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INTRODUCTION

INTRODUCTION TO THE COMMUNITY AND BUSINESS TOOLKIT FOR TIDAL ENERGY DEVELOPMENT

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The Community and Business Toolkit for Tidal Energy Development, produced by the Acadia Tidal Energy Institute, is a comprehensive guide for the sustainable development of in-stream tidal energy. It has been written for people who wish to broaden their understanding of what tidal energy is, what is involved in its development, and what potential impacts and benefits it will have.

The Toolkit provides broad coverage of the challenges and opportunities of sustainably developing in-stream tidal energy. It describes the location of suitable tidal resources in Nova Scotia, environmental assessment, technologies, community and business opportunities, strategies for garnering economic benefit, community engagement, costs, financing and risk. The Toolkit has been developed to provide a foundation of knowledge to empower local stakeholders who are interested in learning more about the many issues related to tidal energy development. The regional focus of the Toolkit is Nova Scotia, Canada, though much of the information is applicable nationally and internationally.

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THE ACADIA TIDAL ENERGY INSTITUTE

The Acadia Tidal Energy Institute is located in Wolfville, Nova Scotia, Canada, near the shores of the world-renowned Bay of Fundy. The vision of the Acadia Tidal Energy Institute is a world that benefits responsibly from tidal energy. The Acadia Tidal Energy Institute aims to be a hub of scientific and socioeconomic research that will help advance knowledge of tidal energy that respects the environment and supports socioeconomic prosperity by leading and disseminating collaborative, objective research regionally, nationally, and internationally.

AIM AND TARGET AUDIENCE OF THE COMMUNITY AND BUSINESS TOOLKIT FOR TIDAL ENERGY DEVELOPMENT

People and organizations in Nova Scotia and elsewhere have already begun work on developing tidal energy. Therefore, this toolkit does not teach engineers how to engineer devices, developers how to develop projects, environmental assessors how to assess the environmental impacts, financiers how to finance, nor community engagement facilitators how to facilitate community engagement. Rather, the Toolkit is primarily designed to inform stakeholders of the steps involved in the process of developing tidal energy. Though most stakeholders will find new information in all modules, including those in the area of their expertise, they will gain particular benefit from toolkit modules that discuss aspects outside their area of expertise. Developers can read about community engagement. Environmentalists can read about the technology being used. Community members can become informed of the environmental assessments to be undertaken. Town councillors can read about the supply chain needs and opportunities and how to keep economic benefits local. Any stakeholder can find out what permitting procedures and government supports are in place.

The toolkit is accessible and downloadable as a PDF file from the Acadia Tidal Energy Institute website (<http://tidalenergy.acadiau.ca/>). The modules from the toolkit can also be downloaded individually.

ORGANIZATION OF THE TOOLKIT

The Community and Business Toolkit for Tidal Energy Development contains eleven modules. They are organized into three broad themes:

A. WHAT IS IN-STREAM TIDAL ENERGY ALL ABOUT?

This first section provides an overview of tidal energy and its history (Module 1), explains the location and measurement of tidal energy resources (Module 2), and describes the generic designs of tidal energy turbines (Module 3).

B. HOW IS IN-STREAM TIDAL ENERGY MANAGED RESPONSIBLY?

This section discusses three aspects of sustainability – environmental, social, and financial. The modules in this section outline the regulatory regime in Nova Scotia for tidal energy (Module 4), environmental risk assessment (Module 5), stakeholder and community engagement (Module 6), and financial evaluation and cost of energy (Module 7).

C. OPPORTUNITIES PRESENTED BY IN-STREAM TIDAL POWER AND HOW COMMUNITIES AND BUSINESSES CAN TAKE HOLD OF THEM.

This section outlines the opportunities presented by tidal energy and strategies for communities (Module 8) and businesses (Module 9) to take up those opportunities. Sources of financing, government supports, and the risks inherent in tidal energy projects are identified and information is given on how to manage those risks (Module 10). Finally, an assessment of the potential economic impact of a hypothetical five megawatt tidal energy development in the Digby area of the Bay of Fundy is summarized (Module 11).

In each module, there are web links and references for readers who want to seek out further information. Each module also includes definitions, examples, vignettes, and so on. These can be found in various boxes located on pages throughout the toolkit.

BOXES IN THE TOOLKIT	
Best Practice	Examples of how things have been done effectively elsewhere in the world or in other industries, such as wind energy, are provided in these boxes.
Emergent/Discussion	These boxes describe subjects on which “the jury may still be out” or for which no empirical evidence is available. The expectation is the issue may require consideration but there is no solution yet.
Foundational Concepts	New concepts and definitions are explained in these boxes.
Nova Scotia In Context	These boxes highlight situations and examples specific to Nova Scotia.
Toolbox	These boxes describe practical tools or checklists available for use.
Vignettes	Vignettes provide the reader with real-world examples to help understand a process or concept.

FREQUENTLY ASKED QUESTIONS

Business and community members have asked the toolkit writers many questions about tidal energy and the toolkit was written to help answer them. Key questions are below, along with where answers can be found in the toolkit.

WHY CONSIDER TIDAL ENERGY?

Nova Scotia generates a large amount of its electricity from imported coal. The emissions, such as CO₂, SO₂, and particulate matter, and the cost and price uncertainty of this fuel source make this unsustainable. Jurisdictions that generate electricity from their own natural resources not only have greater energy security, they enjoy economic spinoffs, such as jobs. As in many jurisdictions, the government in Nova Scotia recognizes the need to change the province's energy mix and develop its own sources of renewable energy.

Globally, in-stream tidal electricity generation is very new. Research, development and testing are being done in several countries, such as Ireland, Scotland, Australia, South Korea, and the USA. With the world-class tidal resource in the Bay of Fundy, we have an opportunity to become a global leader in this new industry, be it through new designs of turbines, bases, electrical systems, monitoring devices, methods of deployment, and operating procedures, or through environmental impact assessment and protection. Developing expertise, products, and processes that will be of use around the world is good for local economic development.

HOW IS TIDAL ENERGY CAPTURED? WILL WE BE ABLE TO SEE THE TIDAL TURBINES?

There are various ways to capture tidal energy but this toolkit deals primarily with in-stream tidal energy devices. Tidal in-stream energy converters, otherwise referred to as "turbines," "TEC," or "TISEC devices," are submerged in the tidal currents. Though some are suspended from barges or mounted on pin piles, others are mounted on the ocean floor or tethered to the bottom with cables. With many designs, the equipment is not visible from the land. The turbines rotate slowly under the water and do not create noise above the surface. For information about the various ways of capturing tidal energy, see *Module 1: Overview of Tidal Energy*. To read about various designs of tidal in-stream energy devices and bringing the electricity to shore, see *Module 3: Tidal Power Extraction Devices*.

WHERE WILL THE TURBINES BE? HOW MUCH ELECTRICITY CAN WE GET?

There are a limited number of locations where the flow of the water is great enough to develop tidal energy. In Nova Scotia, the Minas Channel, Digby Gut, Petit Passage and Grand Passage, Great Bras d'Or Channel, and the Barra Straight are possibilities. Only in the Minas Channel is large-scale tidal energy development possible. The other locations are suitable for small-scale tidal energy development. *Module 2: Measuring and Assessing the Tidal Resource* provides information about where the tidal resources are, what power can be extracted, and how such an assessment is done.

HOW DID WE GET TO THIS POINT?

Nova Scotia has a very long history of trying to harness the energy of the amazing Bay of Fundy tides. *Module 1: Overview of Tidal Energy* explains what tidal energy is, its history, how in-stream tidal energy converters work, and some of the environmental effects.

HOW MANY JOBS WILL IT CREATE?

The number of jobs created will depend on how much tidal energy we develop. There are several initiatives being explored at present: community-owned, small-scale tidal energy projects in the Grand Passage, Petit Passage, Digby Gut and Bras d'Or Lakes; and large-scale 1-MW device testing in the Minas Passage. In both cases, there will be need for tradespeople, marine services, engineering, hotel accommodation and restaurants, and so on. Small-scale tidal energy development needs these in much smaller quantities. Much of it will probably be within the capability of existing Nova Scotian companies, providing them with more work. Large-scale tidal energy development, depending on if it goes beyond testing to become a commercial-scale tidal energy-farm, will require many more products, services, tradespeople, knowledge workers, and infrastructure. Several modules in this toolkit provide information about the jobs needed for development. If you are seeking estimates of how many jobs or "person-years" of employment that could be generated in Nova Scotia during construction and operation, read *Module 11: Assessing the Potential Economic Impacts of a Five Megawatt Tidal Energy Development in the Digby Area of the Bay of Fundy*. If you are interested in knowing what kinds of products, services, skills, and expertise will be needed and at what stage, go to *Module 9: Opportunities and Strategies for Business*. *Module 9* also provides details on where supply chain businesses can get information and how to get involved.

WHAT ABOUT THE OTHER PEOPLE WHO USE THE WATER – FISHERS, MI'KMAQ, TOUR OPERATORS, RECREATIONAL USERS, COMMERCIAL NAVIGATORS, AND SO ON?

Just like on land, there are many competing uses for the water and many people make a living from it. Marine spatial planning and coastal zone management are useful tools for managing conflict between marine uses. How to best apply these tools to tidal energy in Nova Scotia is not fully understood at this point. However, consultation with the members of the communities near the tidal energy sites is important for understanding the needs of the various users and for finding compromises for sharing the water, both above and below the surface and through the seasons. *Module 6: Stakeholder and Community Engagement* provides guidance on how to effectively consult and engage with people who have an interest in the same waters. *Module 6* also provides information on the opportunities for users of the water to express their concerns and suggestions.

WHAT ABOUT THE FISH AND MARINE MAMMALS?

Being low-carbon and renewable are not the only important environmental aspects of tidal energy. The effects on the ecosystem, the tides, marine mammals, fish, and other organisms that depend on the tides should be considered. Care must be taken. If you are interested in knowing more about this, there are two modules that should be useful to you. *Module 4: The Regulatory Regime for Tidal Energy* describes the regulations, permitting and licensing processes, and requirements for environmental impact assessments. *Module 5: Environmental Risk Assessment* provides guidelines for project planners to assess the environmental risks and how to reduce the impact on the ecosystem.

WILL THE ENERGY BE CHEAPER?

This is another element of sustainability – financial. It is early days in the global tidal energy industry. Right now, the TEC devices being tested are expensive to build and install, but engineers are working to bring the costs down in order to be economical. The energy, being ever present in the tides, is free, but there are many costs involved in harnessing that energy, converting it to electricity, and getting it to the electrical distribution or transmission grid. Equipment needs to be built, installed, and maintained, and data need to be collected and monitored. There are insurance premiums, wages, taxes, etc., to be paid. In short, the energy will be expensive in the beginning, but it is believed the cost will come down to be competitive with other renewables. If you are interested in the cost of tidal energy and what makes this cost up, you can read up on it in *Module 7: Financial Evaluation and Cost of Energy*.

WHAT IS IN IT FOR OUR COMMUNITY? HOW WILL IT AFFECT US?

Communities could see some new industrial activity and perhaps some new tourism. They may have the opportunity to garner benefits from tidal energy development. There could also be some negative effects. *Module 8: Opportunities and Strategies for Communities* discusses these and strategies for mitigating the negative impacts and keeping benefits local. *Module 6: Stakeholder and Community Engagement* describes methods project developers can use to engage and consult with members of the community. The process of stakeholder and community engagement includes meetings held in affected communities in order to give people a chance to learn what is going on and to express their concerns.

WILL TIDAL ENERGY DEVELOPMENT PAY OFF? WHAT ARE THE RISKS? HOW CAN THEY BE REDUCED? WHAT ABOUT FINANCING? WHAT HELP IS THERE FROM GOVERNMENT?

There are several modules to answer questions such as these. In *Module 9: Opportunities and Strategies for Business*, supply chain opportunities are detailed and strategies for businesses to take them up are described. While the industry is new and small, business startups may be premature, but many of the businesses in our maritime economy have the skills and expertise to provide services and products for the development of tidal energy.

Module 7: Financial Evaluation and Cost of Energy describes the costs and what must be included in the cost-benefit analysis of tidal energy projects – both small-scale tidal and large. It also describes the levelized cost of energy calculations, an industry-standard measure for comparing costs of energy from various sources.

Module 10: Financing, Government Supports, and Managing Risk outlines the financing available at the various stages of technology and project development, as well as the gaps in financing. Methods of financing are explained and supports provided by the federal and provincial governments in Nova Scotia are outlined, with web links to relevant government information. Finally, the module discusses the risks inherent in a tidal energy project and how to mitigate them.

Guidelines for project developers for consulting and engaging stakeholders and communities are provided in *Module 6: Stakeholder and Community Engagement*. Few things can derail a project like community dissent, so undertaking forthright and thorough community consultation and engagement is not only good stewardship, it is good business.

In summary, the Community and Business Toolkit for Tidal Energy Development has been written to inform the responsible development of tidal energy, empower stakeholders with up-to-date and comprehensive information, and lead communities toward a greener, more secure source of electricity.