop competitive renewable electricity supply technology in Nova Scotia. Proponents, upon the completion of a successful bid process, would be granted the exclusive right to a license to produce up to 300 MW of tidal power. Rights for full deployment would be subject to community and Mi'kmaq consultation and technical safety. The license will contain stages and the license-holder must remain in compliance with the plan subject to any modifications required by the Minister due to lessons learned.

A Power Development License has three stages: (1) investigation, (2) demonstration, and (3) commercial deployment.

(1) The Investigation Stage of a Power Development License encompasses the following:

- The filing of a Power Development Project Plan that outlines in a preliminary and high-level fashion the following matters:
  a. planned level of investment at all stages
  b. plans and commitments to incorporate existing best-in-class technology and improve technology and business methods, practices, and processes in Nova Scotia and deploy that knowledge to other markets from Nova Scotia
  c. plans and commitments to develop Nova Scotia and regional capacities and capabilities for research and development, engineering, design, and manufacturing
  d. plans and commitments to monitor for, and avoid, significant adverse environmental impacts
  e. plans and commitments for safe operation and adherence to standards and best practices developed for the offshore MRE sector
  f. plans and commitments to collect and report on resource and environmental effects data
  g. plans for progress from an investigation stage through to a specific site where demonstration and/or a competitive market-ready project will take place, including planned deployment of devices and quantities to be extracted at various stages that line up with environmental considerations (i.e., deployment at the following thresholds: below potential local impacts; below near-field effects; below far field effects)

h. identification of market for energy supplies once the project produces competitive market-ready supplies
i. plans for Mi'kmaq and community engagement.

- The analysis of resources and geotechnical features to determine the suitability of a precise location for a large-scale commercial project in an area that has been the subject of an SEA.
- The deployment of devices that measure resources to ensure the data on resources and environmental effects is available to the government and the public.

(2) The Demonstration Stage of a Power Development License encompasses the following:

- The deployment of an array of devices for the production of a set capacity at a site identified at the Investigation Stage
- The same market support mechanisms (Feed-in Tariff) available under the Technology Development License will be available at the Demonstration Stage of a Power Development License in the form of a new FIT Rate per kW/h. The rate may be similar to the one set for Technology Development Licenses, but set separately in order to take into account any unique characteristics associated with a permanent pre-commercial demonstration project)
- Confirmation of the plans and commitments made at the Investigation Stage subject to any amendments permitted by the Minister due to a change in market, environmental or technical conditions that take place in the Investigation Stage.

(3) The Commercial Deployment Stage of a Power Development License encompasses the following:

- The deployment of arrays at a site identified at the Investigation Stage or as may have been modified as a result of experience during a Demonstration Stage
- Confirmation of the plans and commitments made at the Investigation Stage with further detail on those plans and commitments based upon lessons learned at any previous Demonstration Stage—subject to any amendments permitted by the Minister due to a change in market, environmental or technical conditions that take place in the Demonstration Stage
- A rate for electricity similar to competing renewable electricity sources available to the NS market. Benchmarks such as the average cost of renewable electricity in the previous 12 months will be considered after consultation with industry.

The commitments and plans outlined above will be measured against regulatory benchmarks including specific provisions in legislation or regulation or where such benchmarks are absent, through Ministerial Guidance.

Transitional Matters, Leases, and Options to Lease

As noted above, authorization from the Department of Natural Resources is required to use submerged Crown land. In the planned legislation, the license process will ensure through a collaborative process that all of the requirements related to the protection and use of Crown land will be completed, including Mi'kmaq consultation and integrated resource management review. The Departments of Energy and Natural Resources will work closely to integrate Crown leasing and energy licensing requirements under the new legislation.

As an interim measure, while the licensing system is not yet established, Letters of Authority (FORCE operated under a Letter of Authority for several years before it was granted a lease in 2012) may be awarded under terms and conditions similar to those outlined here for a license. In addition, COMFIT and FIT projects with approvals in place prior to the proclamation of the legislation shall automatically receive licenses under the act.

In addition, there may be technologies that do not lend themselves to the fundamental conditions of incrementally and reversible development such as barrages or tidal lagoons. Accordingly, these projects will need to clearly demonstrate that their project plans present no expected harm to other marine renewable resource opportunities and no expected significant adverse environmental or socioeconomic effects or impacts.

These non-incremental projects may meet the first test through robust and credible numerical and physical modeling. They may meet the second test through a robust independent environmental panel review. If the outcomes of both processes are positive, the legislation would anticipate they would then be eligible for an award of a Power Development License. To allow a proponent to begin to build a case and file a project description for an EA process, Marine Renewable Energy Strategy policy will allow the Province to issue an option to lease or Letter of Authority after an appropriate period and process for public consultation.

Appendix B:
Who Is Involved?

Fundy Ocean Research Centre for Energy

www.fundyforce.ca

FORCE is Canada's leading test centre for in-stream tidal energy technology. FORCE works with developers, regulators, and researchers to study the potential for tidal turbines to operate within the Bay of Fundy environment. FORCE provides a shared observation facility, submarine cables, grid connection, and environmental monitoring at its pre-approved test site. FORCE receives funding support from the Government of Canada, the Province of Nova Scotia, Encana Corporation, and participating developers.

Offshore Energy Research Association of Nova Scotia

www.offshoreenergyresearch.ca

The Offshore Energy Research Association of Nova Scotia (OERANS) is an amalgamation of OEER Association and OETR Association. OEER and OETR Association were established in March 2006 as independent, not-for-profit corporations whose mission is to lead environmental, renewable and geoscience energy research that enables the sustainable development of Nova Scotia energy resources through strategic partnerships with academia, government and industry.

Fundy Energy Research Network

fern.acadiau.ca

The Fundy Energy Research Network (FERN) is an independent, impartial organization initiated by academic and government researchers as a forum for coordinating and fostering research capacity, collaborations, and information exchange on environmental, engineering and socioeconomic factors associated with tidal energy in the Bay of Fundy. The FERN website provides up-to-date information of interest to the Bay of Fundy tidal energy research community, including news and events, publications, links, research projects, turbine testing activities and FERN and subcommittee initiatives. New online services include: a searchable publications catalogue and Notice Boards that provide a venue for researchers to post research, job & collaboration opportunities and ideas, data and ship time requests and inquiries, and deployed equipment location notices (FERN newsletter, Spring 2011, p. 3)

Acadia Tidal Energy Institute

www2.acadiau.ca/acadia-news-reader/items/acadia-university-launches-acadia-tidal-energy-institute.html

In September 2011, Acadia University announced the formation of the Acadia Tidal Energy Institute. This Institute is the only research institute in North America focused solely on assessing tidal energy resources and the associated environmental challenges and socio-economic opportunities. Strategically located on the Bay of Fundy's Minas Basin, the Acadia Tidal Energy Institute will develop partnerships and lead multi-disciplinary research projects and other initiatives that address knowledge gaps associated with the developing tidal energy industry. The Institute will focus on tidal energy resource assessment, environmental monitoring and impacts, socio-economic growth, sustainable communities, and the development and delivery of tidal energy educational programs and other support materials.

Fundy Tidal Inc.

www.fundytidal.com

Fundy Tidal Inc. (FTI) was established in 2006 to take advantage of local interest in opportunities to generate renewable energy from the tidal currents of the Grand and Petit Passages and Digby County of the Bay of Fundy. FTI's vision is to proactively create opportunities in the emerging marine energy sector with a focus on locally-owned and operated ventures to insure economic development opportunities, wherever possible, benefit local communities and businesses. FTI's mission is to: serve as a vehicle for community-led in-stream tidal energy projects throughout Nova Scotia (and beyond), establish Grand and Petit Passage and Digby County as focal point of marine industry development for commercial and R&D activities, maximize profits and economic opportunities for shareholders, partners and community.

Marine Renewable Energy Strategy

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