# Scoping Study on Socio-Economic Impacts of Tidal Energy Development in Nova Scotia: A Research Synthesis & Priorities for Future Action

## FINAL REPORT

Prepared by

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for the

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## EXECUTIVE SUMMARY


The Fundy Energy Research Network (FERN) Socio-Economic Scoping Study provides a state-of-knowledge comprehensive review of the socio-economic issues associated with tidal in-stream energy conversion (TISEC). Highlighted in this report are international, national and provincial level research, regulatory frameworks and projects.

The purpose of this scoping study is to highlight many of the socio-economic issues related to TISEC development and to discuss best practices, case studies and tools that have been developed to facilitate positive socio-economic benefits and community development. The report provides an overview of research, and best practices developed in Canada and abroad in relation to TISEC developments and other renewable energy technologies. Four specific components of TISEC development are addressed: 2.0 - *Technology, Supply Chain and Workforce Development;* 3.0- *Policy, Assessment and Stakeholder Processes;* 4.0- *Financing and Funding;* and 5.0-*Community Benefits and Economic Development*, which highlights socio-economic concerns in the development of TISEC but also other renewable energy technologies.

Highlighted in the report are issues identified as important to developing a robust TISEC industry and ensuring socio-economic benefits at the local and regional level. These include:

- Provision of knowledge and technology transfer between stakeholders and within the industry to support innovation and share best practices,
- Ensuring that inputs, such as labour, are secure and that a reliable supply chain is developed,
- Ensuring that financing is present, for both private and community groups willing to invest in TISEC,
- Financial mechanisms (revenue and expenditure support) that are in place and capture negative externalities while not discouraging a wide range of project sizes,
- Government taking a “hands-on approach” to industry development without creating a situation where industry will be reliant on government in the long term,
- A streamlined permitting process as the best way to avoid over-regulation and conflicting legislation,
- Environmental impact assessments that better incorporate socio-economic impacts,
- Incorporation of broad range planning tools such as Marine Spatial Planning, Integrated Coastal Zone Management and Strategic Environmental Impact Assessments,
- Ensuring that stakeholders are consulted in a fair, open and transparent process,
- Ensuring that community benefits are measured in an objective and reliable fashion and that community members are involved in the decision making process with the opportunity to invest at any point in a project.

Sections 6.0-10.0 focus on the Nova Scotia context and the research, legislation and practices to date that support TISEC development. It describes possible future research and actions to spur development of the tidal energy sector. Finally, it presents a series of socio-economic research priorities that could support the needs of Nova Scotia’s rural and coastal communities.

This scoping study identified a number of issues, including the need for:

- Development of a strategic plan for the development and deployment of TISEC devices that is in line with the Marine Renewable Energy Technology Roadmap developed by Natural Resource Canada (released in November 2011),
- Jurisdictional and regulatory clarity,
- Streamlining of the evaluation, permitting and decommissioning process,
- Community buy-in to projects and protecting lower income Nova Scotians from severe energy rate increases; and
- Clarity on how benefits to the community will be incorporated into development agreements.

## 1.0 INTRODUCTION

Research in the tidal energy sector has been focused on the natural and applied sciences including: engineering research; assessment of tidal flows; biological and ecological studies on fish, marine mammals and habitat; and sediment dynamics (Isaacman & Lee, 2010). While significant work has been accomplished in the natural and applied sciences, lacking is a comprehensive understanding of the socio-economic variables associated with TISEC.

The purpose of this scoping study is to highlight many of the socio-economic issues related to TISEC development and to discuss best practices, case studies and tools that have been developed to facilitate positive socio-economic impacts and community development.

Key questions to address include:

- What are the socio-economic benefits and costs associated with TISEC?
- What is required to develop the TISEC industry responsibly and with respect to the environment?
- How will coastal communities be impacted by TISEC developments, both positively and negatively? Positive impacts may be local economic development, through employment, leases, taxation and tourism. Negative impacts might be conflict between uses, reduced access to ocean areas, spoiled seascape or landscape, or a decrease in tourism.
- How can the TISEC industry be managed through planning, policy and legislation?

Deployment of TISEC technology is nascent, with only a handful of projects developed around the globe. The UK, Ireland, Korea, China and Canada are currently the leaders in the development of demonstration projects. Due to the pre-commercial stage of the technology, many questions remain on how successful the industry will be in delivering renewable energy targets, and to what extent positive socio-economic benefits will be realized as a consequence of developing a TISEC industry.

Tidal energy, by its nature, is located near and best accessed by coastal communities, many of which are small, rural communities. The potential for industry development and its outcomes – rural regeneration, infrastructure investment and improved quality of life for rural residents should not be understated (Carley et al., 2010). However, the scale and scope of these benefits are difficult to assess in an industry that is in its early stages. To complicate matters, TISEC development requires many specialized services (e.g. crane barges, underwater surveying) and the involvement of a number of governmental agencies and departments.

Addressing these issues through a state-of-knowledge review provides a solid foundation with which to engage researchers, governments, industry, and communities on socio-economic issues related to TISEC.

## 2.0 TECHNOLOGY, SUPPLY CHAIN & WORKFORCE DEVELOPMENT

One of aims of this Scoping Study is to identify and document research and reports that have been written on the socio-economic and non-engineering and environmental factors associated with in-stream tidal energy development. In this section, an overview of issues related to technology, supply chain and workforce development are presented. The various research and infrastructure needs, such as test site construction and management and developing grid connection technologies all represent potential sectors that could create jobs and provide skill training opportunities. This is, of course, as long as local labour and technology are able to meet industry demands. Technology, supply chain and workforce development are topics that will require government, academic and industry research efforts. Any region wishing to facilitate economic growth around TISEC should look to develop their capacity in technology development and supports, supply chain and a skilled workforce.

### *Key Issues*

**Technology Development –** *TISEC technology is still in its infancy, and therefore there is a need to expand R&D activities*

- Engaging stakeholders – In order to facilitate awareness of the industry and potential cross fertilization, the public needs to have access to information on TISEC opportunities and plans
- Test Site Availability – Port Access & Grid Access – Infrastructure to test TISEC designs is essential to move beyond the pre-commercial stage

**Supply Chain Development –** *The efficiency of the supply chain is important to industry development and several gaps have been identified for various regions*

- Manufacturing
- Construction & Installation

**Workforce Development –***Direct benefits to communities from TISEC development is contingent on having a skilled workforce in place when needed*

**Knowledge Transmission & Research Collaboration –** *Renewable targets and energy security concerns are creating a major impetus to facilitate deployment of TISEC devices – research collaborations and cooperation will be essential*

## 2.1 TECHNOLOGY DEVELOPMENT

Tidal technology is still in its infancy. There are still many test models in development and a limited number have been demonstrated around the world (RenewableUK, 2011; Natural Resources Canada [NRCan], 2011a). The recent report by Renewable UK (2011) - *Wave and Tidal Energy in the UK: State of the industry report*, highlights the variety of designs that are currently in the demonstration phase in the UK, with no best model being apparent. Despite the variety of models and research sites developed (the UK has four wave and tidal test sites available for proving technology and grid connectivity), there remains opportunity for additional research in all aspects of marine renewables (Mott MacDonald, 2011; Renewable UK, 2011). Several reports and researchers have suggested that technology development is a fundamental issue that should be addressed to more rapidly move towards the commercialization of TISEC technology and marine renewables (O'Rourke, Boyle & Reynolds, 2010; SQWenergy, 2010; Colander & Monroe, 2011).

### 2.1.1 ENGAGING STAKEHOLDERS

The creation of a robust industry requires a strong supply chain, knowledgeable workers and readily available financing (SQWenergy, 2010). In an industry that is just starting out, such as TISEC, there is a need to develop networks of suppliers, support sectors such as engineering, and project management, as well as ensure potential consumers are aware of industry actions. As suggested in the report by Mott MacDonald – *Accelerating the Deployment of Offshore Renewable Technologies* (2011), this should be done in as broad a manner as possible to ensure that all potential connections between industry segments can be established and that new entrants to the industry are able to make informed decisions.

**Box 1: Case Study: *Renewables - Made in Germany***

An example of promotional work is the "*Renewables - Made in Germany"* exhibition, whose purpose is to draw worldwide attention to the possible applications of renewable energies and to support technology transfers. At the fore of the exhibition is an overview of renewable energies technology with a special focus on the strengths of German suppliers and systems solutions. The German ministry of Economics and Technology, which includes Energy, has also developed a two tier multilingual directory of renewable energy businesses and developers and readily provides this information. One directory focuses on commercial and community scale technologies, while the other provides the same information but for small scale and individual use technologies. Tidal and wave technology is not strongly represented in either of these directories or the *"Renewables –Made in Germany"* report, however, by providing this information, Germany is ensuring that it makes renewable technology accessible and presents an "open for business" approach. Additionally the directories allow for easier communication between domestic producers, suppliers and researchers.

(Source: *Renewables –Made in Germany*: www.renewables-made-in-germany.com/en/publications/specialty-catalogue-off-grid-renewable-energy.html )

## 2.1.2 TEST SITE AVAILABILITY - PORT ACCESS - GRID ACCESS

### 2.1.2.1 TEST SITE AVAILABILITY

The ability to test or incubate technology in high flow environments is an essential step in continuing to move TISEC to full scale commercialization. Monitoring the performance and impacts of tidal devices in coastal and ocean environments is fundamental to advancing TISEC infrastructure designs (Dalton et al. 2009; O'Rourke, Boyle & Reynolds, 2010; SQWenergy, 2010; NRCan, 2011a). Test and incubation sites provide important facilities where pre-commercial designs can be validated. They are generally government funded facilities (at least in part) and would ideally provide the following (Dalton et al., 2009):

- Approved site with existing licensing,
- Environment impact assessment waiver,
- Free cable connection,
- Free data collection,
- Adjacent service facilities.

Several test sites for tidal energy have been developed around the world. The UK itself hosts four sites that are good examples of facilities for the testing of marine energy devices (Renewable UK, 2011):

**QinetiQ:** provides wave and tidal device developers the ability to prove their systems really work, by testing ideas and technology. The facility hosts hydrodynamic model testing facilities: the ocean basin (122m x 61m x 5.5m) and ship towing tank (270m x 12m x 5.5m), both of which incorporate wave making capability.

**Narec:** is the national centre dedicated to advancing the development, demonstration, deployment and grid integration of renewable energy and low carbon energy generation technologies, established in 2002 as an independent R&D centre serving the renewable energy industry. Narec has a large-scale wave flume and a tidal testing facility to allow scale models of prototype devices to be tested in a controlled and monitored environment.

**European Marine Energy Centre:** in Orkney was established in 2003 and offers developers the opportunity to test full-scale grid-connected prototype wave and tidal stream devices. The centre operates two sites – a wave test facility and a tidal test facility – which have multiple berths that allow devices to be tested in the open sea. The berths have an existing connection to the onshore electricity network and facilities for technology and environmental monitoring.

**Wave Hub:** is a grid-connected offshore facility in south-west England for the large-scale testing of technologies that generate electricity from the power of the waves. It leases space to wave energy device developers and exists to support the development of marine renewable energy around the world. The facility has four berths able to connect up to 5MW each.

As outlined in the Natural Resources Canada report - *Charting the Course: Canada's Marine Renewable Energy Technology Roadmap* (2011a), industry incubators and test centres are central enablers in the development of a robust and independent TISEC industry. Similarly to many other reports outlining how to develop marine renewables, *Charting the Course* (NRCan, 2011a) highlights the importance of building on the technology development infrastructure already in place in Canada, from Fundy Ocean Research Centre for Energy in Nova Scotia, to smaller but similarly intentioned facilities in Quebec and British Columbia.

#### 2.1.2.2 PORT ACCESS

Port access is another major factor in the deployment of tidal devices (Renewable UK, 2011; Carbon Trust, 2011; EquiMar, 2011). Wells & McConnell (2011), in a report on the ports and shipping requirements for the marine energy industry in Ireland, identified the importance of ensuring ports have the infrastructure necessary for the deployment and maintenance of marine energy devices. Spatial analysis of supply chain components relative to available port sites and tidal resources is required to strategically plan for future port development as necessary (Wells & McConnell, 2011). Also, as technology progresses, the relocation of key manufacturing closer to deployment sites to minimise onshore transport should be considered (EquiMar, 2011b). In general, easy access to service ports and the availability of skilled service personnel with appropriate equipment are essential for the effective development of the marine energy industry (Dalton et al., 2009).

#### 2.1.2.3 GRID ACCESS

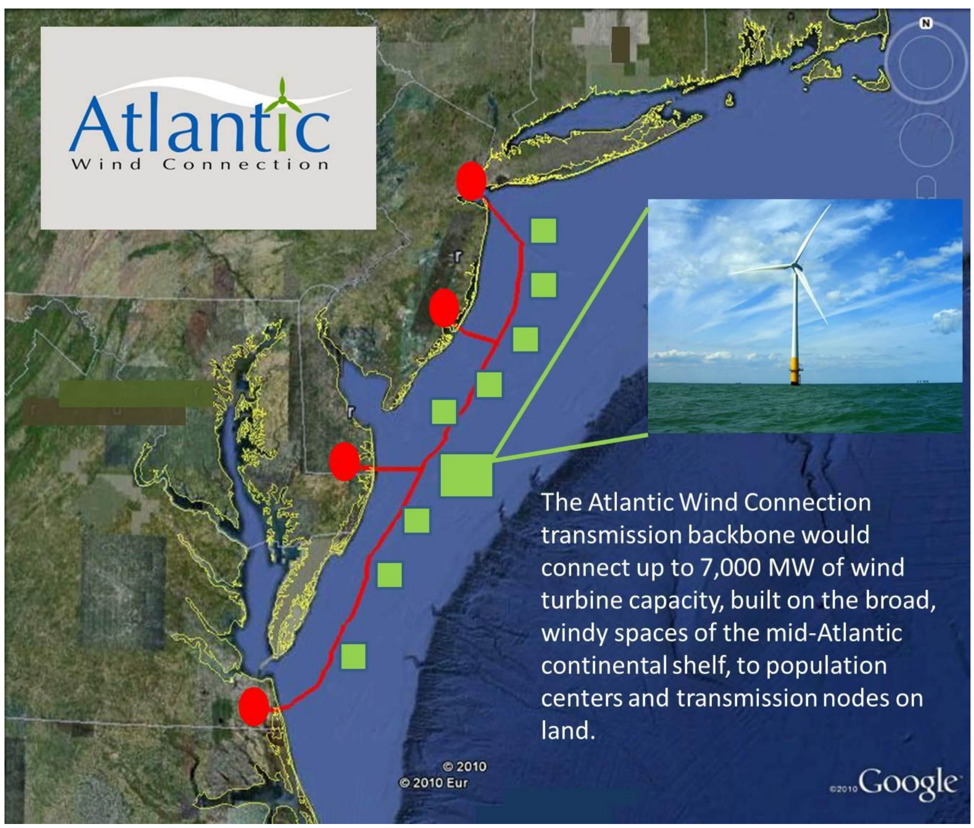
Grid connectivity is a major issue. In order to more equally distribute offshore energy and to reduce the high costs of radial lines (which may be several kilometres from shore), it has been suggested that developing simpler, centralized and less costly grid connections are important to more rapid technology diffusion (Colander & Monroe, 2011). The current transmission-charging regime in the UK, which levies high charges on those projects furthest from the market, has been identified as a major impediment to the growth of renewable projects in remote locations (RenewableUK, 2011). Other mechanisms such as a locational charging mechanism for grid connection simply increase the barrier to entry for investors (RenewableUK, 2011). In Canada, the distance from sea to shore and the rural character of much of the country means that costs of transmission systems will be high (NRCan, 2011a). Again having test facilities with grid access and building on knowledge and experience across the marine renewables sector through collaborative action will help in the long run (NRCan, 2011a).

**BOX 2: Best Practice: Developing more accessible grid connections**

Offshore energy projects that seek to be commercially viable need to be able to get the energy they generate to users in a cost effective manner. Undersea cables, however, can be very expensive (Sustainable Development Commission, 2007a; FREDS, 2009; RenewableUK, 2011). The development of a shared connection closer to devices reduces the cost, permitting and other issues related to installing a radial line for each device.

An example of this approach is the Atlantic Wind Connection, located off the Mid-Atlantic States on the US eastern seaboard. It is being developed by a consortium of investors, including Google. The Atlantic Wind Connection provides a transmission backbone for offshore wind developers (Figure 1). Without it developers would be forced to bring energy to land via radial lines that can make balancing the region's grid more difficult and costly. A single offshore backbone with a limited number of connection points on land will minimize the financial and environmental impacts of building multiple individual radial lines to shore. The Atlantic Wind Connection project not only reduces the need to build many lower-capacity transmission lines, it relieves grid congestion.

Figure 1: The Atlantic Wind Connection transmission backbone.
Source: http://atlanticwindconnection.com/news/awc-schematic/



## 2.2 SUPPLY CHAIN DEVELOPMENT

The cost of offshore energy development is much higher than on land due to a variety of reasons such as the assortment of specialized structures, tools and equipment required to install and maintain devices. Another important concern is the capacity of the supply chain to provide materials and services (Green & Vasilikos, 2011; NRCan, 2011a & b). In discussing the supply chain for the offshore wind industry in Europe, Green & Vasilakos (2011) identify a relatively limited number of installation vessels and long queues in orders from device component suppliers, due to limited production volumes of equipment and parts. It is interesting to note that there are difficulties in the offshore wind supply chain in Europe despite the majority of the world's wind energy devices being located there and the long period over which the industry developed. In Denmark, active promotion of wind began in the 1970's (Sovacool, Lindboe & Odgaard, 2008). This would suggest that tidal energy is likely to face similar issues. Generally, any shortages in supplying device components, connection systems and construction materials can impact on project timelines and turn profitable projects into losses (Mott MacDonald, 2011). The UK, Canada and other European nations have already completed national level studies in supply chain gaps in renewable and marine energy (DTI, 2005; EquiMar, 2011b; NRCan, 2011b; Wells & McConnell, 2011). A report by Natural Resources Canada (2011b) suggests Canada's marine renewables supply chain is currently in the prototype stage. However, the report also suggests that this is acceptable as prototype technologies like marine renewables do not require multi-unit manufacturing. In the MRE Technology Roadmap developed by Natural Resource Canada (2011a), the development of the supply chain for marine renewable technologies is a major priority.

The Natural Resources Canada report - *The Marine Renewable Energy Sector Early Stage Supply Chain* (2011b) lists 10 segments in the Canadian marine renewable supply chain, which are provided in Table 1.

Table 1: Supply chain segments.

| **Supply Chain Segments** | |
|---|---|
| Technology developers | *Marine energy device innovators, designers and developers* |
| Manufacturers and suppliers | *Manufacturers and components suppliers* |
| Project developers | *Utilities and independent power producers* |
| Development services | *Resource assessment modelling, mapping, environmental impact assessment, permitting, approvals planning, etc.* |
| Supporting technology providers | *Wave/tidal current resource measurement devices, environmental monitoring devices, technical resource monitoring and data collection* |
| Engineering and construction | *Onsite management and construction* |
| Operations and maintenance | *Operational monitoring , transportation, port facilities and marine operators with related experience* |
| Research and development | *Public and private research bodies* |
| Policy and industry support | *Government policy development, industry associations and non-governmental organizations* |
| Business services | *Legal, financial, insurance, communications, market research and training activities* |

(Adapted from Natural Resources Canada, CanmetENERGY (2011), *The Marine Renewable Energy Sector Early Stage Supply Chain*).

The report also identifies the following strengths and weaknesses in the Canadian supply chain, which are provided in Table 2.

Table 2: Strengths and Weaknesses of the Canadian supply chain.

| Weaknesses | Strengths |
|---|---|
| • Device manufacturing<br>• Engineering &construction<br>• Foundations/anchoring | • Deep sea ports<br>• Marine construction<br>• Resource monitoring and analysis<br>• Environmental assessment<br>• Marine supplies<br>• Commercial diving<br>• Transport |

(Adapted from Natural Resources Canada, CanmetENERGY (2011) *The Marine Renewable Energy Sector Early Stage Supply Chain*)

Supply chain studies in the UK for specific tidal energy projects found similar gaps in their supply chains. The Mersey and Severn Tidal Power projects supply chain findings are discussed below.

***Mersey Tidal Power project***

The socio-economic impact study completed for the Mersey Tidal Power project (which investigated the feasibility of tidal barrage, tidal fence and a tidal power gate devices) in the Liverpool City Region of the United Kingdom suggested that little is known about the tidal power supply chain – mainly because it is a nascent industry and that it is many years behind wind power in terms of its development (Regeneris Consulting & URS Scott Wilson, 2011). However, the report also suggests that firms active in the supply chain for offshore wind power could be well placed to compete in this market as there is a wide range of common infrastructure requirements as well as shared service industries for tidal and wind power projects, particularly in earlier stages of the supply chain (feasibility planning, etc.) (Regeneris Consulting & URS Scott Wilson, 2011). Firms with experience in wind power projects could be well placed to benefit from a developing tidal industry (Regeneris Consulting & URS Scott Wilson, 2011).

***Severn Tidal Power project***

In 2010, a supply chain survey report was compiled for the Severn Tidal Power project, a tidal barrage project in the UK (which did not go ahead), to explore what demands the project would place on the supply chain and what gaps, if any, were present. The report specifically identified the following supply chain inputs as important to the tidal project:

- Vessels for dredging, caisson[1] installation and embankment construction,
- Aggregates for concrete, ballast and embankment fill (sand and gravel, crushed rock and armour stone),
- Concrete for caissons and other civil works (cement, rebar, etc),

[1] A **caisson** is a retaining, watertight structure used, for example, to work on the foundations of a bridge pier, for the construction of a concrete dam, or for the repair of ships.

- Caisson construction yards,
- Turbines and generators,
- Availability of skilled labour.

The report identified that there would, in fact, be shortages for a tidal barrage project of this type. In particular, there would be supply chain gaps in:

- Vessels for construction. These are limited in the UK and Europe and would have to be ordered 1-2 years ahead of time to ensure they are available when needed and that they are the appropriate vessels.
- The project demand for some but not all types of aggregates are far beyond what the local market could supply.
- Caisson construction yard quality was unknown and may not be suitable, and some additional ones might be needed.
- Turbines were not expected to be able to be produced in the quantity necessary within the UK, and would likely have to be sourced from several different countries such as China and Brazil.
- The report also identified a potential shortage in the workforce in marine and civil engineering, mechanical and electrical installation and project supervisors. It was suggested that this would be due to the various other energy projects scheduled/proposed in the UK in the period to 2030, which would all be competing for the same workers.

There are two essential strategies for supply chain stakeholders (manufacturers, installation and construction) to approach entry to a new market such as TISEC. The first is to be in position to supply goods or services in advance of demand. If a supplier already has a production capability for the required components, then there is likely to be minimal risk or delay in supplying at volume. The second route is to wait until the demand for goods and services is strong enough and move in to supply the industry. A late-mover approach will facilitate learning from earlier mistakes, and a late entrant might enter a more stable industry (EquiMar, 2011b). There are pros and cons to either approach. Both routes involve an element of risk both for developers and suppliers. The late-mover can learn from the negative experiences of others. The early-mover – assuming they are still in business – will have learned from their mistakes, will have ideas for improvement, and will have had the chance to build a relationship with the client (EquiMar, 2011b).

It has been suggested that government policies that attempt to select the best technological approach and support a specific technology at the expense of others intended to achieve the same objective can be risky, distort natural market forces and undermine opportunities for innovation (Mott MacDonald, 2011). While this approach can yield substantial benefits, as has been seen in Germany and Denmark in the promotion of wind energy, there can be negative impacts in the long-term, as some technologies and their supply chains are not able to be developed (Mott MacDonald, 2011). In the case of offshore wind, some companies may be able to shift their resources to meet the fabrication and other needs of tidal and wave energy, but this may take some time. Picking a specific industry to be a leader may provide short-term gains, but may cause shortages in other industry supply chains, leading to longer development time lines, which in turn impacts on the ability to effectively finance projects (EquiMar, 2011b; Wells & McConnell, 2011).

Another important component to effective supply chain development is the spatial arrangement of device manufacturing, maintenance and port facilities (Sustainable Energy Authority of Ireland & Irish Maritime Development Office, 2011). If possible, these should be arranged to maximize industry linkages between manufacturers, R&D, deployment and support services, and to support efficiency in supply chain and transportation systems.

In economic development literature, the expectation is that as technology matures and more projects are built, project costs will decrease. In terms of renewables, wind is often considered one of the more mature technologies and consequently should have lower costs relative to other technologies. Green and Vasilikos (2011) note, however, that in recent years, offshore wind costs have risen rather than decreased, driven partly by increases in material prices (particularly for steel) and partly by a rapidly rising demand relative to supply chain capacity. Therefore, it is important to be mindful of potential external factors which may impact on supply chain performance.

### 2.2.1 MANUFACTURING

The manufacturing sector represents a very significant player in the tidal energy supply chain. As was mentioned in the section “Technology Development”, TISEC devices vary widely in design, meaning many of the component parts are particular to a given design, reducing any economy of scale benefits. Also, companies that have invested heavily in R&D may be reluctant or unable to have many parts manufactured outside their own facilities, consequently lowering the potential for manufacturing jobs in device deployment locations. This may be limited to highly technical components rather than structural pieces. In some cases, the design may necessitate the manufacture of components near deployment sites due to them being uneconomical to ship internationally or inter-regionally. However, emerging businesses may not be able to meet demand immediately and some leakage may occur. At the start of the 2000’s in the UK, early entrants to wind energy device manufacturing were unable to meet project timelines and, as a consequence, many pieces had to be imported, thus reducing local economic benefit and slowing industry learning rates (DTI, 2005).

There is, however, the recognition that some components will have to be imported simply due to other competitors or new entrants being unable to match the efficiencies and capacity of more specialized or older companies. As such, an industry development strategy should fully consider what can be produced locally and what will need to be imported (NRCan, 2011a).

### 2.2.2 CONSTRUCTION

As with terrestrial and offshore wind, the costs of marine technologies are heavily dominated by the initial construction costs which can be as high as 80-75% of the total project cost (Carbon Trust, 2011). Port access and suitability is a central component to establishing strong and reliable construction and maintenance infrastructure for marine renewables. The development of appropriate locations is essential to ensuring that the benefits of operations and maintenance hubs for offshore projects are captured (Sustainable Energy Authority of Ireland & Irish Maritime Development Office, 2011). While port access is a necessary feature so is the availability of ships with the capacity to carry the necessary equipment and loads required to install and service tidal devices. The availability of these types of ships is limited and they can be very costly. This factor can significantly impact on project timelines and overall costs. However, in many cases, researchers contend that a large percentage of renewable energy employment will remain domestic (i.e. they are not at risk of being fulfilled by overseas labour), in particular because one of the largest stages of any renewable project, the installation phase, involves site-specific installation and construction (Carley et al., 2011). However, the benefits for a region in terms of long range impacts from construction is dependent on the consistency of contracts, the current availability of skills and experience and the ability to develop skills and experience that can be exported. As TISEC is being pursued in one form or another throughout the world, the ability for one region to reach a point where they can export services and expertise will depend on how they fare in relation to other jurisdictions.

## 2.3 WORKFORCE DEVELOPMENT

Numerous reports suggest that workforce retention, development and the impacts of worker flows across industries and sectors are important socio-economic policy considerations for the marine energy industry (FREDS, 2009; Mott MacDonald, 2011; Munday, Bristow & Cowell, 2011; RenewableUK, 2011). Munday, Bristow & Cowell (2011), suggest that the long term economic development benefits from renewables, such as wind, are generally low overall – start up is high but once systems are running there is limited direct benefit unless there is the ability to develop skills and R&D options in situ.

There are four workforce development issues that have been identified for the marine renewables industry and renewables generally:

- Professional skills availability, in particular for engineering and project management professionals (FREDS, 2009; Frondel et al., 2010; NRCan, 2011a),
- General labour availability in communities where devices are deployed (quantity and skills mix) (Munday, Bristow & Cowell, 2011),
- Inter-industry interactions and flows of workers (Frondel et al. 2009; NRCan, 2011a),
- Quality and duration of jobs and how they address income distribution in the community (del Rıo & Burguillo, 2009).

Government and industry should consider these issues when shaping renewable energy policy. As Frondel et al. (2010) point out, Germany has seen strong competition for employees in the renewables and "green" technology sectors since the establishment of the Renewable Energy Sources Act (EEG), which lays out renewable energy targets and industry development objectives. Renewable industries typically require medium- and high-skilled workers. But as Frondel et al. (2010) point out, there is strong competition for such employees. This has called into question the net employment effects of the *Renewable Energy Sources Act* (pg. 4054).

Competition for graduates in engineering and project management from other sectors, such as oil and gas, means that there may be a shortage of talent to apply to marine energy. There is an identified need, at least in the UK, to create a slack labour market in order to funnel the necessary skills into marine energy (FREDS, 2009). Another issue that has not been addressed extensively is the demographic shifts occurring throughout the developed world. An ageing population will mean not only certain skilled workers, but workers generally, may be in short supply (NRCan, 2011b). The impact of policies (or lack thereof) that address labour market shortages should be considered when looking at the development of the tidal energy industry.

The first stage in addressing skills shortages is a comprehensive review of the current skills base in order to assess the future requirements at national or regional levels. This should be performed through consultation with industry, and be based on realistic growth targets for the offshore renewable energy sector (Mott MacDonald, 2011). A strategy should be developed to address skills shortages, and should be supported by industry, public and private education providers and other stakeholders (Mott MacDonald, 2011; NRCan, 2011a).

**Box 3: Case Study: Establishment of National Skills Academy in the UK**

National Skills Academies have been initiated by the UK government to address the need for a world-class workforce with better skills, to be employer-led centres of excellence, and to deliver the skills required by each sector of the economy.

Examples of two such academies actively involved in the provision of a skilled workforce for the offshore renewable energy industry include:

- the National Skills Academy for Power (www.power.nsacademy.co.uk); and
- the Energy & Utility Skills (EU Skills) (www.euskills.co.uk).

National Skills Academies are centres of training excellence which have been set up by the UK government in order to support the delivery of skills required in each major sector of the UK economy. Crucially, skills academies are led by employers who work with government and training providers to shape the training and qualifications that will help them compete in global markets. The National Skills Academy for Power is a recent addition to this network of academies, and is supported by major employers in the UK power sector such as Scottish Power, EDF Energy, Scottish and Southern Energy, E.ON UK, National Grid, ABB and others.

The Energy & Utility Skills (EU Skills) is the Sector Skills Council for the gas, power, waste management and water industries, licensed by UK Government and working under the guidance of the UK Commission for Employment and Skills. The Energy & Utility Skills is employer-led, and its purpose is to ensure that its industries have the skills they need now and in the future.

(Source: Mott MacDonald, 2011)

**Box 4: Best Practice: Establish Industry bodies to promote, plan and develop the industry**

As an emerging industry TISEC will likely garner interest from a variety of stakeholders as it develops. Having a centralized access point to provide information to industry members and those interested in investment or career opportunities in marine renewables could be beneficial in the promotion of the industry.

**Example:** UK Marine Industries Alliance: www.ukmarinealliance.com/

The Alliance is a free to join strategic collaboration of UK Marine companies and related stakeholders. The Marine Industries Leadership Council set it up on behalf of the industries. The Council includes trade associations, regional groupings, Government Departments, devolved administrations, and other public bodies. The Alliance provides support between and across various segments of the marine industry, including a one stop place to learn about different industry sectors.

## 2.4 KNOWLEDGE TRANSMISSION & RESEARCH COLLABORATION

An important issue that often arises in TISEC, and renewable energy research generally, is how to share knowledge on successes, failures and best practices. The TISEC sector is in its early stages, and little is known about many of the impacts of the technology and what is possible should the industry flourish. While post-secondary and research institutions do share information and findings, through formal means such as conferences and academic papers, there is still a need to have a coordinated and open approach to research. Some reports have advocated for the sharing of findings to be negotiated as part of the permitting process so there is a limited lag time between the points at which data are available and the time it is able to be shared (Mott MacDonald, 2011). The creation of centres of excellence in offshore renewables, and supporting conferences, seminars and other forms of networking and knowledge transfer have also been cited as important for industry development (Mott MacDonald, 2011, NRCan, 2011a). A potential problem is that industry players may be reluctant to share information that could compromise their competitive advantage (NRCan, 2011a). Another issue is the variance in different monitoring, impact assessment and other data collection, and research methods that may limit the ability to generalize findings from one jurisdiction to another. The establishment of agreed upon industry standards as well as research methods, indicators and tools for marine renewables may allow easier knowledge transfer and the development of best practices.

There has already been the development of several online research libraries by a number of European based organizations. Many of these organizations and projects provide open access to a wide range of environmental, engineering and economic studies and reports. The European Marine Energy Centre, SuperGen Marine Research Consortium, Marine Scotland, the EquiMar Project website and International Energy Agency –Renewable Energy Technology Deployment and a number of nation specific research bodies are some of the key players in marine renewables research. The SeaGen (www.seageneration.co.uk/) project is the only known tidal energy project which provides information on its process and outcomes.

## 3.0 POLICY, ASSESSMENT & STAKEHOLDER PARTICIPATION

This section provides an overview of policy, assessment and stakeholder processes relevant to tidal energy development. As TISEC development is still in the nascent stages of development, there is little data available on potential impacts of future developments. Policy and legislation specific to TISEC is undeveloped and inconsistent. There have been several written reports, on policy and assessment of offshore renewable energy development, which have gleaned many lessons from the offshore wind industry. It has been recognized that the successful licensing, planning, deployment and operation of a marine energy array depends largely on a well planned and executed consultation with stakeholders (EquiMar, 2011c). The stakeholder participation section focuses on identification of stakeholders and stakeholder processes.

### *Key Issues*

**Policy** – *A streamlined permitting process may be the best way to avoid over-regulation and conflicting legislation.*

**Impact Assessment** –*Impact assessments need more thorough coverage of socio-economic issues and opportunities. Impact assessments include:*

- Resource Assessment
- Environmental Assessment
- Economic Assessment
- Strategic Environmental Assessment
- Risk Assessment and Management
- Adaptive Management – *can be utilized when impacts are uncertain, and should be incorporated into policies and plans*

**Marine Spatial Planning (MSP)**– *can minimize barriers in the tidal energy industry*

**Integrated Coastal Zone Management (ICZM)** – *can minimize barriers and provide an overarching ocean management plan*

**Stakeholder Participation** – *Stakeholder participation has been recognized as a critical process for long-term project success. Stakeholder participation incorporates key elements below:*

- Identification of Stakeholders
- Stakeholder Processes
- Public Opinion and Acceptance
- Space-Use Conflicts
- Navigational Practice and Safety

## 3.1 POLICY

As the marine energy industry gains momentum with advances in research and development, several governments have introduced policies dedicated to supporting the demonstration and deployment of marine energy projects (AEA Energy & Environment, 2006). However, there is still a lack of appropriate legislation specific to tidal and wave energy projects, and there is a need to establish coherency in order to promote an international standardization of environmental legislation requirements.

Permitting new and complex technologies in an efficient and consistent manner requires specialised expertise and enough experience to develop a well-informed perspective on key issues, such as risk. While data on regulator expertise on offshore renewable energy deployment is not readily available, a lack of regulator expertise and consistent approach is a common challenge in the implementation of environmental innovations (Mott MacDonald, 2011).

Several best practices have been identified in policy-related aspects of siting and permitting of offshore energy projects. The UK and Germany are moving particularly quickly in developing marine energy. Portman (2010) conducted a review of marine renewable energy policies which are summarized in this section.

**UK: Proactive Site Locating and "One-Stop Shopping"**

The British government launched the Wave and Tidal Stream Energy Demonstration Scheme in 2006, which provides capital grants and revenue support for pre-commercial demonstration of ocean energy systems. Developers pay a one-time lease fee for the use of UK ocean space, and financial incentives are available to them in the form of capital grants, exemption from the climate change levy and through opportunities to sell renewable obligation credits (Portman, 2010).

Ocean energy development is also encouraged by proactive identification of potential sites and a clear regulatory framework. When developing offshore wind power, developers were required to submit proposals that fell within one of three strategic areas designated for wind projects, which already had preliminary environmental assessments completed. A clear regulatory framework is provided by the Marine Management Organisation, which was created after the UK's *Marine and Coastal Access Act* was passed in 2009. The Marine Management Organisation is now the main planning body which manages activities in coastal areas in the UK. The *Coastal Access Act* requires proponents of offshore renewable energy projects to obtain a single consent to construct and operate a renewable energy project from the Marine Management Organisation (Leary & Esteban, 2009; Portman, 2010).

**Germany: Cautious Commitment**

Although Germany has relatively limited ocean resources, ocean energy is included under the existing renewable framework, which supports offshore wind development. The government launched a public-private partnership program in July 2005 – the Offshore Wind Energy Foundation – comprised of members of the offshore wind industry, power utilities, financiers, nongovernment organizations, representatives of coastal states and other federal ministries. The market-based incentives include feed-in tariffs which are a higher amount to reflect the higher costs of developing in offshore regions. The regulatory process is led by the Federal Maritime and Hydrographic Agency, which develops standards for wind farm authorizations, operations and decommissioning. These standards are being revised in an ongoing fashion – which is perhaps an example of adaptive management. German law expedites the approval of offshore renewable energy projects by considering authorization a nondiscretionary administrative act (Portman et al., 2009). Therefore, the presumption is in favour of approval that is rebuttable only by specific reasons of a limited nature, such as impairment of safety and/or efficiency of navigation or threat to the marine environment (Portman, 2010).

**Portugal: Maritime Pilot Zone**

Portugal has focused on developing various forms of wave energy, which has been included in the National Ocean Strategy. An important development in the ocean energy sector was the creation of the Wave Energy Centre, which was formed by a group of Portuguese companies, universities and R&D institutes. The government has also financially supported scientists working on wave energy applications with €5M committed for research, development, and demonstration projects per year from 2000 to 2009 (AEA Energy & Environment, 2006). In 2008, the Portuguese government created a Maritime Pilot Zone off the coast for wave energy extraction in support of the deployment of offshore wave energy prototypes and farms (Portman, 2010). The Maritime Pilot Zone is located off the west coast between 30 m and 90 m water depth, and covers an area of 320 $km^2$. Knowledge gained from this test site will be used for the development of Portuguese (and international) regulations (Palha et al., 2010). The Maritime Pilot Zone is also meant to guarantee simplified and fast licensing and permitting through a managing body that will also identify and promote the establishment of offshore corridors and the construction and maintenance of sector infrastructure (Waveplam, 2008). Portugal's feed-in tariffs for renewable energy are based on the technology used for generation, and are designed to encourage small-scale projects in areas with fewer natural resources (Portman, 2010).  However, most feed-in tariffs to date have been applied for onshore wind.

**USA: Lease Fees**

The US regulatory system differs from the systems of Western European countries mostly by its lack of development standards or proactive siting in the Exclusive Economic Zone through marine spatial planning or a strategic environmental assessment process (Portman, 2010). Also, the US charges lease fees (rents and royalties) to developers for use of the seabed for renewable energy production. The Bureau of Ocean Energy Management (formerly Minerals Management Service) and the Federal Energy Regulatory Commission are involved in regulation of energy projects and they have jurisdiction to issue leases and licenses for hydrokinetic projects. Agreement and consolidation of authority between the two agencies occurred in 2009. The US Department of Energy has also financially supported hydrokinetic energy research (Noblett, 2009; Portman, 2010).

**General Comments**

In Portman's review, she categorized policy-related features of development into three categories: 1) research and innovation policies that help to develop emerging and improved technologies (e.g. government research, development and demonstration programs); 2) market-based policies that underwrite the cost of introducing technologies into the market, provide a competitive market framework, and may internalize externalities in terms of energy security, environmental protections, and economic efficiency; and 3) regulatory advances that simplify and improve the efficiency of permitting offshore energy facilities (Table 3) (Portman, 2010, p. 101).

Table 3: Country comparisons of policy measures in: research and innovation; market-based incentives/controls; and regulatory improvements.

| Country | Research & Innovation | Market-based incentives/controls | Regulatory improvements |
|---|---|---|---|
| **UK** | Earmarking of lease fee | Sales of renewable obligation credits | Establishment of Marine Management Organization |
| **Germany** | Government-supported offshore wind R&D | "Bonus" feed-in tariffs for offshore wind | Renewable energy plant approval: Nondiscretionary administrative act |
| **Portugal** | Government support for Wave Energy Center | Feed-in tariff for wave energy | Streamlined approval for projects in Maritime Pilot Zone |
| **US** | DOE funding for marine renewable energy research | Production tax credits for renewable energy | Bureau of Ocean Energy Management/Federal Energy Regulatory Commission cooperation |

Source: Portman, 2010, p. 102.

The EquiMar (2009a) report, titled *Existing legislation, perspectives and evolution of other similar technologies*, is a particularly useful reference document. It provides a review of existing legislation at the international, European and national level for the leading ocean energy countries (Denmark, France, Portugal, Spain, United Kingdom, Canada and United States), as well as incoming legal instruments with impacts on tidal energy (including the Water Framework Directive, the Marine Strategy Framework Directive and Maritime Spatial Planning). The report concludes with the following recommendations and key points:

- Since the impacts of a project are strongly dependent on the characteristics of the device and the location, the emphasis of the environmental assessment may be tailored to the specific project.
- To avoid over-regulation or conflicting regulatory policies, a one-stop-shop entity should be established. Improved coordination between authorities or agencies can make the process less burdensome.
- Under the Maritime Spatial Planning tool, a very recent and new process endorsed by the European Council, the establishment of maritime areas for the development of ocean energy schemes is expected to promote ocean energy development.

- It is important to streamline and focus the environmental assessment process defining the relevant impacts that should be considered in the analysis as well as the correspondent baseline descriptors to be used for comparison during impacts valuation. The list of potential impacts should be evaluated, prioritized, and updated in the light of ongoing research to account for generic and critical uncertainties of project impacts on the environment that require further research.
- The legal framework should be designed to cover impact uncertainties and allow for amendment of protocols as and when the uncertainties are resolved through a process known as Adaptive Management (EquiMar, 2009a, p.18-19). (Adaptive management is further explained on page 33 of this report).

When numerous different agencies and departments must approve permits for ocean energy, a significant barrier is imposed upon developers. O'Hagan & Lewis (2011) note that a lack of inter- and intra-departmental communication on oceans and coastal management issues and developments in Ireland means that much work occurs on an ad hoc basis, leading to lag time in decision making, which increases uncertainty in development. Multiple permitting stages in the US have led a large number of offshore wind and ocean energy developers to get stuck at the permitting phase (Colander & Monroe, 2011). The concept of a one-stop-shop or a single point of access for licensing for all planning and environmental impact assessments is cited as being a crucial element in encouraging investors to consider participating in ocean energy projects. The advantages of a one-stop-shop facility are savings in time, effort and cost, and facilitating the most appropriate use of data (EquiMar, 2010).

**Box 5: Case Study: Scotland first Marine Bill and creation of Marine Scotland**
A "one stop shop" consent process is now in place for offshore wind and wave and tidal development within Scotland's territorial waters. First, a new legislation, the *Marine (Scotland) Act* (2010) was introduced, which "*provides a framework which will help balance competing demands on Scotland's seas. It introduces a duty to protect and enhance the marine environment and includes measures to help boost economic investment and growth in areas such as marine renewables*" (Scottish Government, 2010). One of its main features is to simplify the licensing system by reducing the number of individual consents. Second, a marine management organisation for Scotland, Marine Scotland, was created in April 2009. Marine Scotland amalgamated the roles previously played by three organisations and its responsibilities extend to a number of areas including planning, licensing, environment, science, energy, fisheries and compliance.

(Source: Mott MacDonald, 2011, p. 121).

Policies and regulations should also recognize the variety of scale among tidal energy projects as there will be significant differences in impacts of a commercial-scale array compared to a single small-scale project. The permitting and planning process should reflect the scale of the project being proposed rather than be generic. In addition, umbrella applications for grid connections (to allow for the proper megawatt scale for connections) would allow small-scale projects to apply within a group who would otherwise not necessarily have the available funds to apply (FREDS, 2009, p. 31).

One further point on the need to establish a common baseline for environmental legislation requirements is to ensure no country benefits from a more environmentally permissive legislative framework to deploy projects (EquiMar, 2009a). Such measures will ensure a level playing field among all nations, while maintaining best environmental practices.

## 3.2 IMPACT ASSESSMENT

Tidal energy developments require various impact assessment measures as an accepted form of best practice. The *EquiMar Protocols for the Equitable Assessment of Marine Energy Converters* (EquiMar, 2011d) outlines high level assessment protocols for wave and tidal energy development. These protocols best reflect industry standards and will be summarized here. Refer to the EquiMar webpage for more detailed information and links to the project deliverables (www.equimar.org).

### 3.2.1 RESOURCE ASSESSMENT

The resource assessment should provide an understanding of tidal energy climates from which estimates of energy production can be determined. This information is also required for engineering design, as the end user may be interested in seasonal aspects, expected average output (in periods such as months, seasons and years) as well as longer-term project length estimators. The EquiMar protocol subdivides resource assessment into two sections, resource characterisation and site assessment, which are described below.

1. **Resource Characterisation** - is normally carried out to establish suitable geographic locations for deployment, and has the following objectives:
   (a) To ascertain the potential resource for energy production with an explicitly stated degree of uncertainty,
   (b) To identify constraints on resource harvesting.

2. **Site Assessment** – is normally carried out prior to deployment, to establish the detailed physical environment for a particular marine energy project, with the following objectives:
   (a) To assess the energy production throughout the life of the project,
   (b) To characterise the bathymetry of the site to an explicitly specified, and appropriate accuracy,
   (c) To ascertain the spatial and temporal variation of the resource with an explicitly stated degree of uncertainty,
   (d) To describe ocean conditions,
   (e) To establish extreme (survivability) conditions with a defined return period,
   (f) To identify potential interference between multiple devices located at the site.

Both *Resource characterisation* and *Site assessment* should result in the following:

- Analysis of the level of resource,
- Description of the limits of the assessment,
- Description of the particulars of the site where the development is to be placed,
- Description of the instrumentation used to collect site data,
- Explanation of the analysis methods used in determining the potential resource and how they meet the criterion for accuracy and consistency,
- Explanation of the use of numerical models in providing the resource assessment,
- Model results and observation data, archived in a consistent, documented and accessible manner for possible future re-analysis (EquiMar, 2011d, p. 25- 26).

### 3.2.2 ENVIRONMENTAL ASSESSMENT

The *purpose* of an environmental assessment is:

*"to understand and evaluate the potential environmental effects of a marine renewable energy project and to promote the sustainable development and implementation of ocean energy projects. The assessment should be used by stakeholders and consenting or regulatory bodies to inform the decision making process from concept to decommissioning"* (EquiMar, 2011d, p. 29).

The objectives of an environmental assessment of a marine renewable energy project include:

- Identify, predict, evaluate and classify the potential environmental and socio-economic impacts (beneficial and harmful) from concept to decommissioning,
- Recognize and evaluate possible cumulative impacts of the project itself and in combination with other projects and/or marine activities,
- Contribute to site selection by identifying significant environmental and socio-economic features of the possible deployment areas, by estimating their sensitivity to the project characteristics (baseline survey outcomes),
- Select appropriate mitigation measures for harmful impacts,
- Establish a monitoring programme for the deployment, operation, decommissioning and post-decommissioning stages,
- Consult with and inform stakeholder groups and the public in general,
- Propose and implement environmental management actions[2],
- Inform the project development process (EquiMar, 2011d, p. 29).

The environmental assessment is normally reported in the results of the Environmental Impact Assessment (EIA) report. However, since the environmental assessment should also be considered as a

[2] An adaptive management process should be followed in the early stages of technology development aiming to improve the efficiency and effectiveness of the environmental assessment process

planning instrument, it is desirable that it form an integral part of the project development from the beginning. In this way, there are several environmental assessment techniques (SEA, ERA, LCA[3]) that can be consulted / applied before conducting an EIA to inform and support the decision making process of the device concept design and activities planning. The results of these complementary environmental assessment techniques / instruments can be integrated in the EIA report. An EIA usually comprises the following phases:

- Screening, which identifies the areas of legislation under which the project falls,
- Scoping, which establishes the boundaries of the investigation, the assessments and measurements required, and any assumptions to be made,
- Baseline survey, which identifies the state of the environment at the deployment site and in surrounding areas, prior to any installation or deployment activity,
- Potential environmental impacts identification and evaluation, both positive and negative,
- Monitoring programme for the deployment, operation, decommissioning and post-decommissioning stages of the project,
- Mitigation measures, to reduce or eliminate adverse impacts,
- Consultation, with feedback from stakeholders and general public, which should feed constantly into the EIA process (EquiMar, 2011d).

Each phase listed above comprises an active process that culminates with a report (EquiMar, 2011d, p. 29-30). The environmental assessment planning should also include an extensive review of the political, legal and maritime spatial planning framework in existence at any potential project site through a Strategic Environmental Assessment (described on page 32 of this report).

#### 3.2.2.1 BASELINE CHARACTERISATION

Environmental assessments should contain baseline characterisation on environmental and social factors. EquiMar (2011d) list the following points on baseline characterisation:

- The baseline characterisation should describe a systematic approach for identifying environmental and social factors that may affect site selection.
- It should provide a rationale for characterising the sensitivity of a site that will affect the extent and variety of data gathering from the site.
- It should describe the key aspects of the receiving environment that should, as a minimum, be considered in environmental assessment of a site (including environmental, commercial and leisure uses).

[3] SEA: Strategic Environmental Assessment; ERA: Environmental Risk Assessment; LCA: Life Cycle Assessment.

- All data gathering should utilise any established protocols that are appropriate to the site and should show variability (seasonal and inter-annual) so that subsequent monitoring can demonstrate any significant environmental effects.
- Particular attention should be paid to environmental characteristics that correspond to the risks identified for the designs under consideration.
- Any amendments to generic protocols required to deal with site specific issues should be based on expert advice, taking full account of the analytical framework within which the data collection is nested (p. 32-33).

#### 3.2.2.2 MONITORING

Project monitoring should be performed throughout device installation, operation, decommissioning and post-decommissioning periods during prototype sea-trials and commercial operations scales. The monitoring plan should follow an adaptive management process in order to identify and respond to uncertainties. The results of monitoring efforts should be made available to stakeholders, and wherever possible, to other developers (Ingram et al., 2011).

### 3.2.3 ECONOMIC ASSESSMENT

In order to attract investors and assist in tidal energy development, economic assessments are essential. According to EquiMar (2011d):

*"Economic assessments are conducted by utilities and investors to identify the technology and layout for a site that satisfies a stated set of investment criteria"*(p. 48).

To further quote EquiMar (2011d):

"*Typically a number of project designs will be available and the objective of a project assessment is to identify the marine energy project design which, subject to levels of uncertainty consistent with the project and technology development stage, satisfies the specified investment criteria."*(p. 48).

To achieve this it is necessary to:

- Quantify expenditure over the project life,
- Quantify revenue over the project life,
- Calculate economic indicators to compare to specified criteria,
- Identify risks associated with the project and assess their effect on the economic indicators (p. 48).

A report on economic viability should include statements of: economic indicators; major capital cost components; major contributions to annual expenditure including planned and unplanned maintenance activities; expected project revenue; methods used to quantify risk; and method used to determine transmission costs (EquiMar, 2011d).

## 3.2.4 STRATEGIC ENVIRONMENTAL ASSESSMENT

In addition to various site level assessments discussed above, the tidal energy industry can greatly benefit from strategic environmental assessment (SEA) processes. The ultimate aim of SEA is to promote sustainability by integrating sustainability issues into the decision making process. SEA can be defined as:

*...a systematic process for evaluating the environmental consequences of proposed policy, plan or programme initiatives in order to ensure they are fully included and appropriately addressed at the earliest appropriate state of decision making on par with economic and social considerations* (Sadler & Verheem, 1996, as quoted in Partidário, date unknown, p. 10).

Generally, a SEA is conducted before a corresponding Environmental Impact Assessment (EIA) is undertaken, as it occurs at a higher level of decision making (Figure 2).

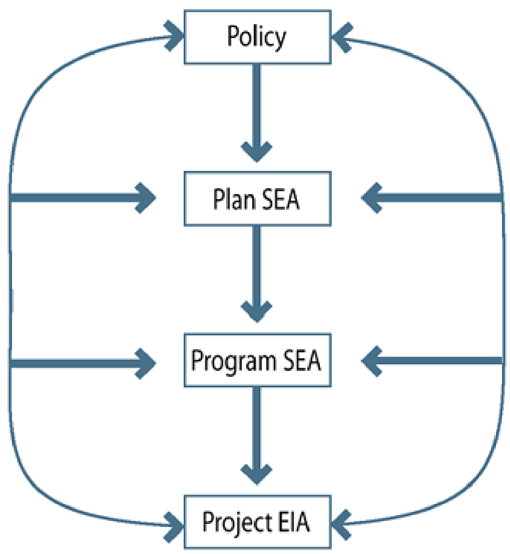



*Figure 2*: Tiers of planning and related environmental assessments (European Commission, 2005).

SEA is a relatively new practice that has evolved out of the need for enhanced response to complexity that EIA processes have been unable to provide as a single tool. To meet sustainability objectives, it is important that SEA reports thoroughly evaluate socio-economic as well as environmental impacts.

There are ample online resources on SEA, such as:

**Canadian Environmental Assessment Agency**:
http://www.ceaa.gc.ca/default.asp?lang=En&n=A4C57835-0

**International Association for Impact Assessment**:
http://www.iaia.org/

**SEA: current practices, future demands and capacity building needs.**
This document forms part of a training course in SEA and contains background information on the evolution, concepts and principles of SEA, and addresses practical implementation of SEA procedures. It is an excellent starting point.
http://www.iaia.org/publicdocuments/EIA/SEA/SEAManual.pdf

### 3.2.5 RISK MANAGEMENT

Complex activities such as offshore energy development include risks and liabilities that require a formal assessment with a robust approach to identify and reduce risks to an acceptable level. The level of acceptance is based on a collective understanding of what risk can be taken and the implicit liability or cost associated with the risk level (EquiMar, 2011d). The aim of risk management is to identify what level of risk is tolerable to a project, or a company, and to ensure that all identified risks have applied measures to maintain them at or below a tolerable limit. It is expected that as the understanding and knowledge of marine energy technology increases, a general de-risking of marine energy arrays will follow.

### 3.2.6 ADAPTIVE MANAGEMENT

One method of dealing with risk and uncertainties is through adaptive management. Adaptive management has been defined as a systematic approach for improving resource management by learning from outcomes (Oram & Marriott, 2010). It is an iterative process used by resource managers to improve management processes over time when environmental impacts are uncertain. True adaptive management is open-ended, omitting contingency plans in favour of added control over the response when an impact is realized. However, as the impacts of marine energy technologies become better understood, adaptive management plans should evolve from being open-ended processes toward more prescriptive, contingency-based plans (Oram & Marriott, 2010). Adaptive management allows projects to be permitted and installed while providing stakeholders the opportunity to verify anticipated impacts (EquiMar, 2011d).

As Figure 3 (below) demonstrates, there are various steps involved in creating an adaptive management plan. Oram & Marriott (2010) state that the first step in making adaptive management a viable option for project planners is to create a baseline understanding among all stakeholders about how the process should proceed, and establish procedural guidelines.

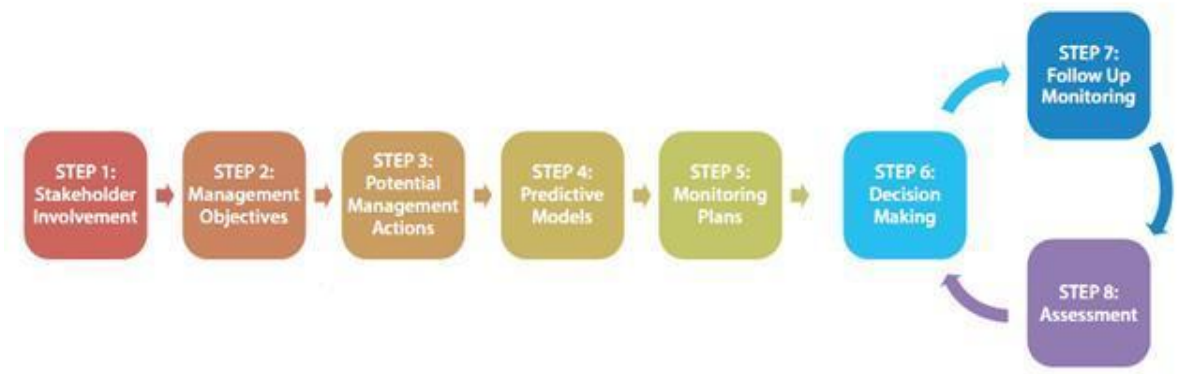



*Figure 3*: Steps for applying adaptive management to project development (Oram & Mariott, 2011, p. 94).

With reference to marine energy development, Oram & Marriott make five recommendations for structuring adaptive management programs:

1) Adaptive management must be a voluntary endeavour,
2) Adaptive management plans must be project-specific,
3) Agencies' statutory and regulatory mandates must guide adaptive management,
4) Disputes may arise during the iterative processes of follow-up monitoring, assessment and decision making, and
5) An adaptive management plan should specify how the parties will resolve those conflicts.

The authors conclude: "Adaptive management is not a new concept, but, as applied to wave and tidal energy projects, it will require creativity and bold leadership by agencies and developers alike. For initial projects, adaptive management will be a critical tool to get projects in the water, and may require more flexibility on the part of agencies and developers than either is used to providing" (Oram & Marriott, 2010, p.97).

## 3.3 MARINE SPATIAL PLANNING

Marine spatial planning (MSP) has been identified as a best practice to minimize barriers in the offshore renewable energy industry (Mott MacDonald, 2011). Marine spatial planning is a "public process of analyzing and allocating the spatial and temporal distribution of human activities in marine areas to achieve ecological, economic, and social objectives that usually have been specified through a political process" (MSP Initiative, 2010). It is a practical tool for managing multiple uses and interactions in marine areas, while balancing development and the need to protect the environment, and achieving social and economic objectives. MSP is an excellent tool that has potential to assist in tidal energy development. There are several examples of successful MSP initiatives around the world such as:

- Eastern Scotian Shelf Integrated Management Plan - http://www.mar.dfo-mpo.gc.ca/e0010285
- Rhode Island Ocean Special Area Management Plan - http://seagrant.gso.uri.edu/oceansamp/
- Integrated Management Plan for the North Sea 2015 - http://english.verkeerenwaterstaat.nl/english/

Marine Spatial Planning is a recognized method of maximising the socio-economic benefits of marine planning for coastal communities, and minimising spatial conflicts of competing uses (Roger Tym Partners & Oxford Consultants for Social Inclusion, 2011). Most Marine Spatial Plans actively use Geographic Information System (GIS) tools to map and site use areas, including potential sites for renewable energy developments (Define et al., 2011).

**Box 6: Case Study: Rhode Island Ocean Special Area Management Plan**

The Rhode Island Ocean Special Area Management Plan (Ocean SAMP) offers insight into one of the most progressive coastal management tools available today. It is the first Ocean SAMP to be completed in the USA, and serves as a model for coastal management. The *Coastal Zone Management Act* encourages states to prepare these types of plans.

*The term "special area management plan" means a comprehensive plan providing for natural resource protection and reasonable coastal-dependent economic growth containing a detailed and comprehensive statement of policies; standards and criteria to guide public and private uses of lands and waters; and mechanisms for timely implementation in specific geographic areas within the coastal zone* (National Oceanic & Atmospheric Administration, [NOAA] 2010, Section 304).

SAMPs work to better align coastal policy and address complex multi-stakeholder issues. Many states have developed SAMPs with varying degrees of success. The state of Rhode Island currently has six SAMPs implemented by the Rhode Island Coastal Resources Management Council (Ocean SAMP, 2010).

*History*

In 2007, the Rhode Island Office of Energy Resources stated that offshore wind farms would be crucial for achieving the state mandate that wind energy must provide 15 % of the state's electrical power by 2019. To achieve this goal, the Coastal Resources Management Council proposed an Ocean SAMP to engage stakeholders and provide policies and recommendations for potential offshore wind energy sites (Ocean SAMP, 2008). The Coastal Resources Management Council Ocean SAMP proposal to the Rhode Island Economic Development Corporation was approved in August 2008. The first year of the project was dedicated to research, stakeholder participation and development of a preliminary zoning map. At the end of year one, wind farm applications were accepted to begin the required preliminary review process. The second year (August 1, 2009 – July 31, 2010) was dedicated to research refinement, stakeholder participation and community events, development of policy and standards and completion of the draft SAMP document to submit for state and federal approval (Ocean SAMP, 2009).

It is expected that the Ocean SAMP will make Rhode Island a world leader in offshore development issues because "it is the fastest, most efficient and cost-effective way to approve and site offshore renewable energy projects." (Ocean SAMP, 2008, p.1). In addition to addressing offshore development issues, the Ocean SAMP comprehensively addresses issues of ecology, climate change, cultural history, fisheries, recreation and tourism, marine transportation and future uses of the Rhode Island marine area.

*Funding Sources*

The Ocean SAMP was funded $3.2 million from federal funds for the two-year project as requested in the 2008 proposal. In 2009, the project was granted an additional $660,050 from federal funds. This money was given by the Rhode Island Economic Development Corporation's Renewable Energy Fund, which is supported by a surcharge on public utility bills. In 2009, Ocean SAMP was awarded a $2.8 million grant from the office of Governor Donald Carcieri, which enabled staff to expand research projects and address new issues. The University of Rhode Island and the University of Rhode Island Graduate School of Oceanography contributed over $1 million worth of sea time and services, along with its research vessel, the *Endeavor* (OceanSAMP, 2009).

In summary, the Ocean SAMP was completed very quickly, with a relatively small budget considering the task at hand. The Ocean SAMP still needs to be tested on whether its implementation is successful. Yet as the initiative moves forward, it has the support of both the state and federal governments, and is working from the foundation laid by its years of research and experience from the SAMP technique. The Ocean SAMP will test tools that will be directly applied to marine planning and management processes.

The Ocean SAMP initiative is committed to broad and open sharing of information and lessons learned. Their website features links to key documents, interactive marine spatial planning maps and GIS data sets (Figure 4).

For more information visit the Ocean SAMP website: [http://seagrant.gso.uri.edu/oceansamp/index.html](http://seagrant.gso.uri.edu/oceansamp/index.html)

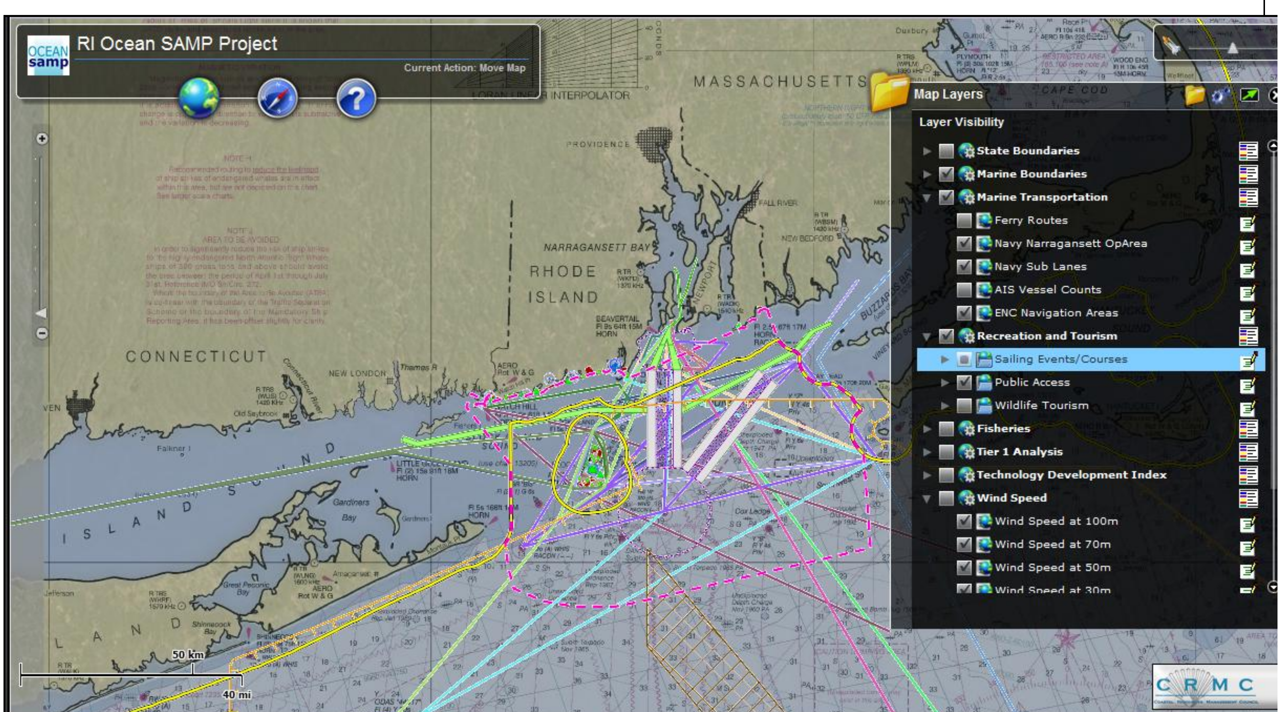



Figure 4: Screenshot of the Ocean SAMP web based map viewer (Source: [http://www.narrbay.org/d_projects/OceanSAMP/LiveMap/index.html](http://www.narrbay.org/d_projects/OceanSAMP/LiveMap/index.html))

### 3.3.1 SPACE-USE CONFLICTS

Coastal and offshore regions are used by a multitude of users, often with conflicting interests, which may result in space-use conflicts. Potential space-use conflicts common to all types of offshore renewable energy projects include commercial fishers, subsistence fishing, marine recreational activities (boating, fishing, diving, surfing etc), sand and gravel extraction, oil and gas infrastructure, navigation, aquaculture, proximity of designated conservation areas and other renewable energy projects (EquiMar, 2009a). It may be difficult to find a marine area without space-use conflicts. More research needs to be conducted on space-use conflicts of tidal energy, and reasonable compensation measures if conflicts cannot be mitigated or avoided.

## 3.4 INTEGRATED COASTAL ZONE MANAGEMENT

Integrated Coastal Zone Management (ICZM) or Integrated Coastal Management (ICM) is another tool which can facilitate tidal energy development. With so many conflicting and competing coastal and offshore interests, it is imperative to develop an overarching and comprehensive ocean management plan. ICZM can be defined as:

> *Integrated coastal management is a process of governance consisting of the legal and institutional framework necessary to ensure that development and management plans for coastal zones are integrated with environmental (including social) goals and are made with the participation of those affected* (The World Bank, 1993).

Integrated Coastal Zone Management utilises an adaptive and participatory approach to achieving sustainable development. It is a process that has the freedom to utilize tools and methodologies from different disciplines to meet the unique requirements of coastal regions. Integrated Coastal Zone Management integrates dimensions of political and jurisdictional units, economic sectors, natural and physical processes and horizontal and vertical integration of government levels.

## 3.5 STAKEHOLDER PARTICIPATION

As tidal energy is a new and emerging industry, the process of planning and decision-making is less developed. Therefore it is imperative that industry recognizes the importance of early, effective and iterative consultation with stakeholders. Public and stakeholder participation is recognized as critical to long-term project success, and lessons of successful participatory processes can be gleaned from other renewable energy developments. Participatory processes promote collaboration between those who have an interest in the uses and benefits associated with coastal areas. This is particularly relevant to tidal energy developments, as there is likely to be a wide range of stakeholders affected. Experience shows that participatory processes facilitates consensus, conflict management, builds a sense of property and local pride, and creates confidence, trust and greater cooperation. Initial research on public acceptance of a tidal energy project in Northern Ireland showed strong support for the project, arising from beliefs that “the project enhanced local distinctiveness by ‘putting the area on the map worldwide’; appeared visually familiar, and helped tackle climate change” (Devine-Wright, 2010, p. 83).

EquiMar prepared a report titled *Impacts upon Marine Energy Stakeholders* which outlines how to identify the stakeholders involved in the development of a marine renewable energy array, and plan a procedure to consult with them. Since marine energy arrays are still in early development stages, the terms and processes described in the EquiMar (2011e) report consider lessons learned from the offshore wind industry, and interactions with stakeholders. Some key points of this report are summarized below (EquiMar, 2011e).

### 3.5.1 IDENTIFICATION OF TIDAL ENERGY STAKEHOLDERS

Tidal energy developments occur in coastal and offshore regions in areas where multiple interests and users interact in what is considered a common resource. As such, there are many stakeholders involved with tidal developments.

A stakeholder can be defined as any person, group, or organisation that has a stake in a tidal energy development, and who can affect and be affected by the actions taking place prior to, during or after the development, and also affect or be affected by the objectives and policies involved (EquiMar, 2011e).

At the initial stages of an array development, the stakeholder body might typically include owners (shareholders), developers, suppliers, employees, the government, unions and individuals or whole communities located near or in the vicinity. When the array is fully operational creditors and end energy users could be included as well (EquiMar, 2011e, p. 2-1). The British Wind Energy Association (BWEA) conducted extensive stakeholder processes with offshore wind farm developments in the UK. The British Wind Energy Association developed a document titled *Best Practice Guidelines: Consultation for Offshore Wind Development*, which can be of use for tidal energy stakeholder engagement processes. BWEA (2002) and EquiMar (2011e) categorize stakeholders into the following four categories:

- **Statutory consultees**
  Statutory consultees are authorities, agencies, groups or bodies defined in local, national or international legislation, which the developers are obligated to consult. While a pre-defined statutory process is usually followed by developers, this category of stakeholders may be included in non-statutory consultation as well.
- **Strategic stakeholders (non-statutory consultees )**
  This category includes local, regional, national or international organisations (and their representatives) who have important information, experience and expertise to contribute, and the final stand of whose, either positive or negative, affects significantly the overall progress of the development. If the development refers to an array of onshore marine energy converters or nearshore with onshore support facility requirements, land owners may be part of this category as well.

- **Community stakeholders**
  This category includes any individual, groups of individuals or organisations, whose lives, interests and welfare can be affected by the development.
- **Symbiotic stakeholders**
  Symbiotic stakeholders can be owners or organisations who may have an interest in, or may have mutual benefits from, a co-development (EquiMar, 2011e, p. 2-1).

Examples of these categories are given in Table 4 below.

Table 4: Examples of typical stakeholders: subject to national and regional differences.

| **Statutory consultees** | **Strategic stakeholders** | **Community stakeholders** | **Symbiotic stakeholders** |
|---|---|---|---|
| Department for Environment, Food and Rural Affairs.<br>Department of Culture Media and Sport.<br>Department of Trade and Industry.<br>Department of Transport, Local Government and the Regions.<br>Centre for Environment, Fisheries and Aquaculture.<br>Civil Aviation Authority.<br>Countryside Agency.<br>Local Authorities.<br>National Heritage and Nature.<br>Ministry of Defence.<br>Maritime and Coast Guard Agency.<br>National Parks. | Investors.<br>Marine Archaeological interests.<br>Marine Conservation society.<br>National Fishermen's Organisations.<br>National Trust.<br>Ramblers Association.<br>Societies for the protection of birds.<br>Yachting Association.<br>Fishery Committees.<br>WWF.<br>Green Peace.<br>Surfers Against Sewage<br>Surf riders Foundation.<br>The Wildlife Trust.<br>Trade Unions.<br>Land owners.<br>Universities.<br>Project Developers. | Residents associations.<br>Individual residents.<br>Sailing clubs.<br>Recreational groups.<br>Regional or local fishermen associations.<br>Local companies.<br>Local touristic agents and / or agent associations.<br>Women's Institutes.<br>Community councils.<br>Church groups. | Offshore wind energy industry.<br>The wind industry supply chain.<br>Offshore oil industry.<br>Electrical grid owners. |

Source: EquiMar, 2011e, p. 2-2.

Identifying stakeholders may be a challenge, however, it is important to include as many stakeholders as possible to avoid excluding a stakeholder that may be crucial to the process. Experience from BWEA (2002) shows that even local individuals can cause delays or cancellations in the overall development. EquiMar (2011e) offer the following questions to aid in identifying stakeholders:

- Who is investing on the development?
- Who will the development affect, either positively or negatively?
- Which are the changes the development will bring and who supports or opposes such changes?
- Which are the official posts in the area of the development and who is holding them?

- Who is influential in the local community?
- Who are the representatives of local organisations with environmental or social interests?
- Who are the representatives of local organisations with economic interests?
- Who are the representatives of similar (if any) developments in the area, such as existing offshore wind farms?
- Was there anybody involved in similar issues in the past?
- Who are the local policy makers?
- Who are the representatives of the local / regional research community?
- Who else should be involved? (EquiMar, 2011e, p. 3-3).

### 3.5.2 STAKEHOLDER PROCESS

The BWEA (2002) report, *Best practices guidelines: Consultation for offshore wind energy developments* outlines processes and techniques for stakeholder consultation in the offshore wind industry. The document is meant to be used by developers, planners, government departments, local organizations, and communities to set a standard for good consultation. The guidelines recognize that each site, community and development plan will be unique, but the principles and techniques offered can be applied to different situations. Therefore, this document can be of use for the planning of stakeholder processes in the tidal energy industry.

BWEA's principles of Consultation include the following:

- *The purpose of stakeholder consultation is to enable all stakeholders to make known their views and to work together to ensure they are addressed.* Everyone needs an opportunity to share their view.
- *Consultation needs to be inclusive.* Although there are many ways of conducting consultations, it is important to use the most appropriate techniques at different stages of the development process. To avoid exclusion, techniques such as participatory appraisal and community mapping can be useful in the early stages. Appendix C of the BWEA report offers further reading on these techniques.
- *People need to be treated equally.* Ideas should be judged on their merits, not on their source.
- *Responsibility for the process and the feedback needs to be shared.* Many consultation processes fail because needs of stakeholders are not met, or because participants feel they have not been kept fully informed of what has been done with their ideas and opinions. It is up to those convening the process to ensure everyone's needs are met – and to take responsibility for disseminating the results, and ensuring that information about their input is linked to decision-making processes.
- *The use of independent professional facilitators should be considered.* Independent facilitators can ensure that meetings are conducted impartially, and as balanced and even-handed as possible.
- *The process must be transparent, especially about uncertainties.* When uncertainties arise, it is best to be open and honest about it. Stakeholders may already be critical, and will be very

upset if not told the truth. Furthermore, stakeholder processes can actually help manage uncertainties by, for example, organizing local research or developing shared contingency plans (BWEA, 2002, p. 8-9).

### 3.5.3 STATUTORY CONSENT AND ENVIRONMENTAL IMPACT ASSESSMENT REQUIREMENTS

Developers usually have to obtain several different kinds of statutory consent, including the submission of an Environmental Impact Assessment (EIA). EIAs mostly focus on the physical and natural environment, but there is also a requirement to assess socio-economic impacts as well. EIA processes also have an established formal procedure for consulting with a limited number of key stakeholders. The BWEA (2002) report outlines a "wider voluntary" consultation process that includes more stakeholders than the formal EIA process. Table 5 shows how the EIA process links to the stakeholder consultation process. Note that the stages may not happen exactly in parallel as shown in the table, and that stakeholder consultation processes need to be iterative. In other words, information gained in Stages 2 or 3 may make it essential to return to Stage 1.

Table 5: Summary of statutory and stakeholder processes.

| Stakeholder Consultation Process | Environmental Impact Assessment and Planning Process |
|---|---|
| **Stage 1: Identifying stakeholders, issues and processes**<br>- Create core team to advise on consultation<br>- Identify stakeholders and issues<br>- Establish key contacts<br>- Draw up detailed consultation process plan<br>- Prepare information for dissemination | **Stage 1: Site selection and Scoping**<br>- Undertake pre-feasibility studies<br>- Site selection<br>- Screening under the habitats directive, if appropriate<br>- Outline environmental profile<br>- Consideration of alternatives<br>- Scoping exercise (identification of main environmental effects)<br>- Production of scoping report |
| **Stage 2: Listening and learning**<br>- Clarify issues, expose assumptions, reduce uncertainties, build on common ground and explore ideas to resolve differences<br>- Commission independent research and fact-finding to avoid the 'adversarial science' problem<br>- Improve communication and relationships<br>- Manage ongoing uncertainties<br>- Turn new ideas into solutions<br>- Agree on changes to existing plans where necessary/possible<br>- Develop continuing commitments<br>- Establish monitoring and reporting procedures | **Stage 2: Commission EIA and Scheme Design**<br>- Description of the development<br>- Description of existing environment<br>- Description of environmental impacts<br>- Identify residual effects<br>- Interpretation of scale and significance of impacts<br>- Identification of mitigation measures<br>- Development of management systems and controls to avoid, reduce and enable mitigation<br>- Propose possible monitoring and reporting measures<br>- Advertise application and lodge in public domain for review and comment |
| **Stage 3: Monitoring, evaluation and maintain contacts**<br>- Reporting back to stakeholders on results of consultation<br>- Reporting back to stakeholders on how results | **Stage 3: Post Granting of Consents**<br>- Implementation of mitigation or compensation and control measures<br>- Monitoring and reporting |

| Stakeholder Consultation Process | Environmental Impact Assessment and Planning Process |
|---|---|
| were used as part of decision-making processes on the development<br>- Evaluation of consultation process<br>- Ongoing contacts<br>- Return to earlier stages if and when necessary | - Continual adjustment where monitoring reveals undesirable results |

Source: BWEA, 2002, pg. 11.

The BWEA (2002) report then goes on to describe in detail the processes of each of the 3 Stages of the stakeholder consultation. Key points are summarized below.

**Stage 1: Starting the consultation process**

The first task is to select who will lead the consultation process (usually the developer), and identify one person to lead the consultation and maintain contact with stakeholders throughout the process. The steps are to:

- Identify the stakeholders and do a preliminary scoping of issues.
- Plan and design the consultation process, outline objectives and outputs, techniques, key events, timing, resourcing (including budgets), and coordination with other statutory and non-statutory processes.
- When meetings are required, draft invitations and indicate whom the stakeholders can liaise. Who sends the invitations and 'hosts' the events may vary (e.g. the developer, local councils, coastal partnerships or an independent body such as a local college).
- Prepare presentations and documents for distribution before or during meetings, ensure efficient logistics to help build confidence in the process (p. 13).

This stage may take several meetings or it may be done via phone and email. Invitations need to be sent 3-6 weeks before events; notices of public meetings need to be published 3 weeks in advance, and again 1-2 days before events. BWEA (2002) suggests that initial consultation should take place during the site selection phase of offshore wind development, to minimize conflict.

A consultation plan will benefit both stakeholders and the development team by clarifying what the consultation process is, and clarifying links to statutory organisations, regulators, NGOs and other relevant bodies. Generic elements of the consultation plan include:

- objectives and scope of the consultation process,
- environmental, economic and social issues raised by the development,
- why the development is being proposed,
- time-frame for consultation set out in parallel with the timing of related activities,
- locations and logistics of consultation,
- tools and techniques of consultation,

- roles and responsibilities of those involved,
- allocation of consultation resources,
- feedback mechanisms (BWEA 2002, p. 13).

**Stage 2: Listening and learning**

The main interactive work of the stakeholder process starts around the same time as work on the Environmental Impact Assessment is emerging. This stage needs to:

- clarify issues,
- expose assumptions,
- identify, manage or reduce uncertainties,
- build on common ground,
- explore ideas to solve problems and resolve differences,
- establish what changes may need to be made,
- commission independent research and fact-finding,
- establish monitoring and reporting procedures, and arrangements for responding to them,
- generally try to improve communication and relationships, and develop continuing commitments (BWEA 2002, p. 14).

If there are issues that require more in-depth discussion, working groups can be established and their remits agreed by all stakeholders. The BWEA (2002) report further discusses stakeholder input to the EIA process.

**Stage 3: Monitoring of the consultation process, evaluating, and maintaining contacts**

As the development process continues, the consultation process should continue checking the following:

- whether all appropriate stakeholders have been consulted,
- whether the stated objectives of the EIA and consultation processes have been achieved,
- what changes to the project have been made as a result of the consultation process, and why,
- whether the consultation process has allowed sufficient time to consider social, economic and environmental impacts to the depth necessary,
- whether stakeholders feel that the consultation has been conducted in a way that has enabled them to contribute fully and freely to the EIA process (BWEA 2002, p. 15).

The consultation plan needs to identify techniques that monitor consultation objectives. An example might be a core group of stakeholders who meet periodically during the process or entire lifetime of the project, so that if concerns or opportunities arise, there is an immediate forum to discuss them. The BWEA report briefly summarizes the most common tools and techniques of consultation, including: providing information; gathering information; face-to-face meetings; public meetings; workshops; liaison groups; public exhibitions; and the internet. Annex C of the BWEA (2002) report is particularly useful as a starting point for further reading material on planning and development processes, community consultation and participation, and other related publications.

Figure 5 shows a series of generic steps linked with the various development and deployment stages of a tidal energy array. The iterative process is demonstrated where information is shared, collected, gained and used within subsequent steps that may make it essential to return to the first step and repeat the procedure (EquiMar, 2011e).

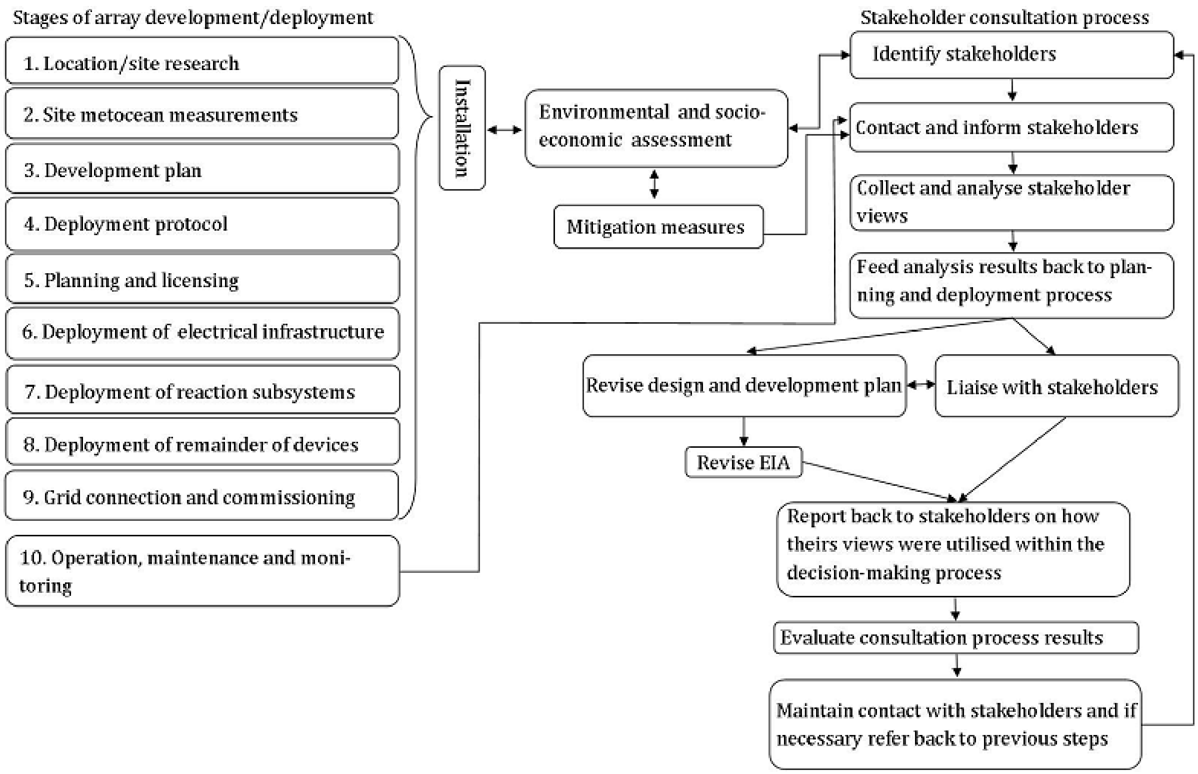



Figure 5: Example of an iterative stakeholder consultation process based on subsequent steps linked to various stages of the array design, deployment and operation (EquiMar, 2011e, p. 5-7).

**Box 7: Case Study: Lessons from the UK Sustainable Development Commission's Public and Stakeholder Engagement Programme on Tidal Power**

The UK Sustainable Development Commission (SDC) launched a research project on tidal power in the UK in 2006, which was followed by a public and stakeholder engagement programme. This programme was evaluated with a focus on the deliberative public engagement elements of the consultation, and the stakeholder workshops, in order to gain knowledge for future Sustainable Development Commission public and stakeholder engagement work (Warburton, 2008). The Warburton (2008) report summarises the methodology of the evaluation, which may be of use for future tidal energy stakeholder process evaluations. Warburton outlined elements of the process that worked well and less well, and identified some lessons for future practices. General aspects of what work best included: learning; having a say and being listened to; sharing views with others; small group discussions; and making contacts and networking. Participants placed a high value on talking with and listening to each other at meetings. General aspects of what was least successful included: the need for more information; reporting back to participants; and "nothing" – meaning that there was nothing that did not work well (Warburton, 2008).

Source: Warburton, D. (2008). *Evaluation of the sustainable development commission's public and stakeholder engagement programme on tidal power.* Available online at: http://www.sharedpractice.org.uk/Downloads/Tidal%20final%20report.pdf

### 3.5.4 PUBLIC OPINION AND ACCEPTANCE

Stakeholders form opinions on renewable energy developments based on their perception of the environmental, socio-economic and emotional impacts the proposed development has on them, and their area (EquiMar, 2011e). Opinion studies conducted in Europe and the US generally indicate that the public is supportive of developing alternative energy sources, specifically onshore and offshore wind energy (Coyle, 2007; Ladenburg, 2008; Dong Energy et al., 2006 as quoted in EquiMar, 2009b). Public acceptance of offshore wind energy in Denmark and the UK show strong trends in the following topics (Michel et al., 2007):

- The public is in favour of offshore wind energy including in the region where they reside,
- Visual impacts appear to be the primary issue of public concern,
- Offshore wind park development appears to gain public approval as the community is exposed to operational projects,
- Early local input to the planning process is critical to gain public acceptance (EquiMar, 2009b, p. 11).

Public opinion is generally shaped by awareness of environmental and socio-economic impacts. People tend to accept renewable energy due to environmental issues (such as climate change), but concerns arise due to potential environmental impacts related to marine mammals, landscape/seascape changes and noise. Onshore ocean energy devices may create a "Not in my backyard" (NIMBY) effect, meaning that although people accept the concept of ocean energy, they do not want developments in their neighbourhood (EquiMar, 2009b). Other negative attitudes may arise due to conflicts with activities such as fishing (commercial, recreational and subsistence), navigation, sand and gravel extraction and recreation such as boating, surfing and diving. Experience from the offshore wind industry shows the importance of providing information and public dialogues, while avoiding technical descriptions that are difficult for the public to understand.

### 3.5.5 NAVIGATIONAL PRACTICE AND SAFETY

The presence of offshore man-made structures is increasing, which has implications for shipping, navigation and safety. The International Association of Marine Aids to Navigation and Lighthouse Authorities (IALA) is monitoring the development of offshore structures and has created documentation to ensure clear and unambiguous marking of waterways for safe navigation, protection of the environment and protection of the structures themselves. IALA created a document titled *IALA Recommendation O-139 on the Marking of Man-Made Offshore Structures* (IALA, 2008). The document covers marking of offshore structures in general, as well as marking of offshore wave and tidal energy devices. The recommendations provided by the IALA should be implemented as a minimum requirement. General suggestions include: stakeholder consultation at an early stage; development of all structures should not prejudice the safe use of Traffic Separation Schemes, Inshore Traffic Zones, recognized sea lanes and safe access to anchorages, harbours and places of refuge; and authorities should consider establishing Exclusion or Safety Zones on a case-by-case basis which would prohibit vessels from entering the structure area. IALA provides 11 suggestions for marking wave and tidal energy devices, which includes use of navigational buoys, lights, radar reflectors, transponders, paint and colour markings, and provides visibility and distance guidelines (IALA, 2008, p. 20-21). Considerations during construction and decommissioning are provided, such as: the use of guard ships in areas of high traffic density; Notices to Mariners; Radio Navigational Warnings; trenching of subsea cables to avoid exposure to scouring or fishing activities; temporary marking for construction and decommissioning phases; and removal of obstructions that could be hazardous to navigation after decommissioning (IALA, 2008, p. 21-22). The IALA also recommends that contingency and/or emergency response plans be developed to address the possibility of individual devices breaking loose and becoming floating hazards. Automatic location and tracking devices should be considered (IALA, 2008, p. 22).

The Maritime and Coastal Agency (UK) published a marine guidance note titled *Offshore Renewable Energy Installations (OREIs) – Guidance on UK Navigational Practice, Safety and Emergency Response Issues* (Maritime and Coastal Agency, 2008). This document provides further guidance, and a series of annexes that address similar issues that the IALA (2008) document addresses. The Mott MacDonald (2011) report titled, *Accelerating the Deployment of Offshore Renewable Energy Technologies*, has a chapter on non-technical barriers and mitigation issues. The main safety issues associated with offshore renewable energy projects are summarized in Table 6 below, along with mitigation measures.

Table 6: Main health and safety issues and mitigation measures

| **Issues** | **Mitigation Measures** |
|---|---|
| Construction and operation activities | • Selection of appropriate vessels, contractors, personnel<br>• Planning<br>• Monitoring and forecasting of weather conditions<br>• Evidence of good safety record and culture in contractors<br>• OHSAS 18001 accreditation of contractors |
| Emergency planning and response | • Emergency plan and procedures in place within health and safety management system<br>• Shelter areas |
| Collision risk and navigational safety | • Collision risk study<br>• Design of structures<br>• Exclusion zones and siting<br>• Signals and markings |
| Access and personal transfer | • Specialised vessels and access procedures<br>• Staff training and qualification |

| Issues | Mitigation Measures |
|---|---|
| | • Personal Protective Equipment<br>• Personnel tracking |
| Weather | • Monitoring and forecasting of weather conditions (wind speeds, wave heights, period and direction, tidal range and flows, temperature)<br>• Understanding of acceptable envelopes for safe operation or<br>• construction |
| Divers and subsea work | • Competency and training<br>• Suitable and specialist vessel and equipment<br>• Remote Operating Vehicles |
| Electrical installations | • Personnel competency and training<br>• Signage<br>• Restricted areas |
| Safety interfaces | • Interface matrices and structure clearly define respective roles and responsibilities between owners, operators, and contractors. |
| Appropriate standards and guidance<br>Legal requirements | • Development of specific guidance and standards by the industry, regulators, certification bodies and international organisations<br>• National and international dissemination of best practices<br>• National and international harmonisation |
| Availability of skilled personnel | • Development of training courses and certification<br>• Campaigns to promote career prospects within education systems<br>• Programmes to support and facilitate transfer of skills from other (declining) industries |

(Source: Mott MacDonald, 2011 p. 107-108).

In the UK, the British Wind Energy Association (BWEA) and the European Marine Energy Centre (EMEC ltd.) in Orkney have developed Guidelines for Health and Safety in the Marine Energy Industry. Such guidelines may provide some level of risk abatement and may speed up permitting along with potentially decreasing lender reluctance.

See www.bwea.com/pdf/safety/Marine_HS_Report.pdf for more information.

## 4.0 FINANCING & FUNDING TIDAL ENERGY

Development of the tidal in-stream energy conversion (TISEC) industry will require a large amount of capital investment, funding and other financial mechanisms. The expectation is that few developers or communities will have enough capital to internally fund projects. This situation is not unfamiliar in renewable energy development generally (Bahaj, 2011); often, communities or developers need to seek external financing to bring projects to fruition. Given the nascent character of TISEC technology, there remain uncertainties around regulation and permitting of tidal energy projects, which makes them inherently risky. Consequently, financing options can be limited or prohibitive. This section will explore barriers to financing projects and mechanisms for funding.

### *Key Issues:*

**Developing lender confidence –** *TISEC is still considered a risky technology to finance*

> Risk reduction and management – *specific steps have been identified to reduce risk in TISEC projects*

**Funding schemes – Taxes, grants and other models**

> Accessibility and Scope of Funding – *to be useful, funding schemes need to be clear in how and when funding is available*

**Providing Project Assistance –** *providing expert and up-to-date information to developers and financers is important in quickening the diffusion of TISEC*

### 4.1 DEVELOPING LENDER CONFIDENCE

In tidal energy and renewable energy development in general, financing has been identified as a major barrier (Ecofys International BV, 2008; Boettcher, Nielsen & Petrick, 2008; Mott MacDonald, 2011; RenewableUK, 2011;). Lending or equity raising terms can be prohibitive in many cases, i.e. high interest rates or expected returns on equity put pressure on project development timelines or returns on energy production. This pressure can result in project failures should minor alteration from the project plan arise. The higher the presumed or expected risk of a project the less likely a lender is to provide financing or they will put in place measures to protect themselves, which puts pressure on the project developer to see early and positive returns (Ecofys International BV, 2008). In the Ecofys International BV report the authors go on to suggest that if renewable energy targets are to be met, it is imperative to remove policy barriers to renewable energy financing so that: a) projects can move forward with more leeway to allow for necessary amendments to the project timeline; and b) a greater number of projects can be successful and thus increase confidence in renewable energy projects. By increasing the number of projects that are revenue positive, valuable examples are provided to lenders and other developers, who, over time will see renewable energy projects as less risky.

Any security that can be provided, in terms of project costs and revenue, will be a benefit. A measure that many jurisdictions have adopted to increase lender confidence and reduce uncertainty is the use of market signals such as Feed-In Tariffs (Sustainable Development Commission, 2007b; Boettcher, Nielsen, & Petrick 2008).

### 4.1.1 RISK REDUCTION AND MANAGEMENT

The central barrier to securing financing is the level of risk associated with a project. Lenders are reluctant to provide monies to a project if they deem it to be too risky, and the ability of the borrower to repay debts is assumed to be low (Ecofys International BV, 2008). In simple terms, not reducing risk to investors will directly limit the number of entrants to the market (Woodmann & Mitchell, 2011). A variety of ways to mitigate risk and increase lender confidence have been identified. Many of these actions need to be initiated by government, but can and should include industry stakeholders. Such actions include the following:

- Establishing clear market signals such as Feed-In Tariffs (Woodmann & Mitchell, 2011),
- Increase production experience and learning processes (Mott MacDonald, 2011),
- Demonstrating political commitment to renewable energy development such as keeping funding for support schemes external to government budgets to ensure stability (Ecofys International BV, 2008),
- Promoting or enabling Public Private Partnerships (P3) or community buy-in development models (Walker, 2008),
- Develop strategic grid connections,
- Provide developer assistance to ensure that due diligence is done (Ecofys International BV, 2008),
- Committing to and delivering strategic infrastructure development for tidal energy,
- Establishing and funding research institutes,
- Establish permitting processes that are clear to avoid uncertainty,
- Develop national standards and monitoring programs for occupational health and safety (e.g. the guidelines developed by EMEC and British Wind Energy Association - www.bwea.com/pdf/safety/Marine_HS_Report.pdf),
- Create and maintain up to date databases on:
  a) energy resources,
  b) current projects,
  c) current and potential changes in legislation.

Other steps that can be taken by industry or project developers include the following:

- Create a project website and make project reports available,
- Demonstrate due diligence in technology, legal and commercial aspects,
- Demonstrate that all possible grant programs have been accessed.

Government supports have been essential to the success of renewable industries worldwide (Leary & Esteban, 2009; Cansino et al., 2010). However, policy shifts, due to budget constraints or elections are common. Where an industry is highly reliant on an individual or group of government policies, there is the potential risk that they could be withdrawn should politics change. In order to reduce this uncertainty, government supports should be designed to be long term and consistent regardless of internal changes (Ecofys International BV, 2008).

Energy purchasing schemes are a major consideration for lenders, as are the length and security of these schemes (Woodmann & Mitchell, 2011). The political commitment towards renewable energy needs to be embodied throughout the government organisation (Woodmann & Mitchell, 2011). Inconsistent funding streams or policy mechanisms often complicate and, in some cases, can even thwart the ability to benefit from long-term impacts of renewable energy development.

> *"On-again, off-again funding makes it difficult for industry actors, community stakeholders, and other involved parties to plan projects, especially projects that take a long time to complete or require years of experience before they reach optimal performance. Consistent, predictable, and sustainable funding streams are therefore vital to the further development of this field and a successful transition toward sustained energy based economic development practice*."
> (Carley et al, 2011, p. 293).

**Box 8: Best Practice: Risk Register**

A risk register entails the creation of a project management matrix that categorizes potential risks throughout the lifetime of an energy project. The matrix rates risks based on their likelihood and their impact on the success of a project. Risks are cross referenced with mitigation measures, implementation times and the individual or department responsible for addressing the problem. A risk register is typical practice for many project developers; however, due to the limited number of TISEC projects at the commercial stage many of the risks associated with TISEC may not be well understood. Building expertise in the management of risk in TISEC will require time. Establishing requirements for developers to provide risk management approaches, either through a risk register or other methods, will be beneficial to this knowledge base. Additionally, developers should be encouraged to share their strategies so that knowledge can be shared and built upon more rapidly.

## 4.2 FUNDING & FINANCING SCHEMES

Securing capital for TISEC projects is a major hurdle to moving the industry forward. There are a variety of ways to help fund or finance tidal energy projects suggested in industry reports and academic literature. The efficacy of any model is largely contingent on the political will of government, and the ability to demonstrate that a project is viable. A variety of public and private financing and funding models have been developed. Government methods may include tax credits for the developer of a project and/or tax on other industries or consumers to generate funds to support renewables, such as carbon and gas taxes, which seek to price the negative externalities of other industries. A range of barriers and associated mitigation strategies to securing financing is outlined in Table 7.

Table 7: Range of barriers to securing finance in offshore renewable energy projects

| Barrier | Mitigation Strategy |
|---|---|
| Early stage technology research and development with no near term commercial prospects. | Government grants, tax incentives for R&D. |
| Lack of business planning skills. | Capacity-building, incubator programmes. |
| Late stager development: unproven technology. | Government grants for demonstration.<br>Funding for test centres and validation, incentives for government and private sector collaboration. |
| Inability to gain finance for scaling up due to insufficient cash flow. | Capital grants, public procurement mechanisms, incentives for the adoption of innovative technology (tax incentives), soft loans, and loan guarantees. |
| Market failure due to high cost of new technology. | Income support measures, regulatory drivers to adopt new technology, strategies to develop economy of scale. |
| Project development risk. | Loan guarantees, streamlined permitting, site pre-assessment (Strategic Environmental Assessments). |
| Project interface risk. | Tendering arrangements that reduce the number of contracts, especially at key interfaces. |

(Source: Mott MacDonald, 2011)

Federal support for renewable energy deployment in the United States has traditionally been delivered primarily through tax benefits, however, many renewable energy project developers are unable to use the majority of these tax benefits directly or immediately, and have therefore often turned to third-party tax equity investors that can monetize the available tax benefits while also providing investment capital (Bolinger, Wiser & Darghouth, 2010). In the US, the Section 1603 Treasury cash grant program enabled renewable power projects to elect cash grants in lieu of federal tax credits that are available (Bolinger, Wiser & Darghouth, 2010). A total of 6.2 GW of the 10 GW of new wind energy capacity installed in the US in 2009 were supported by grants in lieu of production tax credits (Bolinger, Wiser & Darghouth, 2010).

In Germany, duty on electricity is waived if it is generated exclusively from renewable sources and taken from a power grid or a line supplied exclusively with electricity from such sources (Cansino et al., 2010, p. 6004). In Denmark, the law on tax on electricity establishes that an exemption from excise duty applies to electricity produced in small plants (less than 150kW), or by wind, hydropower or solar cell systems (Cansino et al., 2010, p. 6005).

There are a number of revenue support mechanisms that have been developed such as renewable quotas and tradable green certificate systems (Mott MacDonald, 2011). However, by and far the mechanism most often cited as a best practice is the Feed-In Tariff (Dinica, 2008; SQWenergy, 2010;

Mott MacDonald, 2011). Suppliers of debt finance, such as banks tend to favour feed-in tariffs (FITs), due to their long term certainty (Mott MacDonald, 2011). Many countries have established feed-in tariff systems to one extent or another, such as the UK, Denmark, Germany, Spain and many others. In Canada, Ontario and Nova Scotia have established FITs, and other provinces are at different stages in the development of FITs (http://www.wind-works.org/).

A number of expenditure support mechanisms have been developed over the years to support renewable energy. Table 8 shows some examples provided in the report *Accelerating the Deployment of Offshore Renewable Energy Technologies* (Mott MacDonald, 2011, p. 135-1136).

Table 8: Examples of expenditure support mechanisms.

| **Country** | **Tax Incentive** | **Grants** | **Loans/Loan Guarantees** |
|---|---|---|---|
| **Belgium** | Tax deduction for investments in renewable energy by enterprises (1992): 13.5% tax deductions for renewable investments. | | |
| **Canada** | Accelerated capital cost allowance (2007): allows accelerated write-off of renewable energy assets.<br>Canadian renewable conservation expenses (1996): allows corporations to class expenditures associated with start-up of renewable projects as fully tax deductible. | | |
| **China** | Preferential tax policies for renewable energy (2003): Income tax on foreign investment into wind projects reduced from 33 to 15%.<br>Reduced Value Added Taxes for renewable energy (2001): VAT for wind power cut from 17 to 8.5%. | | |
| **Denmark** | | Subsidies for wind turbines and other renewable energy generating plants. | |
| **Finland** | Tax refund of EUR 6.9/MWh for wind. | Investment subsidy up to 40% depending on novelty of system for wind. | |
| **France** | Flexible depreciation (2003): allows accelerated write-off of renewable energy assets. | | Government crediting and loan guarantee for renewable energy investment (2001): covers up to 70% of loans from banks to Small Medium |

| Country | Tax Incentive | Grants | Loans/Loan Guarantees |
|---|---|---|---|
| | | | Enterprises in renewable activities. |
| **Germany** | | Integrated climate change and energy Programme (2008): contains subsidies for offshore wind farm development. | KfWBankengruppe renewable energies programme (2009): offers preferential loans and grants for renewable projects. |
| **Ireland** | Tax relief on corporate investment. | | |
| **Italy** | | EUR 14m funding for various projects including renewables (2010). | |
| **Netherlands** | Energy investment deduction (1997): allows up to 44 % of renewable energy investment to be deducted from taxable profit. | SDE production subsidy paid as a tariff on the basis of average production cost. | |
| **Norway** | $CO_2$ Tax (1991): tax on combustibles and emissions from the petroleum industry. | Investment subsidy for demonstration projects. | |
| **Portugal** | | 35% subsidy on investment up to EUR2.5m and SIEST programme of 25% subsidy on technologies within Azores Region. | 100% reduction on interest of loans up to EUR 750k. |
| **Sweden** | Energy, carbon and sulphur dioxide taxation (1991): complex taxation of $CO_2$, NOx, and sulphur emissions. | | |
| **United Kingdom** | | GBP 1 billion upgrade in grid network.<br>Direct support in manufacturing facilities. | Plans to launch GBP 2 billion “green investment bank. |
| **United States** | American recovery and reinvestment act: tax-based provisions (2009): allows a 50% write-down on renewable projects. Contains various tax credits for renewable energy technologies.<br>Modified accelerated cost recovery system (2008): allows recovery of investment into wind technology to be depreciated over accelerated timescales.<br>Production Tax Credit (PTC) and Investment Tax Credit (ITC). | Option to convert PTCs and ITCs into treasury grants. | American recovery and reinvestment act: tax-based provisions (2009): offers clean renewable energy bonds.<br>DOE Loan Guarantee Programme (2007) Guarantees loans for renewable projects. |

Adapted from Mott MacDonald (2011) Accelerating the Deployment of Offshore Renewable Energy Technology.

In terms of actual financing, there are two main financing modes that have been identified for renewable energy. The first is balance sheet finance using debt raised corporately which can be cheaper, involves fewer parties, and control of the project remains firmly with the owner (Mott MacDonald, 2011). However, this method can be capital intensive and the risk of failure lies entirely with the owner (Mott MacDonald, 2011). The second option being project finance, which allows greater leverage from the available funds for sponsors' equity investment; however, it is typically more expensive and complex, and an element of control over the project is afforded to the lenders (Mott MacDonald, 2011).

In Canada, some researchers have argued that the current government takes a 'hands-off' approach and does not provide the adequate incentives for sustainable energy development. Not creating incentives for renewable energy through, for example, placing stricter regulations on non-renewable sources is due to concerns of losing international industry competitiveness (Jagoda et al. 2011). Regardless of available expense or revenue based mechanisms, there needs to be political weight behind renewable energy projects of any sort if they are going to succeed (SQWenergy, 2010; Jagoda et al., 2011). To address this, the creation of a government financing body for projects to support commercial bank financing and provide a signal to the lending community that the government strongly supports the offshore renewable industry is recommended (Mott MacDonald, 2011).

### 4.2.1 ACCESSIBILITY AND SCOPE OF FUNDING

Government funding schemes have been key to the success of many renewable energy strategies (Leary & Esteban, 2009; Carley et al, 2011). Funding can take a variety of forms, from providing money for legislated impact studies, to community engagement processes. It is important to consider where funding can be applied to best meet the goals of a given policy objective. Plans and timelines for TISEC technology deployment will depend on regional-specific issues that need to be addressed.

In many jurisdictions, government funding schemes have been primarily focused on R&D of renewable technology. The usefulness of a primarily R&D approach has been called into question by some reports (SQWenergy, 2010; RenewableUK & SeaPower, 2011) as it misses some of the other major barriers associated with projects, such as the difficulty many developers face, whether they be private or community-based, in getting past the permitting stage (Carley et al, 2011). There is a need to mix funding between R&D, capital construction and the required pre-permitting stages of development (RenewableUK & SeaPower, 2011).

In some cases the mere complexity of grant applications may preclude some smaller scale developers (in particular small communities) from being able to access funds (DTI, 2005). Regional approaches to providing funding (i.e. offering a type of funding in one area but not another) may also stifle development and the ability to gain valuable experience in renewable energy development (DTI, 2005).

Funding should be flexible in its accessibility and the scope should be allowed to span a variety of needs in the technology refinement, permitting, testing and pre-commercial phases of development

(SQWenergy, 2010; Mott MacDonald, 2011). In cases where the how and when of funding is not in step with the status of the industry, it may not be utilized. An example of this is the Marine Renewables Development Fund – which was developed in 2004 in the UK to support the development of the first marine energy arrays. The funding was not used extensively due to tidal technology not being at the array stage (Mott MacDonald, 2011). Therefore, providing funding for what the industry and technology can accommodate is an important strategy in designing funding schemes.

#### 3.2.1.1 PROVIDING PROJECT ASSISTANCE

As mentioned previously, some potential entrants to the renewable energy market may have limited ability to navigate financing and funding opportunities. In order to offset this difficulty and to encourage expansion of renewable technologies, some jurisdictions have established teams that are able to provide support to potential developers. In England, the Community Renewables Initiative programme, set up in 2001, established Local Support Teams. The Local Support Teams were able to provide expert advice on funding application and financing options amongst a variety of other issues related to renewable power development (Walker & Devine-Wright, 2008). The Community Renewables Initiative funded 10 Local Support Teams operating in areas covering 70% of England. In the areas where Local Support Teams were operating, applications to government capital funding programs for renewables was double that of areas without the support teams (Walker & Devine-Wright, 2008).

# 5.0 COMMUNITY BENEFITS & ECONOMIC DEVELOPMENT

## 5.1 COMMUNITY BENEFITS DISCUSSION

Renewable energy projects are often discussed in terms of the benefits they can provide to the communities where they are situated. Renewable energy resources, such as wind and hydrokinetic energy from waves and tides, tend to be located in peripheral and rural areas. Wind and tidal energy need to be used at their source as opposed to biofuels, which can be transported to combustion facilities as necessary. The consequence of having to utilize some renewable energy *in situ* is this necessitates the development of infrastructure around the resource itself, which in many cases are in small and rural communities. This suggests communities that are close to resources should be able to gain some level of benefit from the development of renewable energy industries. However, gaining benefits for communities is not always straightforward. The amount of local content (workers and goods) in energy projects, community participation in site selection decisions or simply whether communities are allowed to invest in projects can all determine the type and scale of benefits a community receives. Cash or parkland contributions are often used as a way for local benefits to be garnered from a given development (DTI, 2005). In the case of TISEC technologies, understanding what types of contributions could be made, and to whom, is difficult to assess as in most regions marine environments fall under the purview of a number of agencies or are shared by a number of communities.

There are a wide range of potential community benefits to be had from renewable energy projects. Munday, Bristow and Cowell (2011) summarize many of them, as shown in Table 9 below:

Table 9: Potential community benefits from renewable energy projects.

| Categories of 'community benefit' | |
|---|---|
| Conventional economic benefits: | the use of locally manufactured content, and local contractors for construction, operation and maintenance, |
| | land rental income to landowners and any royalties, |
| | local business rates and/or taxes, |
| Flows of financial benefits to local communities: | some form of ownership/investment in the project among local people, either as equity or a form of profit share, |
| | some form of community fund, with lump sum and/or annual payments, either focused on specific purposes (such as energy efficiency) or more open-ended, |
| | cheaper electricity, |
| | sponsorship of local events, |
| Contributions in kind to local assets and facilities: | to landscape and ecological enhancement measures, perhaps that mitigate or compensate for any environmental costs caused by the wind farm, |
| | to tourism/visitor facilities, |
| Provision of other local services: | educational visits or other educational programmes, |
| Involvement in the development process: | various forms of liaison activity. |

Adapted from: Munday, Bristow & Cowell, (2011) *Wind farms in rural areas: How far do community benefits from wind farms represent a local economic development opportunity?*

## *Key Issues*

**Defining Community –** *in order to allocate benefits, a clear understanding of what a community includes is essential.*

**Community Engagement -** *communities should seek to not be passive recipients of projects but active participants.*

Community decision making capacity – *how well benefits are defined, allocated and utilized is impacted by a community's ability to make decisions in a timely and informed manner.*

Community ownership - *a range of community ownership models been shown to provide a number of benefits to communities but also private developers.*

**Measuring impact for community development –** *how impacts are measured in community development is a largely contentious issue and can define how success is defined in practice.*

**Community and private supports –** *some communities cannot engage in renewable projects alone – joint community and developer supports should be a part of any general industry development policy.*

**Economic Development Considerations –** *strategies aimed at fostering economic development need to be rooted in a solid understanding of the capacities and limitations of the communities they are aimed at supporting.*

## 5.2 DEFINING "COMMUNITY"

According to Walker & Devine-Wright (2008), community in a renewable energy project can be defined by:

- A process dimension, concerned with who a project is developed and run by, who is involved and has influence,
- An outcome dimension concerned with how the outcomes of a project are spatially and socially distributed—in other words, who the project is for; who it is that benefits particularly in economic or social terms.

How we define community largely determines how and where benefits are accrued. If community is defined spatially, then we typically look to have benefits centred within a political or environmental boundary, such as a municipality or a watershed. If community is defined socially, then benefits may be allocated to a specific group, organization or population that may not adhere to any specific spatial limits, such as an NGO that may operate in multiple jurisdictions. There are pros and cons to either definition. If community is a group of like-minded people, then deciding on what constitutes an appropriate benefit or developing strategic action plans to gain benefits will likely be easier, however, benefits are potentially reserved for only that particular group of individuals that may not have any investment in the broader community (Walker & Devine-Wright, 2008). If community is defined by jurisdictional or physical limits then the benefits may be better distributed across a wider range of stakeholders, but equally so, decision making will be complicated by multiple voices that may not agree (Walker & Devine-Wright, 2008). In order to define, measure and plan for the distribution of community benefits from tidal energy development, clarity in how "community" will be interpreted is essential, and should be the starting point from which plans are made.

## 5.3 COMMUNITY ENGAGEMENT

In order to provide more significant and direct economic benefits to communities, Denmark and Germany have sought to implement policy and provide technical and legal assistance to encourage increased local ownership of renewable energy projects (Mundy, Bristow & Cowell, 2011). The goal of this policy is to ensure that a greater amount of benefits are channelled to rural areas. Other jurisdictions have designed policies that have (although not intentionally), discouraged community ownership and as a consequence its associated benefits. For example in the UK, the Renewable Obligation legislation was more market oriented to support competition between technologies, which in turn resulted in primarily large companies being involved in the renewable energy industry, due to high entry costs and associated risk levels (Woodmann & Mitchell, 2011). This left most communities unable to enter the renewable energy industry (Woodmann & Mitchell, 2011). Consequently, smaller technologies and projects, which could have been designed around a bottom-up economic development model, were discouraged (Woodmann & Mitchell, 2011). Many reports and academic studies suggest that the best possible way to increase community engagement is to begin consultation at the outset of a project. This ensures that residents can feel as though they are part of the process rather than the recipients of decisions made elsewhere (Portman, 2009).

Many scholars have remarked that Denmark has made exceptional progress since the 1970's toward being less dependent on foreign energy and becoming a global exporter of renewable energy technology and devices, in particular wind energy (Sovacool, Lindboe & Odgaard, 2008; Agterbosch, Meertens & Vermeulen, 2009). While much focus has been on the financial mechanisms associated with the success in Denmark, some authors have suggested that some non-financial aspects are large contributors to this success. For example, in countries like the United States, the production and consumption aspects of energy are segregated, and power plants frequently are placed at the periphery of communities. The opposite occurs in Denmark where energy production is predominately decentralized and close to the end user (Sovacool, Lindboe & Odgaard, 2008; Agterbosch, Meertens, & Vermeulen, 2009). In Copenhagen, wind turbines are integrated into the urban landscape and are highly visible, meaning that people tend to view them as natural (Sovacool, Lindboe & Odgaard, 2008). In other countries such as the United States, Canada and the United Kingdom, NIMBYism (Not in My Backyard) plays a major role in permitting decisions, and energy producing projects tend to be forced to the periphery, further away from the end user (Sovacool, Lindboe & Odgaard, 2008).

Having community and stakeholder participation in projects is typically seen as a best practice. However, some academics have pointed out that current permitting and approval processes entail lengthy and at times, ad hoc consultation procedures, which may not yield meaningful or focused results (Boettcher, Nielsen & Petrick, 2008). Others have suggested that consultation should be replaced with participatory approaches and be tied to action-based research methodologies (Portman, 2009). Some communities may be willing to participate in more active and participatory ways than others; for example, rural residents may be more likely to get involved in public participatory processes than their urban counterparts because the project may represent a significant economic opportunity (Boettcher, Nielsen & Petrick, 2008).

A potential benefit to increasing community participation in a renewable energy project is that the requirements for the creation of industry clusters may be more easily identified (Brun & Jolley, 2011). Although cluster analysis is typically led by consultant or academic activities, the article by Brun & Jolley (2011) suggests that it can be reframed to engage stakeholders in a collaborative process. Brun & Jolley (2011) suggest that the benefits to this process is increased accuracy regarding the specifics of industry capacities and linkages, however the down side is that the process may be more costly and will require more time than a traditional expert led approach.

### 5.3.1 COMMUNITY DECISION MAKING CAPACITY

Numerous authors have discussed the importance of community decision making capacity in ensuring tangible community benefits (Portman, 2009; Walker et al., 2010). Functional issues such as tidal energy device location and type, and whether impact assessments are required, are largely external to community decision making as they are formally defined by legal parameters or by the bio-physical nature of the area. The impacts from development of tidal energy can be direct, indirect or induced as with any major development. In the instance where renewable energy development is driven and owned by a community, rather than a private developer, the understanding is that more benefits can be captured locally (Walker & Devine-Wright, 2008).

Many researchers acknowledge decision making capacity in smaller communities is an issue (DTI, 2005; Halcrow Group Ltd, 2009). Capacity problems may be due to a lack of human resources, community cohesion or simply inexperience in making project development or planning decisions. The literature on community capacity building is expansive, and is far beyond the scope of this report. Typically a lack of information is cited as a major barrier to increasing community decision making capacity. The use of Geographic Information Systems (GIS) has been proposed as a valuable tool for community decision making (Mari et al. 2011).

**Box 9: Tool: Community Accessible Geographic Information Systems (GIS)**

Geographic Information Systems (GIS) can come in a variety of forms from paper maps and physical models to interactive digital 2D and 3D maps. GIS applications in particular web-based technologies are becoming increasingly popular as a way to provide a tool to facilitate greater community participation in development decisions for energy and other projects (Van Hoesen & Letendre, 2010; Mari et al., 2011). Numerous municipalities have invested in developing GIS web-based applications that allow community members to overlay various data layers to analyze the spatial aspects of their community. Two examples are highlighted below.

A generic example is the Halifax Regional Municipalities explore HRM web-based GIS
http://maps.halifax.ca/website/ExploreHRM/viewer.php

An offshore renewable energy model is the Rhode Island Ocean Special Area Management Plan web based map viewer (further described on page 35-36 of this report).
http://www.narrbay.org/d_projects/OceanSAMP/LiveMap/index.html

GIS systems allow community members to overlay a wide variety of data in configurations that make sense to them. It allows residents and stakeholders to question developers, and in some cases to add data layers that they feel are important (Van Hoesen & Letendre, 2010; Mari et al., 2011). Other sources of information such as local ecological knowledge can be integrated into GIS (if designed well), which can be significant in providing legitimacy to local and aboriginal interests. Another potential consequence of using a community based GIS model is a much more rapid and possibly accurate appraisal of sensitive areas, and identification of community concerns (Van Hoesen & Letendre, 2010). This may result in faster pre-approval study times and increased support from community for an energy project (Mari et al., 2011).

### 5.3.2 COMMUNITY OWNERSHIP

Germany, Spain and Denmark have been able to establish strong buy-in regarding wind energy due to legislated benefits to communities through community compensations, pre-approval contributions, local taxes and providing for community investment in projects (DTI, 2005). Several authors have suggested that increasing community ownership levels have a number of benefits to the community (Sustainable Development Commission, 2007b; Walker-Devine-Wright, 2008; Walker et al. 2010; Carley et al. 2011) As Warren & McFadyen (2010) point out, community ownership has impacts on the development process timeline as higher levels of community ownership have been proven to reduce project opposition and NIMBYism. Walker (2008) echoes this point and suggests several other benefits to community ownership models:

- local income and regeneration,
- quicker local approval and planning permission,
- local control over issues like siting and orientation,
- energy security and lowered costs,
- meeting ethical and environmental commitment, and
- smaller scale projects allow for better load management.

**Community Ownership Models** (Adapted from Halcrow Group Ltd, 2009)

- Community ownership - whole project
- Partly community owned - investment by individuals
- Partly community owned - community investment in joint venture company which owns the project
- Not community owned - Revenue stream paid into community trust

There are a number of issues related to community ownership, in particular complete community ownership of a renewable energy project. The most significant is the limitations this places on accessing finance. Community owned projects can be limited in their ability to raise funds, as lending institutions may not be willing to lend to inexperienced project developers and management teams. Full community ownership also exposes the community to all the risks associated with development (Halcrow Group Ltd, 2009). A possible solution is connecting communities with private developers who can assist in accessing better financing options. A few reports have suggested that along with funds for private and community developers, a special fund for joint ventures should be established in recognition of the varying capacity of communities to invest in renewable energy projects (Halcrow Group Ltd, 2009; SAC Consulting, 2010). Both communities and private business can use advisory packages on all aspects of renewable energy development including the management of private and community partnerships (SAC Consulting, 2010). In general, flexibility is important when looking at community ownership possibilities. Some communities will be reluctant or unable to invest in a project at the outset but may wish to be more active in later stages.

## 5.4 MEASURING IMPACTS ON COMMUNITY DEVELOPMENT

How renewable energy development could benefit, or regenerate communities, has been under discussion for decades. In most cases, benefits are defined in terms of direct economic gains such as jobs, local investment and land rents. Two issues in measuring the impacts of tidal energy development (pre and post project) and renewables generally are:

- having useful baseline data, and
- having a framework that effectively accounts for impacts.

Socio-economic impact assessments are typically a part of most Strategic Environmental Assessments, or in some cases Environmental Impact Assessments. However, in many cases they are not as substantial and are largely speculative in nature. There may be a need for a more prominent role for socio-economic impact studies (EquiMar, 2011e). A major limitation to socio-economic impact analysis is the availability of data (EquiMar, 2011a). In many cases, such as in Canada, certain statistics which can facilitate analysis of socio-economic impacts are not readily available[4]. Having a clear idea of what the socio-economic status of a local population is prior to the development of an energy project can serve as a guide in deciding the appropriate route for capturing community benefits (Regeneris Consulting & URS Scott Wilson, 2011).

### 5.4.1 MEASURING AND PLANNING FOR DIRECT BENEFITS

Several researchers have brought up the concern that direct community benefits from tidal and renewable energy projects generally, may be limited due to lack of relevant skills and workforce availability in small and rural communities (Dalton & Ó Gallachóir, 2010; Munday, Bristow & Cowell, 2011). The reality is that smaller communities may not necessarily have the required skills or number of workers necessary to complete projects.

Depending on the situation in a given community, the highly specialised employment opportunities could attract or demand labour from outside the region and would constitute economic benefit leakage (Regeneris & URS Scott Wilson, 2011). The scale of benefits accruing to the local area would only be maximised if workforce development and job matching programmes are introduced at an early stage, to ensure local people benefit from marine renewable development opportunities (DTI, 2005; Regeneris & URS Scott Wilson, 2011). Consequently, there is a need to have an understanding of what the local employment and skills situation is prior to a project, when seeking direct employment benefits from tidal energy development.

Another issue is that many socio-economic impact assessments begin and end with the project permitting process. Measurements need to be ongoing in order to be useful in long-range impact

[4] Based on authors experience attempting to access income, employment and health data at the municipal level from Statistics Canada.

assessment and planning (Neves & Leal, 2010). There is also a need to have an established concept of what will be counted as an impact. Will it be total jobs, percentage of new commercial development, baseline education levels or a mixture of indicators? Having an idea of what will be considered a "benefit" is an often overlooked issue in development studies (ADAS Consulting Ltd, University of Newcastle, 2003).

Some researchers (del Rıo & Burguillo, 2009; Wei, Patadia & Kammena, 2010) have identified that job creation is valuable only to the extent that new jobs

- Provide income stable,
- Value as opposed to de-value workers,
- Respect social and cultural norms in respect to the environment, economy and political structure, and
- Create opportunity for those in the community who are left outside of the labour market - women, rural people and the long term unemployed.

Often, ''jobs'' and ''job-years'' are used interchangeably (Wei, Patadia & Kammena, 2010). Simply referring to ''jobs created" without specifying duration can be misleading (Wei, Patadia & Kammena, 2010). Renewable energy jobs will very likely entail job losses from other sectors, in particular oil and gas (FREDS, 2009). Often reviews of employment impacts from renewable energy projects do not specify the duration, quality or the skills required for jobs. Additionally, the measure of direct, indirect and induced jobs varies widely (Wei, Patadia & Kammena, 2010). Transfers between industries are not often investigated, leading to an incomplete picture of the economic impact. Industrial sectors are not often grouped in similar fashion between nations, potentially leading to different results in estimated employment impacts (Wei, Patadia & Kammena, 2010).

The insight derived from an employment impact assessment is largely determined by the impact model used. An analytical model simply counts direct jobs, whereas an input-output model, calculates direct, indirect and induced effects. Consequently, the model used will determine the scope of community benefits anticipated from a project (Mott MacDonald, 2011). Each model has its particular pros and cons. Input-output models can capture the widest range of job and economic impacts but the data required to develop them can be exceptionally difficult to collect as it requires businesses to specify information about their operations (Mott MacDonald, 2011). Additionally, the time required to collect the data may mean that by the time analysis is completed, the assessment may be outdated (de Carvalho, 2011). The analytical model, while relatively simple to complete, does not provide an assessment of indirect economic impacts (de Carvalho, 2011), and thus does not address the full scope of economic impact.

**Box 10: Toolbox: Accessible Economic Modelling**

The ability for communities to estimate and predict economic impact is a valuable decision making tool. However, many communities do not have the in-house human resources capable to complete economic impact studies, and the costs of having professional consultants complete the work can be prohibitive.

The Ministry of Tourism and Culture in Ontario, Canada developed a tool called the Tourism Regional Economic Impact Model (TRIEM, http://www.mtc.gov.on.ca/en/research/treim/treim.shtml ) to allow communities and other groups to assess the potential direct, indirect and induced economic impacts of tourism development (hotels and other facilities) and cultural events. The model is essentially an input-output model, however, it takes into account time and users can project impacts into the future and results are reported in nominal dollars of the year in which the event takes place.

## 5.5 COMMUNITY & PRIVATE SUPPORTS

Various governments in Europe and North America have established grants, funds and other financial mechanisms to support the development of community owned renewable energy projects. While these are essential components in the development of renewable energy projects, there is also the need for expert guidance and advice on how to best proceed through the various stages of development. Many reports have pointed out that applications for project funding can be complicated, not to mention the impact assessment /permitting processes and that many communities have limited experience in project management (Halcrow Group Ltd, 2009). The report Economic and Community Benefit Study Final Report (2009) by the Halcrow Group Ltd, for the Scottish Government identifies the need for communities that wish to develop renewable energy projects to have access to expert advice and support services. The Community Renewables Initiative (CRI) in the UK was established through the Department of Trade and Industry (DTI) and other agencies to provide guidance to communities in installing small-scale renewable energy devices. The CRI established 10 Local Support Teams to provide advice to communities on planning issues, technology, funding and other project management issues. By 2006, this service was dealing with over 2000 enquiries per year and had successfully delivered over 160 installations with 100 more in development (Walker & Devine-Wright, 2008, p. 500). Evaluation data also showed that in the areas where the Local Support Teams were operating, applications to a government capital funding programme, Clear Skies, were over double the rate of those in areas where there were no Local Support Teams (Walker & Devine-Wright, 2008, p. 500). In the North American context, many tidal energy developments may occur in small or rural communities. If local communities are to be engaged in the development process, either through local administrators, the public or both as has been promoted as a best practice (CANWEA, date unknown; BWEA, 2002; Walker et al., 2010; RenewableUK, 2011), then there may be some human resource shortages in development processing or for public input collection and interpretation.

Canadian communities are becoming more involved in local level energy planning (St. Denis & Parker, 2009). This comes from a desire to reduce greenhouse gas emissions and to become more energy selfsufficient. St. Denis and Parker (2009), suggest that local level management is desirable because it achieves these goals through improvements in three areas: 1) energy efficiency; 2) energy conservation; and 3) switching to renewable energy sources. As St. Denis and Parker (2009) point out, the majority of these planning exercises and decision making processes are undertaken with minimal expert support.

## 5.6 ECONOMIC DEVELOPMENT CONSIDERATIONS

Energy security is inherently an economic development issue (Carley et al. 2011). In previous years energy inputs were a relatively small consideration in relation to other industrial inputs such as labour and raw materials. Energy has become a concern in terms of financial costs, and in meeting government policy requirements for emissions reductions and offsets. Additionally, over the last several years there has been an increasing volatility of fossil fuel markets, which impacts on energy inputs (Carley et al, 2011). Uncertainty around inputs can limit the ability of businesses, especially small-medium enterprises, to plan their operations effectively. In an industry that has been selected for promotion, like tidal energy, a central strategy is to align policy to reduce entry costs to manufacturers, suppliers and developers (DTI, 2005).

Economic benefits are closely tied to community benefits as both are typically measured in the number of direct jobs resulting from a development or policy change. In order to ensure local benefit in terms of jobs, there have been two effective approaches, a deliberate policy of local content as in Spain, or through sheer volume of development as is the case in Denmark & Germany (DTI, 2005). However, many researchers contend that a large percentage of any employment from renewable energy projects is made up of jobs that are guaranteed to remain domestic (i.e. they are not at risk of being fulfilled by overseas labour), because the installation of energy systems involves site-specific installation and construction (Carley et al., 2010). A community's capacity to gain direct economic benefits either due to a lack of available workforce or physical/business infrastructure has led some UK communities to request financial transfers outside of land rents, such as donations to community development funds to ensure some community benefit is captured (Munday, Bristow & Cowell, 2011). This approach, while positive, in the sense that at least some benefit is provided to the community, does not provide the broader socio-economic benefit of actual employment. Also, these donations or contributions are typically understood or referred to as compensation benefits, which send the wrong message about renewable energy projects; namely that they require compensation due to some negative impact (Munday, Bristow & Cowell, 2011).

Carley et al (2011) suggest that the practice of economic development through energy projects or energy-based economic development is different from traditional economic development, as the field of energy-based economic development offers significant policy and planning opportunities to achieve simultaneous goals in the fields of economic development and energy.

Despite commonality in the literature on economic development through renewable energy projects, the various studies on this topic are difficult to compare in terms of predictable outcomes because the key inputs used in these analyses are inconsistent; examples include the technologies examined, the regions studied, the types of employment effects (i.e., direct, indirect, and induced) and even the definition of what constitutes a "job" (full-time or part-time, temporary or long term). Differences in these inputs and other assumptions have led to a wide variety of job growth estimates and multipliers for energy-based economic development, and have contributed to confusion over what impacts actually are (Carley et al. 2011). In sum, any approach to economic development that uses renewable energy, requires consideration of a multiplicity of physical, social and economic features.

> *They also require public-private partnerships and a prominent role for policymakers, economic development practitioners, and energy users to facilitate the process of bringing new products to market, establishing appropriate infrastructure for more efficient energy use, cultivating a healthy business climate based on reliable energy supply and predictable costs, developing energy-related industry clusters, retooling workforce training to align with new skills requirements, and creating a quality of life for places that encourage sustainability as a part of community economic development* (Carley et al, 2011, p. 293).

## 6.0 NOVA SCOTIA CONTEXT & REVIEW

### 6.1 TIDAL IN-STREAM ENERGY CONVERSION (TISEC) CONTEXT IN NOVA SCOTIA

Nova Scotia is uniquely positioned to develop a tidal energy industry in the Bay of Fundy. The energy potential in the Bay of Fundy is unparalleled, with more than 160 billion tonnes of water flowing in and out of the Bay, twice daily – more than the combined flows of the world's freshwater rivers. According to a US-based Electric Power Research Institute, the Bay of Fundy is the most potent site for tidal power generation in North America (EPRI, 2006). It is expected that new in-stream tidal energy conversion technology has the potential to generate at least 300 megawatts from locations in the Bay of Fundy, which is enough energy to power nearly 100,000 homes (Government of Nova Scotia, 2008).

Nova Scotians began building small tidal mills along the Bay of Fundy as early as 1607, when a mill partially powered by tidal energy was built in Port Royal. These early mills converted roughly 25 to 75 kilowatts of energy from tidal power – enough to power about 10 modern homes (Government of Nova Scotia, 2008). In 1985, the Annapolis Tidal Power Station was built, which is one of only three tidal barrages in the world (NS Power, 2011). It has a capacity of 20 megawatts and a daily output of 80-200 megawatt hours, depending on the tides (NS Power, 2011). It produces enough power for about 6,000 homes (Government of Nova Scotia, 2008). See Figures 6 and 7 below.

**Figure 6 and 7**: View of the Annapolis Tidal Power Plant (NS Power, 2011).

In the last five years, there has been a resurgence of tidal energy research and development in Nova Scotia. An abbreviated timeline of tidal power activities in Nova Scotia is provided in Table 10.

**Table 10: Nova Scotia TISEC Timeline**

| Date | Action |
|---|---|
| 1984 | ▪ Annapolis tidal barrage installed |
| 2006 | ▪ Offshore Energy Environmental Research (OEER)/Offshore Energy Technical Research (OETR) Associations are established |
| 2007 | ▪ The Offshore Energy Environmental Research Association (OEER) was commissioned by the NS Department of Energy to carry out a Strategic Environmental Assessment (SEA) focussing on tidal energy development in the Bay of Fundy |

| Date | Action |
| --- | --- |
| 2008 | ▪ Province selects three developers, commits to support tidal test centre, research, legislation<br>▪ Major vessel survey identifies ideal site<br>▪ Final SEA report submitted |
| 2009 | ▪ Fundy Ocean Research Center for Energy (FORCE) is established<br>▪ Environmental Assessment approved<br>▪ NS Power deploys OpenHydro (first large-scale device in North America)<br>▪ Environmental monitoring begins<br>▪ OEER Association contracts Membertou Geomatics Consultants to perform a Mi'kmaq Ecological Knowledge Study related to marine renewable energy projects in the Bay of Fundy. |
| 2010 | ▪ Province releases the 2010 Renewable Electricity Plan, which commits a target of 25% renewable electricity by 2015 into law, and sets of goal of 40% by 2020<br>▪ Request for Proposal of 4th berth at FORCE announced<br>▪ Province announces tidal FIT<br>▪ OpenHydro retrieval from test site |
| 2011 | ▪ Atlantis wins 4th berth at FORCE<br>▪ FIT and COMFIT price announced<br>▪ Acadia University launches Acadia Tidal Energy Institute<br>▪ FORCE and the European Marine Energy Centre forge alliance by signing a strategic agreement to help advance marine renewable energy industry worldwide<br>▪ FORCE Interpretive Centre Opens |
| Upcoming | ▪ Subsea cable installation at FORCE<br>▪ Transmission line for Parrsboro / FORCE<br>▪ New legislation to clarify commercial path and public interests<br>▪ Release of Mi'kmaq Ecological Knowledge Study<br>▪ ALSTOM, Atlantis, Minas Basin Pulp and Power TISEC device installation |

Adapted from Nova Scotia Department of Energy (n.d.). Nova Scotia Tidal Energy (brochure). Available online at: http://fundyforce.ca/userfiles/Nova%20Scotia%20Tidal%20Energy%20Brochure%20Oct%202011.pdf

## 7.0 GAP ANALYSIS

The purpose of a gap analysis is to measure where you are relative to a desired state. A desired state with clearly defined goals has yet to be articulated for TISEC development and the marine renewables industry in Nova Scotia. Gap analysis is often informed by strategic plans. Natural Resources Canada (2011a) has just recently released *Charting the Course: Canada's Marine Renewable Energy Technology Roadmap*, which provides a valuable industrial development context, from which to conduct research in other integral areas, such as legislation, socio-economics and community development. Places like the United Kingdom have already developed a large amount of technical and policy literature around marine renewable energy. This is born out of a strong commitment by government at national and regional levels to ensure that benefits from marine renewable energy, in particular tidal energy are captured. Nova Scotia has also done a considerable amount of work on exploring the opportunities and barriers associated with tidal energy and also much time in seeking input from Nova Scotians on this emerging industry. Despite the absence of a strategic plan, using the insight and the goals and objectives developed in other jurisdictions, we can identify several features of a desirable end state for the tidal energy industry. Reports from Europe, the United States, Canada and Nova Scotia highlight similar needs and issues for an efficient, equitable and economically sustainable tidal energy industry. They are represented by the following eight themes:

- Legislation & Strategic Planning
- Financing & Investment Models
- Monitoring & Assessment
- Supply Chain & Infrastructure
- Community Support & Participation
- Analytical Tools, Data & Research
- Socio-Economic Impacts
- Technology Development & Deployment

This gap analysis highlights specific goals (e.g. developing legislative clarity on tidal resource rights and access) that have been identified elsewhere. These goals have been used to determine if, and to what extent, a gap exists in Nova Scotia. Where applicable, a possible action to address the gap or compliment current activity has been proposed. The purpose of the gap analysis is not to comment on the quality, validity or legibility of what is currently available in Nova Scotia to support marine renewables and TISEC, but to identify if and what is available. A detailed investigation of what is currently in place should be conducted at some point. Following the gap analysis, a table of recommendations and potential actions is provided that could be useful in meeting the goals identified in the gap analysis. Reports and articles that support these recommendations and actions are cited.

**Table 11: Gap Analysis**

| **Strategic Goal** | **Current State** | **Gap** | **Possible Action** |
|---|---|---|---|
| Legislation & Strategic Planning | | | |
| **Strategic & topical plans** | • Renewable Electricity Plan,<br>• Marine Renewable Energy Infrastructure Assessment,<br>• Draft Coastal Strategy,<br>• Marine Renewable Energy Legislation: A Consultative Process,<br>• Fundy Strategic Environmental Assessment (Fundy SEA),<br>• Mi'kmaq Ecological Knowledge Study (underway).<br>All provide a base for a Strategic Plan. | No overarching Strategic Plan for TISEC. | Develop a Strategic Plan as soon as possible to guide future investment in TISEC and marine renewables in a coordinated fashion. |
| **Legislative clarity** | Discussion of legislative issues began in 2006 and has been ongoing.<br><br>Changes to the Energy Act and the Renewable Electricity Regulations have been completed to facilitate feed in tariffs and other reforms. | Review of legislation is ongoing. | As soon as possible begin shaping legislation that integrates or combines the various legislative acts at the provincial and federal level to reduce uncertainty around TISEC. Legislation should be flexible and adaptive as the industry is still evolving. |
| **Streamlined permitting process** | One window permitting process established. | | A one window system has been identified internationally as a best practice –however, until the process has been proven overtime, attention should be paid to the experiences of large and small scale developers. Developing pre-permitted areas may reduce project permitting time and financial burdens, as development could be done as of right. |

| Strategic Goal | Current State | Gap | Possible Action |
|---|---|---|---|
| **Identification of potential TISEC deployment sites and tenure** | Nova Scotia, Renewable Land Opportunities Directory.<br><br>This allows people who own land and are willing to sell or lease it for renewable electricity projects to list their sites. | All sites still unidentified | Spatial analysis of resources, the best sites to access them and their tenure would provide important project information for consultation, assessing cost of development and potential partnership options. |
| **User and jurisdictional conflict management tools, such as Integrated Coastal Zone Management (ICZM) & Marine Spatial Planning (MSP) in place** | Eastern Scotian Shelf Integrated Management (ESSIM) Initiative – is an approximate to ICZM.<br><br>Ecology Action Centre report, *Integrated coastal zone management in the Bay of Fundy: Implications for tidal power.* | No known ICZM or MSP in Fundy Region | Investigate the possibility of ICZM in the Bay of Fundy based on the ESSIM initiative.<br>Look to the Rhode Island Ocean Special Area Management Plan for guidance on implementing MSP. |
| Financing & Investment Models | | | |
| **Reduction of Market Risk for TISEC** | • Community Economic Development Investment Funds,<br>• COMFIT,<br>• Power Purchase Agreement with Nova Scotia Power Incorporated (NSPI),<br>• Creation of a Renewable Electricity Administrator to manage independent power producer (IPP) competitions for medium and large-scale renewable electricity projects. | The effectiveness of these mechanisms in terms of meeting renewables targets and to facilitate meaningful industry development has yet to be determined. | Collect information on industry growth and renewables targets as they progress. |
| **Multi-stakeholder investment and partnership models (Large & Small projects)** | Community Economic Development Investment Funds,<br><br>COMFIT Guidelines. | More information on how to engage and negotiate investments and partnerships, especially for smaller projects and project developers would be useful. | |

| Strategic Goal | Current State | Gap | Possible Action |
|---|---|---|---|
| Monitoring & Assessment | | | |
| **Methodology for and timing of socio-economic impact studies** | Fundy SEA has identified gaps in data and methodology.<br><br>Currently, developments post Fundy SEA need to undergo site specific Environmental Assessments. Environmental Assessments may leave socio-economic impacts unaccounted for. | No specific process identified. Numerous gaps in data and no clear methodological standards identified. | Review in Nova Scotia practices and reports completed by provincial Departments and other agencies across Nova Scotia that have completed socio-economic studies and select best approaches. |
| Supply Chain & Infrastructure | | | |
| **Transparent and fair access to electricity transmission infrastructure.** | A Renewable Electricity Administrator to manage independent power producer (IPP) competitions for medium and large-scale renewable electricity projects.<br><br>Currently any producer over 100kW are subject to costs associated with:<br>• Required studies,<br>• Customer's interconnection facilities,<br>• Nova Scotia Power Incorporated interconnection facilities, and<br>• Distribution system upgrades.<br><br>Nova Scotia Power Incorporated controls technical approval to connection to the electricity distribution network. | Connections have not been mapped and overlaid with tidal resources and tidal access points. Also, some concern remains around how decisions around how COMFIT type projects will be affected by Nova Scotia Power Incorporated's control of interconnections. | Utilize available data to assess the location of current interconnection capacity and access points relative to tidal resources and access points to determine future strategic investments in grid connection infrastructure.<br>Investigate the current standards outlined in the Power Purchase Agreement with Nova Scotia Power Incorporated to see if they are fair and feasible for different project scales. |
| **Marine and terrestrial short, medium and long term infrastructure needs identified** | Marine Renewable Energy Infrastructure Assessment. | Impacts of tidal energy industry on terrestrial transportation and potential infrastructure upgrades are largely unknown. | Infrastructure requirements should be reviewed regularly.<br><br>Information on planned infrastructure improvements and expansions should be available to |

| Strategic Goal | Current State | Gap | Possible Action |
|---|---|---|---|
| | | | project developers. |
| **Self-sustaining industry training in place** | Apprenticeship training and employer incentives available through the Department of Labour and Advanced Education for trades.<br><br>Support for professional program is unknown. | No current industry specific training or financial supports for trades and professions. | Assess industry trade and professional needs and begin program, supports and curriculum development with NSCC, universities and industry players as needed. |
| Community Support & Participation | | | |
| **Standards of practice for public participation for project and industry development** | COMFIT proponents are expected to engage with the Mi'kmaq community in Nova Scotia as per Section 24(f) of the *Renewable Electricity Regulations*. | Detailed guidelines for public participation, specific to Nova Scotia for renewable energy are unknown. | Review best practices in renewable project development and other industries. Develop standards as required. |
| **Compensation mechanisms in place** | Fundy Strategic Environmental Assessment – recommended developing compensation protocol. | No known parameters. | Define who, how, and under what circumstances compensation should be allocated. |
| **Community Development Resources available** | COMFIT Guide developed. | Outside of the COMFIT Guide, few community resources are available specifically for TISEC. | Identify key informational needs for small (and large) scale independent power producers and community-based groups, and develop decision making and project development tools. |
| Analytical Tools requisite data & Research | | | |
| **Knowledge transfer among developers, researchers and public is regulated and encouraged** | • Recommendations in Fundy SEA and Marine Renewable Energy Legislation.<br>• A Consultative Process to establish a system of knowledge transfer,<br>• MOU signed between Nova Scotia & the state of Maine,<br>• Research agreement signed between Fundy Ocean Research Center | Research collaboration and sharing agreements are in place between governments and research bodies.<br><br>No official process to share knowledge gained through project assessments and demonstration projects. | Follow up recommendations from the Fundy SEA and the Marine Renewable Energy Legislation to develop a system of knowledge transfer that respects the intellectual property rights of TISEC developers. |

| Strategic Goal | Current State | Gap | Possible Action |
|---|---|---|---|
| | for Energy & the European Marine Energy Centre. | | |
| **Defining, locating or creating required data for socio-economic research** | • FERN Scoping Study,<br>• Fundy SEA,<br>• Marine Renewable Energy Legislation: A Consultative Process.<br>All these reports raised questions about availability of information for socio-economic analysis. | Requirements still largely unknown. | Review socio-economic data needs and compare to currently available data. |
| **Establish short, medium and long-term research goals and the organizations/institutions/departments to undertake them.** | Key local research bodies:<br>• Offshore Energy Technical Research Association,<br>• Offshore Energy Environmental Research Association,<br>• Fundy Ocean Research Centre for Energy,<br>• Fundy Energy Research Network,<br>• Acadia Tidal Energy Institute. | Many recommendations have been made both within Nova Scotia on what should be included in a research plan for TISEC, but no specific targets or plans have been defined as of yet. | Create a research plan that provides targets that complements government and industry plans and actions for TISEC development. Define budgets, timelines and specific bodies to undertake research |
| **Engage coastal research organizations beyond those dealing primarily with Marine Renewables** | • Provincial Oceans Network,<br>• Coastal Communities Network,<br>• Coastal CURA,<br>• Bay of Fundy Ecosystem Partnership,<br>• Ecology Action Centre. | Several research bodies working in this area in Nova Scotia – the only gap is for TISEC. | Build upon knowledge and action based research already conducted in coastal Nova Scotian communities and involve current organizations active in coastal research and management. |
| Socio-economic Impacts | | | |
| **Mitigation of negative impacts on low & medium income persons due to increases in energy costs** | Nova Scotia Poverty Reduction Strategy. | Strategy does not directly address energy costs. | |

| Strategic Goal | Current State | Gap | Possible Action |
|---|---|---|---|
| Technology Development & Deployment | | | |
| **Test and research facilities for technology development** | Fundy Ocean Research Centre for Energy facilities will soon be completed and grid accessible.<br><br>Key document - *Defined by the sea: Nova Scotia's oceans technology sector present and future* | None identified | Continue to build partnerships and networks of local technology developers and key input producers |
| Other Issues | | | |
| **Adopt Occupational Health & Safety Standards** | Occupational Health & Safety for Offshore Oil & Gas developed and in use. | Unknown whether this is sufficient for TISEC. | Review practices in other jurisdictions for tidal and adapt current standards as necessary. |

## 8.0 RECOMMENDATIONS AND POTENTIAL ACTIONS

In order to attain many of the goals outlined in the gap analysis, additional activities, policies and research are required. Numerous academic and professional studies and reports have identified a wide range of actions, research areas, and policy initiatives that could support rapid diffusion of TISEC and marine renewable technologies, and socio-economic growth. The following recommendations and priority actions are pertinent to the Nova Scotia context and are based on both regional and international research and experience.

Table 12: Recommendations and Potential Actions

| Priority/Recommendation/Goal | Report Citation |
|---|---|
| **Develop a Strategic Plan for Tidal Energy** | Robert O. Fournier (2011). Marine Renewable Energy Legislation: A Consultative Process.<br><br>Carbon Trust (2011). Accelerating marine energy: The potential for cost reduction – insights from the Carbon Trust Marine Energy Accelerator.<br><br>Mott MacDonald (2011). Accelerating the deployment of offshore renewable energy technologies: final report. |
| **Improve cooperation across provincial departments and other levels of government.** | Government of Nova Scotia (2011) Draft Coastal Strategy.<br><br>Ryan, C. (2009). Workshop on Economic Opportunities, Challenges and Actions of Marine Renewable Energy: Final Report, Thackeray Consulting for Nova Scotia Department of Energy, 21 pgs.<br><br>Electric Power Research Institute (2008) Prioritized Research Development, Deployment and Demonstration Needs: Marine & Other Hydro Kinetic Renewable Energy. |
| **Define jurisdictional boundaries and commercial rights.** | Nova Scotia Department of Energy (2010). Marine Renewable Energy Legislation for Nova Scotia Policy Background Paper.<br><br>Offshore Energy Environmental Research Association (2008). Fundy tidal energy strategic environmental assessment: final report. Prepared for NS Department of Energy. |
| **Investigate whether it is possible to provide any additional financial mechanisms, in particular for device testing and installation.** | Carbon Trust (2011). Accelerating marine energy: The potential for cost reduction – insights from the Carbon Trust Marine Energy Accelerator.<br><br>Renewable UK & SeaPower (2011). Sea Power: Funding the Marine Energy Industry 2011-2015. |

| Priority/Recommendation/Goal | Report Citation |
|---|---|
| | Mott MacDonald (2011). Accelerating the deployment of offshore renewable energy technologies: final report. |
| **Reduce redundancies between federal and provincial legislation.** | Robert O. Fournier (2011) Marine Renewable Energy Legislation: A Consultative Process.<br><br>Mott MacDonald (2011). Accelerating the deployment of offshore renewable energy technologies: final report. |
| **Supply chain, skills inventory & labour availability assessment.** | SLR – Environmental Consultants (2010). FINAL REPORT Renewable Energy Opportunities and Competitiveness Assessment Study, For: NS Department of Energy, Business and Technology Division.<br><br>Ryan, C. (2009). Workshop on Economic Opportunities, Challenges and Actions of Marine Renewable Energy: Final Report, Thackeray Consulting for Nova Scotia Department of Energy.<br><br>Electric Power Research Institute (2008) Prioritized Research Development, Deployment and Demonstration Needs: Marine & Other Hydro Kinetic Renewable Energy.<br><br>Mott MacDonald (2011). Accelerating the deployment of offshore renewable energy technologies: final report.<br><br>FREDS – Marine Energy Group (MEG) (2009) Marine Energy Road Map.<br><br>NRCAN (2011) Charting the Course: Canada's Marine Renewable Energy Technology Roadmap |
| **Create a public education & outreach plan.** | Robert O. Fournier (2011). Marine Renewable Energy Legislation: A Consultative Process.<br><br>Mott MacDonald (2011). Accelerating the deployment of offshore renewable energy technologies: final report.<br><br>FREDS – Marine Energy Group (MEG) (2009) Marine Energy Road Map. |
| **Create standards of practice for public participation.** | Robert O. Fournier (2011). Marine Renewable Energy Legislation: A Consultative Process.<br><br>EquiMar (2011c). Deliverable D5.8: Impacts upon marine energy stakeholders.<br><br>BWEA (2002). Best practices guidelines: Consultation for offshore wind energy developments. |

| Priority/Recommendation/Goal | Report Citation |
|---|---|
| | British Winder Energy Association, Renewable Energy House, London. |
| **Continue to streamline permitting process based on applicant feedback.** | Robert O. Fournier (2011). Marine Renewable Energy Legislation: A Consultative Process<br><br>Mott MacDonald (2011). Accelerating the deployment of offshore renewable energy technologies: final report. |
| **Review interconnection to grid process, to ensure that it is clear and fair and does not present any exceptional risk to developers (small or large).** | Ecofys International BV - David de Jager and Max Rathmann (2008). Policy instrument design to reduce financing costs in renewable energy technology projects.<br><br>Adams, M., & Wheeler, D. (2009). Stakeholder Consultation Process for a New Renewables Energy Strategy for Nova Scotia: Final Report to the Government of Nova Scotia.<br><br>Mott MacDonald (2011). Accelerating the deployment of offshore renewable energy technologies: final report. |
| **Investigate future grid infrastructure upgrades.** | FREDS – Marine Energy Group (MEG) (2009). Marine Energy Road Map. |
| **Define budgetary allocations from government for desktop, action based and device testing research.** | Electric Power Research Institute (2008). Prioritized Research Development, Deployment and Demonstration Needs: Marine & Other Hydro Kinetic Renewable Energy.<br><br>FREDS – Marine Energy Group (MEG) (2009). Marine Energy Road Map. |
| **Create mechanism to provide for the transfer of information about tidal energy projects. Define how and what type of information will be shared with the public, industry and other developers to encourage quicker learning rates.** | Offshore Energy Environmental Research Association. (2008). Fundy tidal energy strategic environmental assessment: final report. Prepared for NS Department of Energy<br><br>SQWenergy (2010). Economic study for ocean energy development in Ireland: a report to sustainable energy authority Ireland and Invest Northern Ireland.<br><br>Mott MacDonald (2011). Accelerating the deployment of offshore renewable energy technologies: final report.<br><br>NRCAN (2011) Charting the Course: Canada's Marine Renewable Energy Technology Roadmap |
| **Provide information and tools to assist communities in developing TISEC & to manage coastal issues themselves.** | Adams, M., & Wheeler, D. (2009). Stakeholder Consultation Process for a New Renewables Energy Strategy for Nova Scotia: Final Report to the Government of Nova Scotia. |

| Priority/Recommendation/Goal | Report Citation |
|---|---|
| | Government of Nova Scotia (2011) Draft Coastal Strategy. |
| **Ensure compatibility of Marine Renewable Energy plans with plans within other departments and levels of government.** | Carbon Trust (2011). Accelerating marine energy: The potential for cost reduction – insights from the Carbon Trust Marine Energy Accelerator.<br><br>FREDS – Marine Energy Group (MEG) (2009) Marine Energy Road Map. |
| **Develop local marine spatial plans, including guidelines, and if necessary training.** | Tym & Partners (2011) Marine Management Organisation : Maximising the socio-economic benefits of marine planning for English coastal communities.<br><br>FREDS – Marine Energy Group (MEG) (2009). Marine Energy Road Map. |
| **Socio-economic profile & SWOT assessment of community capacity for tidal energy development (Capacity assessment of small, large or array systems).** | Collective Wisdom Solutions, Services Inc., Maritime Tidal Energy Corp (2011) Marine Renewable Energy Infrastructure Assessment.<br><br>Tym & Partners (2011). Marine Management Organisation Maximising the socio-economic benefits of marine planning for English coastal communities. |
| **Establish mechanisms to ensure Strategic Environmental Assessments are revisited when needed.** | Nova Scotia Department of Energy (2010). Marine Renewable Energy Legislation for Nova Scotia Policy Background Paper. |
| **Define what, how, to whom, and under what circumstances compensation from TISEC projects will be provided.** | Offshore Energy Environmental Research Association (2008). Fundy tidal energy strategic environmental assessment: final report. Prepared for NS Department of Energy.<br><br>Mott MacDonald (2011). Accelerating the deployment of offshore renewable energy technologies: final report. |
| **Understanding household impacts (in particular for low income households) of FIT programs and what if any support programs should be put in place.** | Adams, M., & Wheeler, D. (2009). Stakeholder Consultation Process for a New Renewables Energy Strategy for Nova Scotia: Final Report to the Government of Nova Scotia<br><br>Nova Scotia Sustainable Electricity Alliance (2010). Discussion Paper: Key Policy Elements for Nova Scotia to Achieve Stable and Equitable Renewable Electricity Growth.<br><br>Mott MacDonald (2011). Accelerating the deployment of offshore renewable energy technologies: final report. |

## 9.0 OPPORTUNITIES & BARRIERS

The development of the TISEC industry in Nova Scotia, as identified in the gap analysis, has already made progress and has important features such as the Feed-In Tariff for tidal arrays, COMFIT and Fundy Strategic Environmental Assessment in place. However, not all facets of the industry will or can be addressed currently. The following table identifies some opportunities and barriers present in Nova Scotia that may affect the growth of TISEC in Nova Scotia. The table does not include technical or environmental opportunities and barriers as this is beyond the scope of this study. The table is by no means comprehensive as many unknowns remain regarding TISEC and its impact on the socio-economic landscape of Nova Scotia. This table and this report in general are intended to serve as a resource for discussion and a leaping off point for focused research and other activities.

Table 13: Opportunities & Barriers to TISEC development: Socio-economic and regulatory

| OPPORTUNITIES | BARRIERS |
|---|---|
| The provincial government has demonstrated commitment to TISEC through:<br>• Plans for a FIT for developmental tidal arrays,<br>• A COMFIT and a commitment to have 100MW of renewable energy by 2015,<br>• Facilitation support to help communities who want to better understand the technical, financial and regulatory work needed to develop these projects,<br>• The creation of a Renewable Electricity Administrator to manage independent power producer (IPP) competitions for medium and large-scale renewable electricity projects,<br>• A review in 2012 to determine whether the regulations set out for COMFIT's are appropriately supporting the target of reaching 25% renewable electricity supply by 2015. | Municipalities may have difficulty with COMFITs as they have to own at least 100% of the project to qualify, given infrastructure deficits across the province. This situation is unlikely to change dramatically within the next few years.<br><br>Other entities may have difficulty raising capital necessary to develop TISEC projects. |
| As identified in several documents, there is ample research and development capacity in Nova Scotia. However, specific areas like socio-economics are underrepresented. But as the technology matures more attention may be paid to other areas. | Knowledge sharing, especially regarding technical and engineering data may be problematic, especially in instances where intellectual property is an issue. |
| MOU signed with the State of Maine and the agreement between the European Marine Energy Centre and the Fundy Ocean Research Centre for Energy could result in much more rapid learning rates and the solving of key technical questions and other research issues. | Coordination across government departments, internally or externally, can require much time and effort. |
| Nearly all reports on developing marine renewable energy in Nova Scotia have identified jurisdictional rights as an issue and have proposed tools such as Marine Spatial Planning as a way to deal with this issue. | Jurisdictional boundaries and commercial rights are still unclear. |

| OPPORTUNITIES | BARRIERS |
|---|---|
| Recent naval ship contract awarded to Irving Shipyards could result in an influx of new workers to the area to mitigate labour shortages. | Ageing of the population and outmigration may create a tight labour market, and with the recent naval ship building contract to Irving Shipyards there may be competition for key skills and trades. |
| | Access to onshore converters is not uniform throughout Nova Scotia or the Bay of Fundy, and the cost to access the grid can increase project costs substantially. NSPI holds the power to provide technical approval for projects over 100kW and should be investigated in terms of its impact on fair treatment of projects. |

## 10.0 RESEARCH PRIORITIES

Identifying research priorities at this stage of TISEC development is both essential and problematic. It is essential because as the *Marine Renewable Energy Legislation: A Consultative Process* (2011) points out, it is important to have a coordinated approach to research in order to avoid redundancies and to facilitate faster industry development. Also the recent release of a national level marine renewable technology roadmap (NRCan, 2011a) provides some guidance in how TISEC amongst the other marine renewable technologies will be approached. Setting research priorities can be problematic because many unknowns remain, such as the feasibility of certain devices, the capacity and coordination within Nova Scotia's supply chain and simply the level of future investment and industry interest in TISEC. The following table highlights several potential research priorities on socio-economic issues associated with TISEC. This is by no means a complete list of all research and actions that need to be taken based on the gap analysis and the recommendations identified in other reports. These priorities do, however, represent foundational work that needs to be done. Some of these priorities are primarily desktop based research, while others will entail action and community based research. In order to facilitate timely and durable socio-economic benefits a coordinated approach to research is key. As marine renewables develop in Nova Scotia and internationally, more information will become available on what can be expected from TISEC and other marine renewable technologies. As new information becomes available research priorities should be amended to build upon new findings.

Table 14: Suggested research priorities for TISEC development in Nova Scotia

| **Research Priorities** | |
|---|---|
| **1** | Development of a Strategic Plan, which addresses research capacities and short, medium and long term research needs. |
| **2** | Review policy and legislation that may limit or block adaptive management, marine spatial planning and taking an integrated coastal zone management approach in the Bay of Fundy. |
| **3** | Consult with Bay of Fundy users and map both spatially and temporally critical sites for user groups: e.g. traditional and commercial fishing places and seasons, high tourism sites, etc. |
| **4** | Establish benchmarks for evaluating socio-economic impacts of TISEC on coastal communities. |
| **5** | Collect information from current TISEC developers and their input (component parts) and service suppliers (installation, transport) regarding : a) current and projected labour and skills needs; b) production capacity & flexibility (is TISEC their primary activity?); and c) knowledge of local, regional and provincial supply chain – this should be compared to what is currently present in terms of skills inventory & labour availability, and what can be made available through current post-secondary and other programs. |
| **6** | Identify data and skills needs to implement a Marine Spatial Plan for the Bay of Fundy. |
| **7** | Identify legislative, capacity and other barriers to community based investment and development of TISEC projects and develop appropriate information packages and tools to address these barriers. |
| **8** | Explore synergistic relationships between current, planned and future users: E.g. off season fishers providing back up and support roles for TISEC device installation & |

| Research Priorities | |
|---|---|
| | operations & maintenance. |
| **9** | SWOT assessment of community capacity for tidal energy development (Capacity assessment of small, large or array systems) to identify potential key development sites. |
| **10** | Research the relationship between Feed In Tariff programs, energy conservation and management programs and the socio-economic impacts on energy costs to consumers – in particular low and medium income persons. |

## 11.0 CONCLUSIONS

The FERN Scoping study has summarized a substantial amount of literature on TISEC and marine renewables from Nova Scotia and abroad. Despite the diversity in the legislative, geographic and economic contexts of regions undertaking TISEC development, several key issues are common throughout, including the need for:

- Creating strategic plans that provide useful guidance on how to pursue TISEC industry development,
- Removing unnecessary barriers related to permitting and approval mechanisms and processes,
- Understanding supply chain sectors and capacity,
- Developing and fostering financial models that allow for TISEC deployment at various scales,
- Ensuring socio-economic research on the impacts of TISECs is coordinated and funded,
- Allowing public based input and community buy-in to renewable energy projects, and
- Creating contexts that allow for substantial and sustainable community benefits.

Nova Scotia, in the policies and mechanisms that have been put in place to date, has demonstrated that it has paid attention to what has worked in other jurisdictions. However, many issues still need to be better understood.

Key areas recommended for research activity include:

- Strategic Planning,
- Coastal and user conflict management,
- Supply chain, technology and workforce development,
- Financial and investment models, and
- Community scale research on the impacts and potential of TISEC development.

## ANNEX 1: LOCAL TIDAL ENERGY ORGANIZATIONS

**Acadia Tidal Energy Institute**

http://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. 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 Energy Research Network (FERN)**

http://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 socio-economic 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.

**Fundy Ocean Research Centre for Energy (FORCE)**

http://www.fundyforce.ca/

FORCE is Canada's leading test center 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.

**Fundy Tidal Inc. (FTI)**

http://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 of the Bay of Fundy. FTIs 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. FTIs mission is to:

- Serve as a vehicle for community-led in-stream tidal energy projects throughout Nova Scotia (and beyond)
- Establish Grand & Petit Passage & 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

**Offshore Energy Environmental Research Association (OEER)**

http://www.offshoreenergyresearch.ca/

OEER is a not-for-profit corporation dedicated to fostering offshore energy and environmental research and development including examination of renewable energy resources and their interaction with the marine environment. The Association was incorporated in March 2006, with grants that now total $8,205,000 from the Nova Scotia Department of Energy. OEER's members are Acadia University, St. Francis Xavier University, Cape Breton University and the Nova Scotia Department of Energy.

The objective of OEER is to build research capacity in Nova Scotia and to assess the potential impacts of: petroleum exploration, development and production and renewable energy technologies (ocean currents, wind, tides and waves) on the marine environment.

**Offshore Energy Technical Research Association (OETR)**

http://www.offshoreenergyresearch.ca/OETR/tabid/55/Default.aspx

OETR is a not-for-profit corporation dedicated to fostering research to enhance petroleum exploration and development of Nova Scotia's offshore. The Association was incorporated in March 2006, with grants that now total $21,782,000 from the Nova Scotia Department of Energy. OETR's members are Dalhousie University, Saint Mary's University and the Nova Scotia Department of Energy.

The objective of OETR will encourage and fund research work that builds geoscience knowledge about Nova Scotia's offshore oil and gas potential as well as research that reduces the technical and engineering barriers to the development of discovered reserves.

Specific Project Aims:

1. To support studies that look at geoscience issues
2. To hold workshops that will bring together world experts
3. To acquire strategic geoscience information
4. to support other studies consistent with the general objectives

## ANNEX 2: MARINE ENERGY AND RENEWABLES ORGANIZATIONS – INTERNATIONAL

### The European Marine Energy Centre

http://www.emec.org.uk/

The European Marine Energy Centre's (EMEC's) Mission Statement is:
"To be the internationally acknowledged leading test and certification centre for marine energy converters."
The main services EMEC offers to the Marine renewable industry are:

- **Provision of Wave and Tidal testing capabilities:**
  - Independent assessment of devices' energy conversion capabilities, structural performance and survivability
  - Assistance with Grid connection and Renewable Obligations Certificate accreditation
  - Real-time monitoring of meteorological and marine resource conditions
  - Extensive assistance with consent & regulatory issues
  - Opportunity to join EMEC's Monitoring Strategy
  - Extensive local research and engineering support
  - Nearby access to sheltered water and harbours
  - Office and data centre support
- **Consultancy and Service provision**
  - Provision of off-site testing validation
  - Provision of consultancy on all aspects of design and operation of marine test centres
  - Provision of data and marine services
- **Projects and Research**
  - Provision of specialist resources for all projects related to Marine Renewable research specifically related to a Marine Test site.

### Atlantic Wind Connection

http://atlanticwindconnection.com/

The Atlantic Wind Connection backbone transmission project is an essential foundation to this new industry. Designed to accelerate offshore wind development, the project is led by well-established independent transmission company Trans-Elect and sponsored by Good Energies, Google and Marubeni Corporation.

### The Rhode Island Ocean Special Area Management Plan

http://seagrant.gso.uri.edu/oceansamp/index.html

The Rhode Island Ocean Special Area Management Plan (SAMP) serves as a federally recognized coastal management and regulatory tool. Using the best available science, the Ocean SAMP provides a balanced approach to the development and protection of Rhode Island's ocean-based resources

**Scottish Renewables**

http://www.scottishrenewables.com/

Scottish Renewables is the representative body of the Scottish renewables industry (since 1996). They give their members "genuine influence at the heart of policy making, presenting a united voice to decision makers". They represent over 300 members leading the debate on how Scotland can maximise the benefits of renewable energy.

Their member organisations are wide ranging across all technologies and supply chains and they have developed 14 focus areas to fully represent the industry:

- Bioenergy
- Community engagement
- Economics
- Grid
- Heat
- Hydro
- Marine
- Micro
- Offshore wind
- Onshore wind
- Planning
- Skills
- Supply chain
- Transport

**SuperGen Marine Consortium**

http://www.supergenmarine.org.uk/drupal/

The SuperGen consortium undertakes collaborative research with the intention of achieving a step change in the development of generic marine energy technologies. The academic partners within the phase one consortium were: The University of Edinburgh, The Robert Gordon University, Heriot Watt University, Lancaster University and the University of Strathclyde. The industrial collaborators included more than 20 national and international marine energy and electricity supply companies.

**Marine Management Organisation**

http://www.marinemanagement.org.uk/

The Marine Management Organisation (MMO) was established to make a significant contribution to sustainable development in the marine area and to promote the UK government's vision for clean, healthy, safe, productive and biologically diverse oceans and seas.

They are a new executive non-departmental public body established and given powers under the Marine and Coastal Access Act 2009. This act brings together key marine decision-making powers and delivery mechanisms.

They have incorporated the work of the Marine and Fisheries Agency and acquired several important new roles, principally marine-related powers and specific functions previously associated with the Department of Energy and Climate Change and the Department for Transport.
The establishment of the MMO as a cross-government delivery partner therefore marks a fundamental shift in planning, regulating and licensing activity in the marine area with the emphasis on sustainable development.
They have a wide range of responsibilities, including:

- Implementing a new marine planning system designed to integrate the social requirements, economic potential and environmental imperatives of the UK seas,
- Implementing a new marine licensing regime with clearer, simpler and quicker licensing decisions,
- Managing UK fishing fleet capacity and UK fisheries quotas,
- Working with Natural England and the Joint Nature Conservation Committee to create and manage a network of marine protected areas (marine conservation zones and European marine sites) designed to preserve vulnerable habitats and species in UK marine waters,
- Responding to marine emergencies alongside other agencies developing an internationally recognised centre of excellence for marine information that supports the MMO's decision-making process.

**UK Marine Industries Alliance**

http://www.ukmarinealliance.co.uk/

The UK Marine Industries Alliance is bringing together all aspects of this diverse sector with the goal of working together to secure the maximum opportunity for the industry to flourish. All UK companies, trade associations and public sector agencies operating in the marine sector are offered free membership of the UK Marine Industries Alliance, and use of its brand identity.

## ANNEX 3: ANNOTATED BIBILOGRAPHY - NOVA SCOTIA RESEARCH

The following section provides an annotated bibliography of research, up to the date of this report, in Nova Scotia on tidal in-stream energy conversion (TISEC) technology. The annotations also include information on marine renewables, wind energy and renewable energies generally. The focus of the annotations is to highlight points that are relevant to industrial development, policy and the socio-economic issues related to renewables and TISEC in Nova Scotia.

<table>
<tr><td>Sector:</td><td colspan="3">General - Renewable/Sustainable Energy Development</td></tr>
<tr><td>Category</td><td>Policy Development</td><td>Jurisdiction:</td><td>Nova Scotia</td></tr>
<tr><td colspan="2">Title</td><td colspan="2">Type of Research/Report:</td></tr>
<tr><td colspan="2">Discussion Paper: Key Policy Elements for Nova Scotia to Achieve Stable and Equitable Renewable Electricity Growth</td><td colspan="2">Policy Discussion Paper</td></tr>
<tr><td colspan="2">Author(s)</td><td colspan="2">Key Issues Raised:</td></tr>
<tr><td colspan="2">Nova Scotia Sustainable Electricity Alliance (NovaSEA)</td><td colspan="2" rowspan="4"><ul><li>The problem of energy poverty and the vulnerability of lower income populations to fluctuations in energy costs caused by potential downloading of costs from integrating renewable energy into the main grid.</li><li>Energy access is a social equity issue not solely an economic development concern</li><li>Tendering of small projects may be too costly (proposal, assessments and approval processes) for communities at this point and it may be some time before that can be possible.</li><li>Potential of transfer of Feed in Tariffs (FIT's) funds to local development and community improvement programs</li></ul></td></tr>
<tr><td>Reference:</td><td>Nova Scotia Sustainable Electricity Alliance (2010)Discussion Paper: Key Policy Elements for Nova Scotia to Achieve Stable and Equitable Renewable Electricity Growth, pgs.6</td></tr>
<tr><td>Peer Reviewed</td><td></td></tr>
<tr><td colspan="2">Abstract / Executive Summary Details</td></tr>
<tr><td colspan="2" rowspan="2">The Alliance was formed as a result of a common mission to support the implementation of policies that facilitate the development of community based and community owned renewable energy production. The purpose of NovaSEA is to encourage a strong long term renewable energy policy framework; facilitate the transition to price stability that a secure long term supply of renewable electricity generation affords; and create an environment of equitable access to renewable energy development opportunities for all Nova Scotians.<br><br>The paper generally discusses policy elements that would support the development of community based and larger scale renewable energy in Nova Scotia. The paper suggests that promotion of renewable energy options should occur at the regional (E.g. NSPI), community and individual level Primarily discusses the role of various types of feed in tariffs (FIT's) for the promotion and viability of various forms of renewable energy.</td><td colspan="2">Discussion / Comments:</td></tr>
<tr><td colspan="2" rowspan="3">This is a brief paper which focuses on the role of community based energy security, production and the benefits in terms of environmental, economic and social measures. Does not discuss in detail any socio-economic issues but points to the possible transfer of funds created from FIT's to community development programs and the potential local economic benefits of smaller scale energy development, both directly in terms of job creation and investment and over the long term in terms of spin-off activities<br><br>The report discusses the benefit of encouraging through Feed In Tariffs (FIT's) and other incentives individual as well as community level renewable energy production. The report suggests that this could serve to incubate the development of small scale energy technology development, production, maintenance and retail sales.<br>The report identifies a problem associated with FIT's –that if payments from FIT's exceed a point the energy distributer (NS Power) may have to increase the cost to consumers elsewhere – placing an unnecessary burden on some populations. The report advocates for an Advanced Renewable Energy Tariff and General Tariff<br><br>Differentiation that would be determined by technology, resource availability, etc. However, it also suggests that there should be no limit on the community scale FIT. Micro-FIT's (for technology for the home or for a small business) are also recommended as they</td></tr>
<tr><td colspan="2">Other Information / Link:</td></tr>
<tr><td colspan="2">http://novasea.ca/site/wp-content/uploads/2010/03/NovaSea-Policy-Paper-Final-Draft-v3-1-2.pdf</td></tr>
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| | allow for two factors 1) individual energy security / reduced costs/income generation and 2) the development of small scale direct consumer technology. The author suggests that tariffs should be set so as to send clear market signals to those technologies that are emerging, commercially viable and that are preferential from an ecosystem perspective. |

<table>
<tr><td>Sector:</td><td colspan="3">Renewables - General</td></tr>
<tr><td>Category</td><td>Public Consultation</td><td>Jurisdiction</td><td>Nova Scotia</td></tr>
<tr><td colspan="2">Title</td><td colspan="2">Type of Research/Report:</td></tr>
<tr><td colspan="2">Stakeholder Consultation Process for a New Renewables Energy Strategy for Nova Scotia: Final Report to the Government of Nova Scotia</td><td colspan="2">Report on stakeholder consultation process</td></tr>
<tr><td colspan="2">Author(s)</td><td colspan="2">Key Issues Raised:</td></tr>
<tr><td colspan="2">Dr Michelle Adams, Dr David Wheeler<br>Faculty of Management, Dalhousie University</td><td colspan="2" rowspan="5"><ul><li>Engagement of community based enterprises is seen as a key factor in meeting renewable energy targets.</li><li>Public recognizes the importance and value in developing renewable energy options, however they are reluctant or unwilling to pay more than they currently do for renewable energy. In order, wind (99%), solar (93%) and tidal (91%) are the top three preferred options for development.</li><li>Revenues required from consumers is expected to rise between (7 -9%, APEC) if NS is to meet its 2015 targets under certain energy mix scenarios (tidal is not included under this)</li></ul></td></tr>
<tr><td>Reference:</td><td>Dr Michelle Adams, Dr David Wheeler (2009)Stakeholder Consultation Process for a New Renewables Energy Strategy for Nova Scotia: Final Report to the Government of Nova Scotia (pgs. 52)</td></tr>
<tr><td>Peer Reviewed</td><td>Professional</td></tr>
<tr><td colspan="2">Abstract / Executive Summary Details</td></tr>
<tr><td colspan="2" rowspan="2">This report presents findings from stakeholder consultations on a renewable energy strategy for Nova Scotia. The results are compiled from hundreds of responses and a range of interest groups. The report presents recommendations on a) ideal energy source mix from renewables (wind and biomass are prominent), b)regulation, marketing and sector development framework to successfully develop a renewable strategy, including research and governmental department roles. The Utility and Review Board is seen as a key player in the effective integration of renewable energy into the power mix for Nova Scotia – the report suggests that the UARB mandate should be altered to include the development of FIT's.</td></tr>
<tr><td colspan="2">Discussion / Comments:</td></tr>
<tr><td colspan="2">Other Information / Link:</td><td colspan="2" rowspan="2">The report utilized survey data and interview and personal submission data from hundreds of Nova Scotians, to understand the current public perception and openness to renewable energy development. Serves as a good starting point for several socio-economic issues.<br>Highlights many of the regulatory and business development issues associated with renewable energy development. There is a distinct focus on bio-mass as an option and tidal is not discussed, however hydro is marginally considered. Economic impacts are primarily focused on two groups 1) consumers and 2) small and community based energy developers. Key concerns include the cost transferred to consumers in the short and intermediate phase of renewable development from additional connections and converter stations, the cost of Feed In Tariffs and administrative work associated with site assessment and approval processes, development and payment of FIT's. General sense is that low income households and SME's will see increases in power prices, which may unfairly burden them. Discussion of a power poverty plan is discussed but only in loose terms, and the report suggests this is an issue the provincial government will have to investigate. Report (pg. 22) acknowledges that there will be different impacts for different groups in the population, but only suggests that this is an issue the government will have to address.<br>Access to grid connectivity is mentioned as an issue if NSPI remains the primary decision maker in where and how those connections and converters are placed. Processes for approval need to be</td></tr>
<tr><td colspan="2">http://www.gov.ns.ca/energy/resources/EM/renewable/Wheeler-Renewable-Stakeholder-Consultation-</td></tr>
</table>

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|---|---|
| Report.pdf | streamlined the report recommends a one-stop shop where all approval needs can be met in one however long process.<br>Specifically in the case of community based energy development, the report suggests that expert advice for all aspects of energy development should be available to community groups so that opportunity is not lost simply because of a lack of access to skills that are available within the province. This could be done through establishing a network of experts to consult with any community based enterprise wanting to engage in renewable development |

| | |
|---|---|
| Sector: | Renewables - General |
| Category | Business Development |
| Jurisdiction: | Nova Scotia |
| Title | FINAL REPORT Renewable Energy Opportunities and Competitiveness Assessment Study |
| Type of Research/Report: | Consultants Report – Investigating the business opportunities for full-service of renewable energy industry in Nova Scotia |
| Author | SLR – Environmental Consultants For: NS Department of Energy, Business and Technology Division |
| Reference: | SLR – Environmental Consultants (2010)*FINAL REPORT Renewable Energy Opportunities and Competitiveness Assessment Study*, For: NS Department of Energy, Business and Technology Division |
| Peer Reviewed | NA |
| Key Issues Raised: | • Provides listings of many of the renewable energy developers in Canada and renewable demonstration projects.<br>• There is an MOU signed between Maine & NS to develop OE –R &D, networks etc.<br>• Tidal energy projects are limited in Canada, with BC, ON, & NS appearing to be the only ones active in tidal energy<br>• Cites government approval times as a major challenge or opportunity for the development of tidal energy in Nova Scotia<br>• In the event of commercialization, industrial capture rates in Nova Scotia are expected to be high<br>• Of note is that fact that of the three demonstration projects that have or will be present in the Bay of Fundy only Vancouver based Clean Current's design is the only unit to be designed, built, and operated in Canada. |
| Abstract / Executive Summary Details | The focus of this study is to examine the opportunities for the business community in Nova Scotia to participate in the manufacturing, development, operation, servicing and maintenance of renewable energy projects locally, regionally and internationally. The study provides insights as to how the provincial government might assist Nova Scotia-based firms to take advantage of those opportunities. Particular emphasis is placed on the wind power and in-stream tidal power opportunities. |
| Other Information / Link: | http://www.gov.ns.ca/energy/renewables/explore-invest/recent-reports.asp |
| **Discussion / Comments:** | **T**his reports provides an overview of the potential Nova Scotia has in developing a renewable energy sector and the competitiveness of Nova Scotia in this sector generally. The report provides a good starting point for assessing the economic development capacity of the tidal industry in Nova Scotia. At the beginning of the report a list of relevant policy and financial components of the Nova Scotia context are provided (E.g. COMFIT's etc)<br>The report is divided into three sections. Section 1 highlights the state of current wind and tidal energy investment, level of government support through incentives etc. and current and planned projects. International, National and Regional (Atlantic Provinces) level information is presented and the challenges, potential and/or competitive advantage of that area is highlighted.<br><br>Section 2 looks specifically at Nova Scotia and the supplier capabilities, supply chain opportunities and other issues. The information and discussion of tidal energy is relatively scant compared to wind, but the report identifies that this is largely due to the mostly R & D phase that the industry is in, but remains positive about Nova Scotia companies being able to meet most if not all of the manufacturing and other inputs required to develop tidal energy in Nova Scotia. A significant factor in establishing tidal and other renewables is connecting them to the grid – due to the geographic location of these resources an expanded grid system will be required, employing hundreds over a long period of time. Similarly port facilities and their over land connections would see gains in the import and potential |

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| | export of tidal related products as well as other activities such as maintenance of in stream systems. The following characteristics were identified as important to ocean energy developers:<br>• For construction the port must have 24 hour access, long quays, craneage, hardstanding surfaces for work and skilled labour<br>• The location of the port does not have to be close to the installation point for construction, however for major manufacturers a close (to the installation) port of choice is preferred to minimize personnel transfer times<br>• A small area of land with long term availability is required, where there is no conflict with other port facilities<br><br>Section 3 is a summary of potential investment and employment in renewable energy in Nova Scotia. The report suggests that local demand for tidal is estimated at up to 110 MW by 2020. With large 2 MW tidal turbines, this equates to some 55 units. Cost data presented from the deployment of 55 large units would result in an estimated investment of $165M by 2020 (assuming costs go down from the experimental stage), with an estimated 60% to 70% local capture, and would create over 340 person-years of employment. Fundy Tidal Inc. is moving forward with small tidal technologies, which at these early stages appears to hold the promise of high Nova Scotia content (70% to 80%).<br><br>Section 3.2 provides a list of manufacturers, operators and specialized suppliers of renewable related technologies or who do or are able to provide component parts operating in Nova Scotia.<br><br>Section 4.0 provides an overview of education and research that is occurring in Nova Scotia related to renewables.<br><br>Section 5.O identifies potential markets for Nova Scotian renewables and related products – in particular the North-eastern seaboard for tidal, as well as smaller/remote communities for smaller tidal (Fundy Tidal and local suppliers)<br><br>Page 8 provides a graph highlighting the tidal power projects that are a) established and b) those that are expected to come online in the future up to 2013. The UK by far has the most current and future projects in tidal. The report goes on to suggest that the timeline for commercialization of the tidal industry in generally as of 2008 is 10-20 years off. However the report suggests that Nova Scotia –due to the current attention in the Bay of Fundy, could see tidal energy become a significant contributor to the grid around 2016-2020. |

| Sector: | Renewables – General | | |
|---|---|---|---|
| Category | Economic Development | Jurisdiction: | Nova Scotia/New Brunswick |

**Title:**

More than Wind: Evaluating Renewable Energy Opportunities for First Nations in Nova Scotia and New Brunswick,

**Author**

Diana Campbell

| Reference | Diana Campbell, (2011) *More than Wind: Evaluating Renewable Energy Opportunities for First Nations in Nova Scotia and New Brunswick,* for the Atlantic Policy Congress of First Nations Chiefs Secretariat, under The Atlantic Aboriginal Economic Development Integrated Research Program |
|---|---|
| Peer Reviewed | Professional |

**Abstract / Executive Summary / Excerpt**

The Atlantic Policy Congress of First Nation Chiefs, under the Atlantic Aboriginal Integrated Research Program, commissioned More than Wind: Evaluating Renewable Energy Opportunities for First Nations in Nova Scotia and New Brunswick to identify and summarize information regarding the development of renewable energy in both the Province of Nova Scotia and New Brunswick. This report is intended to assist First Nations in understanding renewable energy opportunities and provide recommendations on how they might more actively participate in new development. (Taken from page 13)

There are 13 Mi'kmaq First Nations in Nova Scotia and 15 Mi'kmaq or Maliseet First Nations in New Brunswick. The communities range in size from 101 to 3,955 members. First Nations in Nova Scotia belong to either the Union of Nova Scotia Indians or the Confederacy of Mainland Mi'kmaq Tribal Councils. The Assembly of Nova Scotia Mi'kmaq Chiefs is a body that is comprised of all thirteen Chiefs and has the

**Type of Research/Report:**

Policy Document /

**Key Issues Raised:**

- In the case of renewables, including TISEC, many resources are located in areas where Aboriginal title is being negotiated, or is asserted but not yet proven
- The majority of band employees are not familiar with renewable energy development, education, training or development potential
- The Nova Scotia Mi'kmaq are currently developing a long-term renewable energy strategy, and it is expected to be completed in the spring of 2011 (not yet released)
- First Nations in NS & NB are concerned about the impact of tidal energy development on their fishing rights

**Discussion / Comments:**

This research project entailed a literature review of materials related to aboriginal and non-aboriginal renewable energy development, three surveys of Economic Development, Native Employment, or Education Officers in New Brunswick and Nova Scotia, and a series of telephone and in-person interviews

This report provides a concise breakdown of the legislation, to date activities, policy priorities and funding opportunities in Nova Scotia regarding renewable energy in Chapter 3, and 4. Chapter 5 outlines the current projects and the energy potential in Nova Scotia and New Brunswick as well as current and expected First Nations participation.

Chapter 7 highlights the educational an employment possibilities for NS and NB first nations. Given their higher than average growth rates and much younger median age they present a potential renewable energy workforce. Additionally a special educational tracking system by the Mi'kmawKina'matnewey (MK), the Nova Scotia Mi'kmaq Education Authority called the Student Information System (SIS) which can track and report on K-12 student achievement, programme enrolment, and graduation expectations for those students attending on-reserve

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| mandate to represent the Mi'kmaq on issues that impact all communities. (Taken from page 30)<br><br>The Assembly of Nova Scotia Mi'kmaq Chiefs are party to the Mi'kmaq-Nova Scotia-Canada Framework Agreement, which lists renewable resources as one of the matters to be negotiated. The Mi'kmaq have expressed interest in collaborating on the development of the renewable energy sector and have notified the Provincial Government that they intend to be consulted on energy development in this Province through the Mi'kmaq-Nova Scotia-Canada Consultation Terms of Reference. (Taken from page 31) | federally funded schools. This presents an opportunity to link the data managed through the MK PSE SIS to the Aboriginal EnviroCareers module administered by ECO Canada could potentially link renewable energy employers to First Nation graduates.<br><br>Appendix 6 provides information on wind, solar and biomass energy potential for all First Nations in NS & NB - tidal is not included in these profiles.<br><br>The study goes on to discuss the potential benefits of developing renewable energy projects in partnership with or on First Nations land. In particular a) there is no Nova Scotia Business Occupancy Tax (BOT), b) business hours are not regulated by the province, c) the band will have access to funding, research and training opportunities unique to Aboriginal business, including the Centre for Indigenous Environmental Resources & the Ulnooweg Development Group which works in Atlantic Canada providing business loans to aboriginal communities, d) decision making at the local level is much faster due to the nature of First Nations communities. Other benefits to Band communities are the lowered energy costs associated with paying the energy bills for on-reserve band members, such as seniors and those in receipt of social assistance. |
| Other Information / Link: | |
| http://www.unsi.ns.ca/upload/file/more%20than%20wind%20-%20evaluating%20renewable%20energy%20opportunities%20for%20first%20nations%20in%20nova%20scotia%20and%20new%20brunswick%5B1%5D.pdf | |

| | | | |
|---|---|---|---|
| Sector: | Renewables-General | | |
| Category | Economic Impact | Jurisdiction | Nova Scotia |

**Title**

**Economic implications of renewable energy in Nova Scotia**

**Author**

Michael Gardener, Gardener-Pinfold Consulting Economists Ltd.

| | |
|---|---|
| Reference: | Michael Gardener (2009)*Economic implications of renewable energy in Nova Scotia*, Gardener-Pinfold Consulting Economists Ltd, pgs. 16 |
| Peer Reviewed | Professional |

**Abstract / Executive Summary Details**

This paper is a consultative process aimed at building a consensus on a preferred approach for meeting Nova Scotia's renewable energy target. It is one of three papers examining the social, environmental and economic implications of four alternative scenarios developed to meet the target. This paper focuses on economics. Its specific objective is to identify the costs and benefits arising from each scenario, with a preliminary assessment of risks and implications to consumers in Nova Scotia. (Taken from pg. 2) The assessment is conducted within a social benefit-cost analysis (BCA) framework, also referred to by some as "full-cost" accounting. This is a conventional approach for evaluating public sector projects. BCA is a tool designed to assess the economic efficiency of a proposed initiative from the perspective of society as a whole. In general terms, a project would be considered economically efficient if society is better off as a result of the investment..

**Other Information / Link:**

http://eco-efficiency.management.dal.ca/Files/NSREC/NSREC_Energy_Future_Final_Report_111609.pdf

**Type of Research/Report:**

Economic Impact Assessment - Benefit Cost Analysis - Policy

**Key Issues Raised:**

- Current costs associated with non-renewable energy is not being captured effectively in Nova Scotia
- There are long range impacts from non-renewable sources in the forms of health and income burdens, as well as a loss of economic diversity generated in developing new industrial sectors.
- Electricity rates will increase with action on GHG's – including the development of ocean energy. However, as the shift to renewables occurs energy demand and conservation investments are likely to increase which may result in overall lower energy costs despite higher per unit costs.
- FIT's are likely the best mechanism to encourage renewable energy investment and should be a) technology specific, b) reduce automatically to reflect changes in technology and knowledge to avoid windfalls

**Discussion / Comments:**

Report presents 4 scenarios under which renewable energy targets (2015 & 2020) are met using varying mixes of technology and energy demand management/conservation. Tidal is not a significant feature in this discussion. The focus of the report is primarily on wind, but tidal is featured in scenario 3 & 4. The report in its caveats points to the fact that costs associated with ocean energy development generally are difficult to assess due to the largely R & D phase of technologies and the uncertainty around permitting and approval processes.
This report serves as a clear and concise examination of the full cost of renewable energy development in Nova Scotia.

| | | | |
|---|---|---|---|
| Sector: | Renewables - General | | |
| Category | Economic Development | Jurisdiction | Nova Scotia |
| Title | | Type of Research/Report: | |
| Draft COMFIT Tariffs: Initial Calculations and Discussions | | Finance | |
| Author | | Key Issues Raised: | |
| Synapse Energy Economics Inc. | | • Investors interested in tidal energy are likely to experience a great share of risk<br>• Potential investors are likely to see size and portfolio risk in all COMFIT projects (pg. 6).<br>• Lenders (financial institutions) will find it challenging to finance COMFIT projects because of project sizes, ownership structures and because technologies are emerging.<br>• Non-recourse financing may be difficult to secure in COMFIT's<br>• Due to the state of tidal technology at the time of this report the authors foresee tidal assuming a 100% equity financing model<br>• Lenders suggested that Debt Service Coverage Ratio's for COMFIT's are expected to be set at least 1.5x (.3 higher than non-COMFIT projects) | |
| Reference: | Synapse Energy Economics Inc.(2010),*Draft COMFIT Tariffs: Initial Calculations and Discussions*, pgs. 22 | | |
| Peer Reviewed | Professional | | |
| Abstract / Executive Summary Details | | **Discussion / Comments:** | |
| This document is first deliverable from Synapse Energy Economics acting as consultant to the Nova Scotia Utility and Review Board ,in the process of developing Renewable Energy Community Based Feed-in Tariffs. These tariffs include: two size ranges of wind, combined heat and power (CHP) biomass, small scale in-stream tidal, and run-of-the-river hydroelectricity. | | This report is dated as the COMFIT's that it is describing have already been established. However, it does provide insight into how renewables and in particular in-stream tidal energy is looked at from a financing perspective. The authors assume that tidal will be the most difficult to finance due to the development cost and the emergent nature of the technology. The authors also point to the possibility that tidal may be unable to garner much support from lenders due to the risk associated with investing in a costly and new technology. In particular COMFIT sized projects are expected to be small and operated by organization inexperienced in energy generation (municipalities, universities, etc.) thus posing additional risk. Manulife, for example, stated that they would likely not be involved with COMFIT projects since their threshold is $10 million and above. (pg. 7)<br>Page 8 provides a breakdown of the requirement of developers in securing an interconnection to the grid of greater than 100 kW and serves as an example off one of the many cost hurdles COMFIT projects may face. | |
| Other Information / Link: | | | |
| http://www.wind-works.org/FeedLaws/Canada/NovaScotiaDraft_Tariffs_12-10-10%20%282%29.pdf | | | |

| | | | |
|---|---|---|---|
| Sector: | Renewables –General | | |
| Category | Planning | Jurisdiction: | Nova Scotia |
| Title | | Type of Research/Report: | |
| Renewable Electricity Plan: A path to good jobs, stable prices, and a cleaner environment. | | Plan | |
| Author | | Key Issues Raised: | |
| Nova Scotia Department of Energy | | • The 2015 target of 25 percent renewable electricity will have the force of law<br>• Tidal energy will play a large role in achieving the target<br>• Plan establishes a community-based feed-in tariff (COMFIT) for distribution connected tidal projects and a special FIT covering direct incremental costs related to device deployment for developmental tidal arrays connected to the grid at the transmission level | |
| Reference: | Nova Scotia Department of Energy. (2010). Renewable electricity plan: a path to good jobs, stable prices, and a cleaner environment. 32 pgs. | | |
| Peer Reviewed | Professional | | |
| Abstract / Executive Summary Details | | **Discussion / Comments:** | |
| This Renewable Electricity Plan sets out a detailed program to move Nova Scotia away from carbon-based electricity towards local sources of hydro, wind, solar, biomass, and tidal energy. The plan commits the 2015 target of 25 percent renewable electricity to law, with penalties for any failure to meet it. The 40 percent target for 2020 is the goal, which may require expanded grid connections and a greatly expanded role for tidal energy. The plan uses several mechanisms to achieve the transition, with roles for everyone from Nova Scotia Power and large independent producers, to community organizations and committed citizens. | | The plan encourages projects though the COMFIT for an expected 100 MW of renewable energy projects connected to the grid at the distribution level. The plan also introduces programs to assist community groups in the technical, financial and regulatory work needed to develop these projects.<br>The net metering program provided by Nova Scotia Power is enhanced by this plan, as projects up to one megawatt will be eligible to use two-way meters, and participants will receive payment at retail rates for excess power produced. The plan is part of a larger strategy on clean energy production and use to be released in 2011.<br><br>The background report for this plan was prepared by a consulting team from Dalhousie University (See the annotation, for report by the Adams & Wheeler, 2009). | |
| Other Information / Link: | | | |
| http://www.gov.ns.ca/energy/resources/EM/renewable/renewable-electricity-plan.pdf | | | |

<table>
<tr><td>Sector:</td><td colspan="3">Renewables – General</td></tr>
<tr><td>Category</td><td>Planning</td><td>Jurisdiction:</td><td>Nova Scotia</td></tr>
<tr><td colspan="2">Title</td><td colspan="2">Type of Research/Report:</td></tr>
<tr><td colspan="2">Update and Preliminary Guide on Renewable Electricity in Nova Scotia: Renewable Electricity Plan Implementation</td><td colspan="2">Government Publication</td></tr>
<tr><td colspan="2">Author</td><td colspan="2">Key Issues Raised:</td></tr>
<tr><td colspan="2">Nova Scotia Department of Energy</td><td colspan="2" rowspan="4"><ul><li>A new website has been established to provide information and accept applications for the renewable electricity program (www.nsrenewables.ca). Application processes for both COMFIT and medium to large-scale projects Independent Power Producer (IPP) projects are done through the website</li><li>The Renewable Electricity Administrator (REA) is an independent authority that will oversee the competitive bidding process for medium and large-scale IPP projects. Legislation and regulations gives the REA authority to issue a call for bids on renewable electricity projects, evaluate proposals, and award contracts to the successful bidder(s).</li><li>Medium and large-scale renewable electricity projects will be split evenly between NSPI and IPPs in order to better understand whether a regulated rate-of-return utility model or a competitive process delivers best long-term value.</li><li>COMFIT rates are set at different levels to account for differences in the relative costs of each technology type, and to best accommodate for economies of scale. Small-scale in-stream tidal devices will have a different rate than developmental tidal array projects.</li></ul></td></tr>
<tr><td>Reference:</td><td>Nova Scotia Department of Energy. (2010). Update and preliminary guide on renewable electricity in Nova Scotia: renewable electricity plan implementation. 20 pgs.</td></tr>
<tr><td>Peer Reviewed</td><td>Professional</td></tr>
<tr><td colspan="2">Abstract / Executive Summary Details</td></tr>
<tr><td colspan="2" rowspan="2">In April 2010, the Government of Nova Scotia released its Renewable Electricity Plan to support and encourage increased development of renewable energy resources for electricity generation. In October 2010, the Province of Nova Scotia enacted renewable energy regulations supporting the Renewable Electricity Plan. This guide explains the new law related to renewable electricity. The guide provides a background and overview of the plan, how the system will work, and overviews the public feedback on the draft regulations.</td><td colspan="2">Discussion / Comments:</td></tr>
<tr><td colspan="2" rowspan="3">Although the competitive bidding process has been used in the past for IPP renewable electricity projects, addition of the REA is new and has changed aspects of the bidding process. To learn more about the process and role of REA refer to www.nsrenewables.ca<br><br>A review of the Renewable Electricity Plan will be conducted within 18 months of implementation (sometime in 2012), to determine whether the regulations are appropriately supporting the target of reaching 25% renewable electricity supply by 2015. The review will help determine whether the current structure of the COMFIT is successful in supporting community-based projects.</td></tr>
<tr><td colspan="2">Other Information / Link:</td></tr>
<tr><td colspan="2">http://www.chebuctowindfield.ca/news/RER-Document-English.pdf</td></tr>
</table>

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|---|---|---|---|
| Sector: | Renewables - General | | |
| Category | Planning/Policy | Jurisdiction: | Nova Scotia |

| Title | Type of Research/Report: |
|---|---|
| Synthesis Paper Final: A renewable energy strategy for Nova Scotia | Synthesis Paper |

**Author**

Yves Gagnon

| | |
|---|---|
| Reference: | Gagnon, Y. (2009). Synthesis paper final: a renewable energy strategy for Nova Scotia. Presented to the Nova Scotia Renewable Energy Consultation. 34 pgs. |
| Peer Reviewed | Academic/Professional |

**Abstract / Executive Summary Details**

This Synthesis Paper was commissioned by the Nova Scotia Renewable Energy Consultation (NSREC) as a component of the renewable energy strategy of the Government of Nova Scotia. The paper synthesizes the outputs of stakeholder consultations and suggests favourable scenarios for Nova Scotia to meet its short and long-term renewable energy strategy while considering economic, social, technological, and environmental factors. The candidate scenarios are described in terms of relative costs, benefits, and risks. Each scenario is described to give a broad overview of their main issues, time scales, and barriers.

**Other Information / Link:**

http://eco-efficiency.management.dal.ca/Files/NSREC/NSREC_-_Synthesis_Paper_Final_Yves_Gagnon_-_December_2009.pdf

**Key Issues Raised:**

- Provides general context for renewable energy scenarios
- Nova Scotia should position itself to become a leader in emerging technologies such as tidal power, as the province has a distinct differential advantage in comparison to other jurisdictions

**Discussion / Comments:**

The author states that the Nova Scotia Renewable Energy Strategy should have clear provisions in regards to the Renewable Energy Credits obtained with the generation of electricity from renewable sources, and the stakeholder consultation does not appear to have addressed this issue.

The Renewable Electricity Plan (2010) also does not address Renewable Energy Credits for the purpose of carbon market trading.

| Sector: | Renewables -General | | |
|---|---|---|---|
| Category | Policy | Jurisdiction: | Nova Scotia |

| Title | Type of Research/Report: |
|---|---|
| Towards a Green Power Vision and Strategy for Atlantic Canada | NGO |

**Author**

Lipp, J., Tampier, M., Pattenden, M

| Reference: | Lipp, J., Tampier, M., Pattenden, M. (2006). Towards a green power vision and strategy for Atlantic Canada. 58 pgs. |
|---|---|
| Peer Reviewed | NA |

**Abstract / Executive Summary Details**

This report is part of a broader initiative led by Pollution Probe (an environmental non-government organization) to determine a path forward for renewable energy development in Canada. This report focuses on Atlantic Canada, and is informed by two workshops that discussed considerations for renewable energy development. The report stated that many technologies for capturing energy from the wind, sun, and geothermal sources are market ready, but are not being utilized to their full potential. Emerging technologies, such as offshore wind, tidal, and wave energy, need more research and technical support. Lack of infrastructure, awareness, and financing are some of the barriers that need to be addressed. The report identifies further barriers to green power development in the Atlantic region and proposes a framework for building a green power vision and strategy.

**Other Information / Link:**

http://www.pollutionprobe.org/old_files/Reports/Towards%20a%20Green%20Power%20Vision%20and%20Strategy%20for%20Atlantic%20Canada.pdf

**Key Issues Raised:**

A few key recommendations include:

- Green power credits that recognize the environmental qualities of green power may be one way to address the financial barriers – a certificate trading system should be explored for the region; a carbon tax is another option (p.44)
- Internalize external costs and implement full-cost accounting. This ensures that polluters (non-renewable energy producers) have to pay for changes in environmental quality, and the real cost is reflected in the price. Full-cost accounting enables renewable energy to be more competitive.
- Apply a system benefits charge where relatively small increases on consumers' bills (e.g. 0.5 cents/kWh or less) can lead to the accumulation of substantial capital to fund green power pilot projects, buy-downs, or other programmes.
- Streamline zoning, planning, and permitting requirements to enable rapid deployment of green power technologies at suitable sites

**Discussion / Comments:**

It should be noted that there have been many changes and updates in the renewable ocean energy sector since this report was published in 2006. Nonetheless, the report offers insightful background information on the context of renewable energy in Nova Scotia, New Brunswick, Prince Edward Island, and Newfoundland.

| Sector: | Tidal In-Stream Energy Conversion | | |
|---|---|---|---|
| Category | Policy | Jurisdiction: | Nova Scotia |
| Title | | Type of Research/Report: | |
| Sustainable Energy and Rural Development: Options and Alternatives: A Discussion Paper | | Discussion Paper | |
| Author | | Key Issues Raised: | |
| Bay of Fundy Marine Resource Centre | | • Rural areas are often disadvantaged in the level of direct economic benefits they can gain from renewable energy projects<br>• There is a need to develop financial structures that would allow rural Bay of Fundy communities to invest in tidal energy development in the Bay of Fundy<br>• Research into how private corporate ownership of Nova Scotia's electrical grid affects the ability of rural communities to benefit from tidal energy development | |
| Reference: | Date not provided, pgs. 14 | | |
| Peer Reviewed | NA | | |
| Abstract / Executive Summary Details | | **Discussion / Comments:** | |
| The purpose of this paper is to identify some possible models for ways that energy development can directly benefit rural communities.<br>The specific context for this paper is the development of tidal energy in the Bay of Fundy. The Bay of Fundy Marine Resource Centre (MRC) has been funded by OEER to research options for how rural communities can benefit from marine energy.<br>The paper includes research from other jurisdictions (national and international) on tidal and renewable energy, qualitative information from a group of Bay of Fundy communities and representatives of community organizations. | | The report is short, not particularly well written and often avoids discussing the details of examples cited when they would in fact be quite useful. The report does however, address the issue that socio-economic benefits to rural communities can be small if non-existent unless the proper planning and policy dimensions are in place prior to energy development. Suggested options include developing legislation around ensuring local direct benefits of energy development and the allocation of a percentage of all revenues from community based projects into community development funds for small business development. | |
| Other Information / Link: | | | |
| http://www.offshoreenergyresearch.ca/LinkClick.aspx?fileticket=KjAKSg07Km8%3D&tabid=199&mid=931 | | | |

| Sector: | Tidal In-Stream Energy Conversion | | |
|---|---|---|---|
| Category | Assessment | Jurisdiction: | Nova Scotia |

**Title**

Background Report for the Fundy Tidal Energy Strategic Environmental Assessment

**Author**

Jacques Whitford

| Reference: | Jacques Whitford (2008). Background report for the Fundy tidal energy strategic environmental assessment. Project No. 1028476 |
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| Peer Reviewed | Professional |

**Abstract / Executive Summary Details**

This report was commissioned jointly by the Offshore Energy Environmental Research Association (OEER) Tidal Advisory Group (TAG) and the New Brunswick Department of Energy. Both Nova Scotia, through the OEER, and New Brunswick are carrying out strategic environmental assessments (SEA) of marine renewable energy in the Bay of Fundy, with particular focus on tidal in stream turbines

This background report is intended to inform the SEA participants in both provinces by (a) drawing together existing information on the environment, the socio-economic context, and marine renewable technologies, (b) addressing potential interactions, and (c) identifying information gaps.

The report describes: Nova Scotia and New Brunswick's current energy demand and supply situation, policies, programs and renewable energy goals; the existing biophysical and socio-economic environment; the location and properties of high renewable energy potential locations; the types of ocean renewable energy technology; potential pilot and development scenarios; potential interactions between renewable energy technologies and the biophysical and socio-economic environments; cumulative effects; the contribution of ocean renewable energy to economic development in NS and NB and to community economic

**Type of Research/Report:**

Background Report

**Key Issues Raised:**

Based on the results of an issues scoping exercise, a list of Key Environmental Issues (KEIs) was prepared from which to focus the evaluation.

The KEI's evaluated include: Critical Physical Processes; Fisheries; Fish and Fish Habitat; Marine Benthic Habitat and Communities; Pelagic Communities; Marine Mammals; Marine Birds; Species at Risk; Aquaculture; Marine Transportation; Tourism and Recreation; Marine and Coastal Archaeological and Heritage Resources; and Economic Development.

**Discussion / Comments:**

The background report accounted for a broad range of biophysical and socio-economic issues related to tidal energy development. However, as noted by the authors, the information provided in the report is at an overview level and based on readily available sources. There are information gaps in the description of existing environmental and socio-economic conditions, ocean energy technologies, potential environmental interactions and management strategies. Given the lack of specific knowledge on the nature, location and timing of potential tidal power development projects in the study area, potential interactions are described in general terms.

It is assumed that all specific ocean energy projects, including demonstration projects, will be subject to project and site specific environmental assessment requirements as part of the regulatory environmental approvals process. This site specific evaluation, including consultation with potentially affected stakeholders, is considered vital for a complete evaluation of potential environmental effects and their significance as well as the development of specific mitigation and monitoring programs.

The report provides an overview of general planning and management considerations which may be implemented to avoid or reduce potential environmental interactions. There is heavy emphasis on physical processes and biological impacts, with less emphasis placed on socio-economic considerations.

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| development in coastal areas; information gaps and recommendations for addressing them. | Useful tables:<br>TABLE E.1 Typical Environmental and Socio-economic Interactions with TISEC Projects (pg. iii)<br>TABLE E.2 Summary of Data Gaps and Recommendations (pg. v) |
| Other Information / Link: | |
| http://www.offshoreenergyresearch.ca/OEER/StrategicEnvironmentalAssessment/BackgroundreportfortheFundyTidalEnergySEA/tabid/280/Default.aspx | |

<table>
<tr><td>Sector:</td><td colspan="3">Tidal In-stream Energy Conversion</td></tr>
<tr><td>Category</td><td>Assessment</td><td>Jurisdiction:</td><td>Nova Scotia</td></tr>
<tr><td colspan="2">Title</td><td colspan="2">Type of Research/Report:</td></tr>
<tr><td colspan="2">Fundy tidal energy strategic environmental assessment: community response report</td><td colspan="2">Consultant Report</td></tr>
<tr><td colspan="2">Author</td><td colspan="2">Key Issues Raised:</td></tr>
<tr><td colspan="2">OEER</td><td colspan="2" rowspan="4">The main public concerns were:<br>• Some of the recommendations were couched in terms that were too general, which could hamper implementation<br>• The SEA process is only advisory, there is no certainty that the recommendations will be (a)adopted and (b) acted upon<br>The main tidal developer concerns were:<br>• Requirements for extensive research should not delay the onset of small demonstration projects that would be unlikely to have adverse effects<br>• The SEA's recommendations for extensive consultation and stakeholder involvement should be streamlined to avoid duplication with existing processes and regulatory requirements.</td></tr>
<tr><td>Reference:</td><td>OEER Association. (2008). Fundy tidal energy strategic environmental assessment: community response report. Prepared for NS Department of Energy.</td></tr>
<tr><td>Peer Reviewed</td><td>Professional</td></tr>
<tr><td colspan="2">Abstract / Executive Summary Details</td></tr>
<tr><td colspan="2" rowspan="2">This report is an addendum to the Fundy Tidal Energy Strategic Environmental Assessment (SEA) Final Report. After the SEA Report was submitted on May 11, 2008, OEER held a second round of community forums to present an overview of the Report's conclusions and to seek community feedback. The forums, attended by about 150 participants, were held in six locations throughout Nova Scotia. In addition, OEER received a number of written submissions in response to the Final Report.<br><br>This report is organized to cover the topics addressed in Chapters 4-11 in the SEA Report. A synopsis of the issues raised at each forum is included in each section together with pertinent extracts from written submissions. The three tidal developers involved in the proposed demonstration facility, Minas Basin Pulp and Power, Clean Current and Nova Scotia Power Inc. provided somewhat longer submissions (with some duplication) addressing each of the recommendations.</td><td colspan="2">Discussion / Comments:</td></tr>
<tr><td colspan="2" rowspan="3">The public consultation report showed that there was significant support at the six forums for the SEA recommendations, and particularly the ten sustainability principles. OEER's proposal to move ahead cautiously into the demonstration phase was met with approval. There was mixed response about how the recommendations would apply to small or community scale developments, and whether they should be subject to the same requirements of a berth holder at the FORCE demonstration facility. There was concern about exactly how community access to the tidal resource would be provided, and how communities might expect to receive a share of the economic rents that should eventually accrue to the Province. OEER responded that such concerns could be addressed in the proposed socio-economic background study (yet to be conducted).</td></tr>
<tr><td colspan="2">Other Information / Link:</td></tr>
<tr><td colspan="2">http://www.offshoreenergyresearch.ca/OEER/StrategicEnvironmentalAssessment/FinalSEAReport/tabid/312/Default.aspx</td></tr>
</table>

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| Sector: | Tidal Energy | | |
| Category | Governance | Jurisdiction: | Nova Scotia |
| Title | | Type of Research/Report: | |
| Tidal Energy: Governance Options for NS. | | Academic consultant | |
| Author | | Key Issues Raised: | |
| Doelle, M., Russell, D., Saunders, P., VanderZwaaq, D., & Wright, D. | | • There is uncertainty surrounding what marine areas are considered "within the Province" and what areas fall within federal property rights. This uncertainty may constrain the Province in exercising resource and regulatory jurisdiction over offshore tidal power projects.<br>• The governance options consider: 1) what might be done on the provincial level within the existing regulatory framework, and; 2) how Nova Scotia might move forward on federal-provincial relations on tidal power development | |
| Reference: | Doelle, M., Russell, D., Saunders, P., VanderZwaaq, D., & Wright, D. (2006). *Tidal energy: governance options for NS. Final Report*. Marine & Environmental Law Institute, Dalhousie University, 40 pgs. | | |
| Peer Reviewed | Academic | | |
| Abstract / Executive Summary Details | | **Discussion / Comments:** | |
| This report outlines governance options for tidal power development in the Bay of Fundy. The international and constitutional context within which any governance regime for the Bay of Fundy would exist is identified. The existing legislative and regulatory systems in place in Nova Scotia that relate to tidal power development are described. Related experiences in other jurisdictions are assessed, both with respect to tidal power and for other comparable offshore developments, such as wind. The report concludes with some preliminary thoughts on the essential elements of a suitable governance regime. | | This report provides an excellent overview of the constitutional and regulatory frameworks affecting tidal power development in the Bay of Fundy. | |
| Other Information / Link: | | | |
| http://law.dal.ca/Files/MEL_Institute/Reports/Tidal_Report_-_Feb06.pdf | | | |

| Sector: | Marine Renewables | | |
|---|---|---|---|
| Category | Policy / Legislation | Jurisdiction: | Nova Scotia |

| Title | Type of Research/Report: |
|---|---|
| Marine Renewable Energy Legislation for Nova Scotia<br>Policy Background Paper | Policy Guidance |

| Author | |
|---|---|
| Nova Scotia Department of Energy | |
| Reference: | Nova Scotia Department of Energy (2010), *Marine Renewable Energy Legislation for Nova Scotia*<br>*Policy Background Pape***r**Pgs.80 |
| Peer Reviewed | Professional |

**Key Issues Raised:**

- Collaboration with New Brunswick on research and regulation of tidal energy in the Bay of Fundy is important
- Suggests that public and stakeholder participation is an essential component to the success of marine renewable projects
- Report suggests marine renewable benefits (environmental) tend to be less concentrated on the area around the development rather they are regional and provincial.
- Nova Scotia currently lacks a strategic system for awarding tidal energy development rights to proponents.

Abstract / Executive Summary Details

This Paper is a partial response to the Offshore Energy Environmental Research Association's (OEER) Strategic Environmental Assessment which recommended that marine renewable legislation be created prior to allowing commercial-scale marine energy projects.

In order for the marine renewable energy industry to progress and grow in Nova Scotia, legislation and regulatory frameworks need to provide predictable, effective, and efficient processes that promote resource conservation, environmental, health and safety protection, advancement of environmental goals, and economic development. Legislation should place a high value on the long-term public interest while maintaining the overall integrity of internationally recognized habitats and species.(pg 9)

The report is divided into two parts. Part one outlines the challenges and opportunities related to the development of marine renewable energy in Nova Scotia. Part two outlines planning, policy, legislation and regulatory issues associated with the industry. In part two and in Appendix A & B the different regulatory, policy and legislative approaches are examined using a pro versus con approach and draws upon

**Discussion / Comments:**

This report is a much more substantial discussion of the issues raised in Marine Renewable Energy for Nova Scotia: A Discussion Paper. These two reports together offer a thorough examination of the issues surrounding the development of marine renewable legislation. In discussing the socio-economic impacts this report is more in depth but the report also acknowledges that there are gaps in knowledge around the impact on other users of the Bay of Fundy and marine environments and the quantifiable benefits to communities and the province. It should be noted that this report was composed prior to the development of the Community Feed In Tariffs.

Legislation would serve to provide clear, predictable, and efficient processes that would support the sustainable growth of the sector. Jurisdiction over offshore renewable resources has two aspects according to constitutional law: Nova Scotia ownership and related proprietary jurisdiction over areas of the seabed and federal legislative jurisdiction with respect to interference with fishing and navigation rights.(pg. 10)

Sections 2.1.2 – 2.3 identifies the legislation and codes that are relevant to the establishment of marine renewables and the multiple users and uses that would need to be considered/consulted in the development of marine renewables.

Section 3.0 – outlines potential renewable energy legislation from other jurisdictions that

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| examples from jurisdictions outside of Nova Scotia. | could serve as examples for the Nova Scotia context. In particular is the UK's approach to offshore wind energy as a valuable example.<br><br>Section 4.0 outlines the regulatory framework that marine renewable projects would need to pass through. The discussion is relatively general but does provide some information on the different processes involved in projects of varying scope and scale such as small scale and tidal arrays.<br><br>Section 6.0 outlines planning issues related to the installation and management of marine energy projects, of particular note is the concept of safety zones, which are applied in the offshore oil and gas industry. Safety zones are designed to ensure that activities cannot occur within a specified limit of the energy project. The report presents the pros and cons of two types – mandatory permanent or rolling basis which would shift according to energy project activity.<br>The report suggests that early and ongoing stakeholder engagement with tidal energy projects will assist in their success and the avoidance of conflicts between multiple users. |
| Other Information / Link: | |
| http://www.gov.ns.ca/energy/resources/spps/public-consultation/NS-MRE-Policy-Background-Final.pdf | |

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|---|---|---|---|
| Sector: | Marine Renewables | | |
| Category | Legislation – Public Input | Jurisdiction: | Nova Scotia |
| Title | | Type of Research/Report: | |
| Public submissions to Dr. Robert O. Fournier regarding marine renewable legislation | | | |
| Author | | Key Issues Raised: | |
| Multiple – Public Letter | | The following are highlights from the 18 different submissions in this document<br>• There is concern over the level of ecosystems disturbance and its impact on among other things fishing access<br>• Marine spatial planning is considered an important step in assessing impacts of tidal development may also serve as a valuable tool<br>• Concerns over Nova Scotia's Environmental Assessment process not being as rigorous as the Federal model<br>• Provincial and federal EA's do not address socio-economic impacts well, or to a useful extent. A separate socio-economic impact assessment should be a part of all projects.<br>• Need to establish clear geographic jurisdiction and subject matter jurisdiction related to the resource<br>• What transitional rights will those test projects in the Bay of Fundy have after their 4 year tenure in the Bay and should legislation be created to allow or preclude those rights?<br>• Legislation should facilitate collaboration and information sharing amongst developers, researchers, and regulators through incentives or other mechanisms<br>• Develop a clear and fair compensation system for other marine environment users, should MRE impact on their activities<br>• Make monitoring and baseline data available and public<br>• Rights allocation has to be fair but also take into account access for other users<br>• Development of clear indicators of environmental health, that are consistently monitored and available for public viewing and interpretation<br>• MRE legislation must include expropriation rights to allow for the most cost effective route from MRE collectors to the grid<br>• Rents and royalties will slow entrants into MRE projects and should not be seriously considered until the MRE is commercially viable, consequently legislation should be able reflexive and adaptive to changes in the industry and technology.<br>• Legislation should be created to avoid land banking in MRE, and eliminate the speculator market for land leases.<br>• Technology and impacts should be tested at sites outside of the Bay of Fundy in order to assess potential and specific requirements to that area<br>• Legislation will need to address caps on energy extraction in order to minimize environmental | |
| Reference: | Pgs, 176 | | |
| Peer Reviewed | | | |
| Abstract / Executive Summary Details | | | |
| NA | | | |
| Other Information / Link: | | | |
| http://www.gov.ns.ca/energy/resources/spps/public-consultation/marine-renewable-energy/Marine-Renewable-Energy-Legislation-submissions.pdf | | | |

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| | (or socio-economic) risks<br>• There is distinct need to allow for conditional licenses and investigative permits for developments so that investors can test the waters and engage in some risk aversion.<br>Submissions of particular interest are those from:<br>• ECELaw*<br>• FORCE*<br>• Fundy Environmental & Educational Consultants*<br>• Guysborough County Regional Development Authority*<br>• Marine Affairs Program (MAP), Dalhousie University*<br>• Ocean Renewable Energy Group*<br>• World Wildlife Fund – Marine Spatial Planning paper* |

| Sector: | Oceans Technology – General | | |
|---|---|---|---|
| Category | Business Development | Jurisdiction: | Nova Scotia |

**Title**

Defined by the sea: Nova Scotia's oceans technology sector present and future

**Author**

Government of Nova Scotia

**Reference:** Government of Nova Scotia(Date unknown)*Defined by the sea: Nova Scotia's oceans technology sector present and future, pgs. 24*

**Peer Reviewed**

**Abstract / Executive Summary Details**

This report highlights the current composition of Nova Scotia's ocean technology sector, current and potential future markets for ocean technology products, services and research currently being done in Nova Scotia. The oceans technology sector is comprised of knowledge intensive industries. Strategic areas of concentration include: acoustics, sensors, and instrumentation; marine geomatics; marine biotechnology; marine unmanned surface and underwater vehicles; marine data, information, and communications systems; and naval architecture. The market segments where these technologies and applications are required and applied are primarily defence and security; shipbuilding and marine transportation; ocean science and observation; offshore and coastal energy; and aquaculture and fisheries. The report does not discuss manufacturing. The report is primarily designed as a promotional report to entice investment and as a connection to the jobsHere strategy.

**Other Information / Link:**

http://www.gov.ns.ca/econ/sectors/docs/Defined_by_the_sea-NS_Oceans_Technology_Sector.pdf

**Type of Research/Report:**

Industry Profile / Promotional

**Key Issues Raised / Points of Interest**

- 15.5% or $5b of provincial GDP is from ocean related industries
- 75% of the core oceans technology sector are located in Nova Scotia
- Oceans technology sector is primarily composed of SME's with a few multinationals
- Oceans technology accounts for 1/3 of all R & D among businesses in Nova Scotia.
- The global market for ocean observation systems was estimated at approximately US$1.8 billion in 2006 and was expected to grow to US$2.2 billion by 2011.

**Discussion / Comments:**

This report serves as a brief overview of what are key industries in the ocean technology sector in Nova Scotia. The main thrust of the report is promotional and offers little in the way of critical examination of socio-economic issues.

The report serves as a useful starting point for understanding some of the key players in the oceans technology sector in Nova Scotia and lists a number of these businesses in the report. Many of these business are involved in a global value chain for products and services which indicates that these Nova Scotia companies are some of the most efficient in their sector.

Report emphasizes the robust institutional capacity in Nova Scotia to support an oceans technology cluster – of not are the Bedford Institute of Oceanography (BIO), Dalhousie University (in particular the Aquatron Laboratory which can simulate ocean environments and conditions), National Research Council Institute for Marine Biosciences.

The highlight of the report is on page 18 , which presents a table which lists all the major oceans technology and related research institutions in Nova Scotia and identifies the areas that each is currently working in. Provides a quick and concise illustration of the oceans research capacity in Nova Scotia.

| | |
|---|---|
| | Nova Scotia is home to a number of ocean-related industry associations in Nova Scotia, including the Oceans Technology Council under the Aerospace and Defence Industries Association of Nova Scotia (ADIANS). The Environmental Services Association of Nova Scotia (ESANS), Offshore Onshore Technologies Association of Nova Scotia (OTANS), and Nova Scotia Boat builders Association (NSBA), there are also connections to national associations, such as Ocean Networks Canada, the Alliance for Marine Remote Sensing, and the Ocean Management Research Network. These network s position Nova Scotia well to quickly uptake new technologies in this sector. The report closes by identifying provincial programs designed to assist in the development of oceans sector businesses. |

<table>
<tr><td>Sector:</td><td colspan="3">Wind Energy</td></tr>
<tr><td>Category</td><td>Environmental Assessment</td><td>Jurisdiction:</td><td>Nova Scotia</td></tr>
<tr><td colspan="2">Title</td><td colspan="2">Type of Research/Report:</td></tr>
<tr><td colspan="2">Proponent’s guide to wind power projects: guide for preparing an environmental assessment registration document</td><td colspan="2">Environmental Assessment guide</td></tr>
<tr><td colspan="2">Author</td><td colspan="2">Key Issues Raised:</td></tr>
<tr><td colspan="2">Nova Scotia Department of Environment</td><td colspan="2" rowspan="5">- Proponents with thoroughly prepared EA documents are less likely to be required by the Minister of the Environment to submit additional information once the EA process has begun.</td></tr>
<tr><td>Reference:</td><td>Nova Scotia Department of Environment. (2009). Proponent’s guide to wind power projects: guide for preparing an environmental assessment registration document. 19 pgs</td></tr>
<tr><td>Peer Reviewed</td><td>NA</td></tr>
<tr><td colspan="2">Abstract / Executive Summary Details</td></tr>
<tr><td colspan="2" rowspan="2">This guide helps proponents ensure that issues associated with wind power projects have been considered prior to the submission of the Environmental Assessment Registration Document. The purpose of the guide is to: 1) provide a reference for proponents prior to registration for wind power projects; 2) to provide consistent advice regarding the assessment of wind power developments; and 3) to explain what is expected of Proponents of wind projects during the Environmental review process (p. 3).</td></tr>
<tr><td colspan="2">Discussion / Comments:</td></tr>
<tr><td colspan="2">Other Information / Link:</td><td colspan="2" rowspan="2">This guide helps simplify the process of preparing an EA registration document for wind power developers. The appendix includes hyperlinks to relevant reference documents, definitions of terms and abbreviations, and useful contact information. A similar guide may be useful for tidal energy developers.</td></tr>
<tr><td colspan="2">http://www.gov.ns.ca/nse/ea/docs/EA.Guide-Proponents-WindPowerProjects.pdf</td></tr>
</table>

| Sector: | Wind Energy | | |
|---|---|---|---|
| Category | Best practices | Jurisdiction: | Nova Scotia |

**Title**

Final report: model wind turbine by-laws and best practices for Nova Scotia municipalities

**Author**

Jacques Whitford.

**Reference:** Jacques Whitford. (2008). Final report: model wind turbine by-laws and best practices for Nova Scotia municipalities. Project No. 1031581. 177 pgs.

**Peer Reviewed:** Professional

**Abstract / Executive Summary Details**

This report summarizes the current state of knowledge on the impacts of wind energy generation, common and unique approaches, and "best practices". It also presents a set of model policy approaches and by-laws to be considered by Nova Scotia municipalities wanting to include provisions for wind energy generation in their land-use planning strategies and by-laws. Recognizing that each municipality has unique circumstances related to wind power generation, the model by-laws resulting from this study serve as starting points for municipalities in Nova Scotia interested in better policies and practices that will advance wind energy development in their jurisdictions while balancing and protecting a range of other community interests (p. iv).

**Other Information / Link:**

http://www.sustainability-unsm.ca/index.php?option=com_docman&task=cat_view&gid=49&Itemid=57

**Type of Research/Report:**

Consultant

**Key Issues Raised:**

The following results are presented in this report:

1. A short review of the status/issues with respect to wind energy development and municipalities in Nova Scotia.
2. A review of wind turbine zoning by-laws, guidelines and best practices in Nova Scotia.
3. A review of wind turbine zoning by-laws, guidelines and best practices, primarily in Canada.
4. Specific discussion and recommendations for model wind turbine zoning by-laws and practices for Nova Scotia municipalities, designed to conform with the Municipal Government Act, and available in a format which can be easily adopted and adapted by municipalities.
5. A compendium of science-based literature that supports the recommended by-laws and best Practices

**Discussion / Comments:**

Although the report is specific to best practices within the wind energy sector, there may be some useful information relevant to tidal energy development. Both wind and tidal sectors have uncertainties regarding socio-economic and environmental impacts. However, Nova Scotia municipalities cannot wait for scientific or societal consensus on all issues before they move forward on by-laws. This report shows that by-law decisions will in many respects need to be contextual, in consideration of the unique characteristics of each municipality - its communities, geography, energy potential, commitment to renewable energy alternatives, and resident's readiness or attitudes. The author states that there is "logic to consider intra-provincial, regionally consistent or integrated by-laws and policies in recognition of the trans-boundary nature of wind resources and economic potential" (p. v). This logic may also apply to tidal energy development.

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