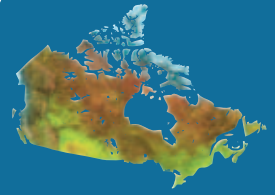




Natural Resources  
Canada

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**CanmetENERGY**

*Leadership in ecoInnovation*

Marine Energy Technology Team  
Renewable and Integrated Energy Systems

Strategic Plan 2010-2015

# CATCHING THE CURRENT



Canada

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Catching the current - strategic plan 2010-2015, Marine Energy Technology Team

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# Catching the Current

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# A Message from the Manager

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# Marine Energy Technology Team

The next five years are likely to be pivotal for marine renewable energy development in Canada and around the world. Marine energy's potential to provide a clean, continuous source of power has begun to attract significant interest from countries seeking sustainable, environmentally sound solutions for meeting their energy needs. Momentum is building, propelled by decades of research and innovation.

With a unique national perspective, our Marine Renewable Energy Technology team, part of the Renewable and Integrated Energy Systems division, is ideally positioned to help Canadian industry realize the commercial opportunities of marine energy. We promote dialogue and further the research and development (R&D) of wave, tidal current and hydrokinetic technologies by providing expert technical advice, delivering federal R&D projects and programs, and forging national and international networks that facilitate the sharing of knowledge, expertise and best practices. We also draw on CanmetENERGY's deep history in other renewable energy areas such as hydro-electric power and wind, and the country's experience in ocean engineering and offshore operations.

Through our work we aim to help discover niches in which Canada is particularly well suited to excel, furthering our competitive advantage. We are also committed to sharing our expertise on the global stage to help tackle the industry challenges that no single nation can take on alone.

Today's global marine energy sector is rich with a mix of technologies and players. The next step in its evolution is to execute large-scale real-world demonstrations. Such demonstrations are complex and capital intensive, demanding collaboration among a wide range of stakeholders including

technology developers and entrepreneurs, policymakers and technical experts in Canada and elsewhere. Our Marine Energy Technology team takes a comprehensive view of the innovation cycle, aiming to leverage collective knowledge and innovative partnerships to ensure Canada's marine energy investments stand the best possible chance of success.

This strategic plan captures our role in creating and supporting marine energy opportunities for Canada, the drivers and challenges associated with it, and the ways we can apply our expertise in the interest of all Canadians. It lays out the objectives we aim to achieve in the five years from 2010 to 2015, namely: overcoming technical barriers, contributing to better informed policy, strengthening our people and expertise, and helping Canada establish a position of leadership in marine energy on the world stage.

We will build on proven practices gleaned from other alternative energy sectors and work with industry and government stakeholders to explore the feasibility and effectiveness of marine energy technology in the Canadian context. And we will apply our technical perspective to ensure that those explorations are in the Canadian public's best interest.

I look forward to working in collaboration with our partners and sharing the results of our collective efforts as we enact this plan over the next five years.

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## **Melanie Nadeau, P.Eng.**

Manager, Marine & Hydro Energy Technologies  
Renewable and Integrated Energy Systems  
CanmetENERGY  
Natural Resources Canada



# Our strategic vision

By 2015, as Canada's science and technology leader in marine renewable energy innovation, our research will have accelerated Canada's capacity to develop world-class technology, demonstrating marine energy as a reliable source of power.

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## Catching the current

The Marine Energy Technology team is part of the Renewable and Integrated Energy Systems division at CanmetENERGY, Natural Resources Canada, the nation's largest centre for clean energy research and technology development. We are the only dedicated federal program with the mandate and experience to facilitate marine energy technology research, development and demonstration projects and programs.

Partnering with industry and academia, we help develop emerging Canadian innovative technologies. Collaborating with policy makers, we help develop the market regulations and standards that will allow these technologies to flourish in a responsible way. Our team provides leadership on key issues and facilitates longer-term, higher-risk initiatives that will increase the country's technical capacity. In every case, we are selective and strategic, applying our expertise where it is likely to yield the greatest value.

Canada's extensive coastal and inland waters make it an ideal country for proving the potential of renewable marine energy. By advancing technology, developing standards, sharing knowledge and delivering objective, evidence-based research results, we will help Canada's marine energy sector mature and establish a position of international competitiveness. Through our work, we will enable the adoption and application of international marine energy practices in the Canadian context, and provide a conduit for delivering Canadian discoveries to the world.

This 2010-2015 Strategic Plan outlines the path we will take to realize our vision and achieve objectives of value to our government partners, industry, academia, and the citizens of Canada.







Our vast coastal waters promise the emergence of an **innovative, globally competitive** renewable energy sector. Canada has the know-how and the resource to be a **global leader** in the emerging marine energy industry.



# Environmental scan

## Trends and drivers

Investment in renewable energy is growing around the world—surpassing expenditures on fossil fuels in 2008, according to the United Nations report, *Global Trends in Sustainable Energy Investment 2009*. Driving that investment is a matrix of political, economic, social and technological considerations ranging from long-term energy security to industrial competitiveness, public health and innovation. In response to the economic crisis that began in 2008, many countries have incorporated clean energy investments into their economic stimulus packages—to reduce energy costs, conserve resources, minimize environmental impacts and create ‘green’ jobs.

Canada has made its own clean-energy objectives clear, committing by 2020 to reduce greenhouse gas (GHG) emissions by 17 percent from their 2005 levels, and 50 percent by 2050. The federal government has implemented a variety of programs to support the country’s efforts to achieve these targets.

On September 1, 2009, the federal government announced its intention to launch a National Roundtable on Renewable Energy, and another on Clean Energy Science & Technology. At the provincial level, political will is evident in announcements of GHG reduction targets and requirements for increased production of renewable electricity.

All of this strongly indicates that momentum is building and opportunities are increasing for the development, demonstration and adoption of renewable energy technologies such as marine power.

## The Marine Energy Technology Team

We support technology research, development and demonstration in Canada by:

- Assessing water resources
- Disseminating science and technology results and findings
- Enabling the commercialization of new technology
- Developing the infrastructure—such as standards and codes—to support innovation
- Developing linkages between utilities, industry, and academia
- Identifying and developing opportunities for renewables integration
- Supporting federal policy and programs
- Supporting training and education

## Spotlight on marine

The value proposition of marine energy is compelling, especially for Canada, which has abundant inland and offshore marine resources. Tides, waves and rivers present continuous sources of energy. The industry-led Ocean Renewable Energy Group (OREG) notes that the oceans on their own have the capacity to meet “current global energy consumption levels.”<sup>1</sup>

As an economic subsector, renewable marine energy is at an early stage of development. Alternative technologies abound, the players are many, and the market itself is not yet defined.



Interest, however, is growing. Today, the International Energy Agency’s Ocean Energy Systems (IEA-OES) executive committee comprises 18 member countries, all signatories to an agreement to collaborate on the development of marine renewable energy technologies. Canada has been a member of IEA-OES since 2003.

OREG points out that there is a definite market opportunity given the country’s “ocean technology, engineering, shipbuilding, marine fabrication and marine operations experience,” and that “Canadian power export and trading experience will access green power markets.” Moreover, a marine energy industry could also explore business opportunities in the areas of “desalination, refrigeration, pumping, and hydrogen production.”<sup>2</sup>

OREG itself is an example of Canada’s leadership in marine energy. Founded in 2004 to align industry, academia and government and ensure Canada’s leadership in ocean energy solutions, it has become the largest dedicated marine energy association in the world. In 2005, the federal government added to the country’s marine energy capacity by creating the federal interdepartmental Marine Renewable Energy Committee, followed two years later by the Marine Energy Research and Development program.

While investments in tidal, wave and river energy projects are being made across the country, Canada’s marine energy sector remains relatively small and regionalized. Participating firms—and partners such as utility companies—are currently focused on leveraging the country’s R&D history to successfully implement marine technology on a large scale; explore new areas of application such as deep-water deployments (beyond the current typical five-kilometre limit); and produce the necessary technology components to help the industry grow.

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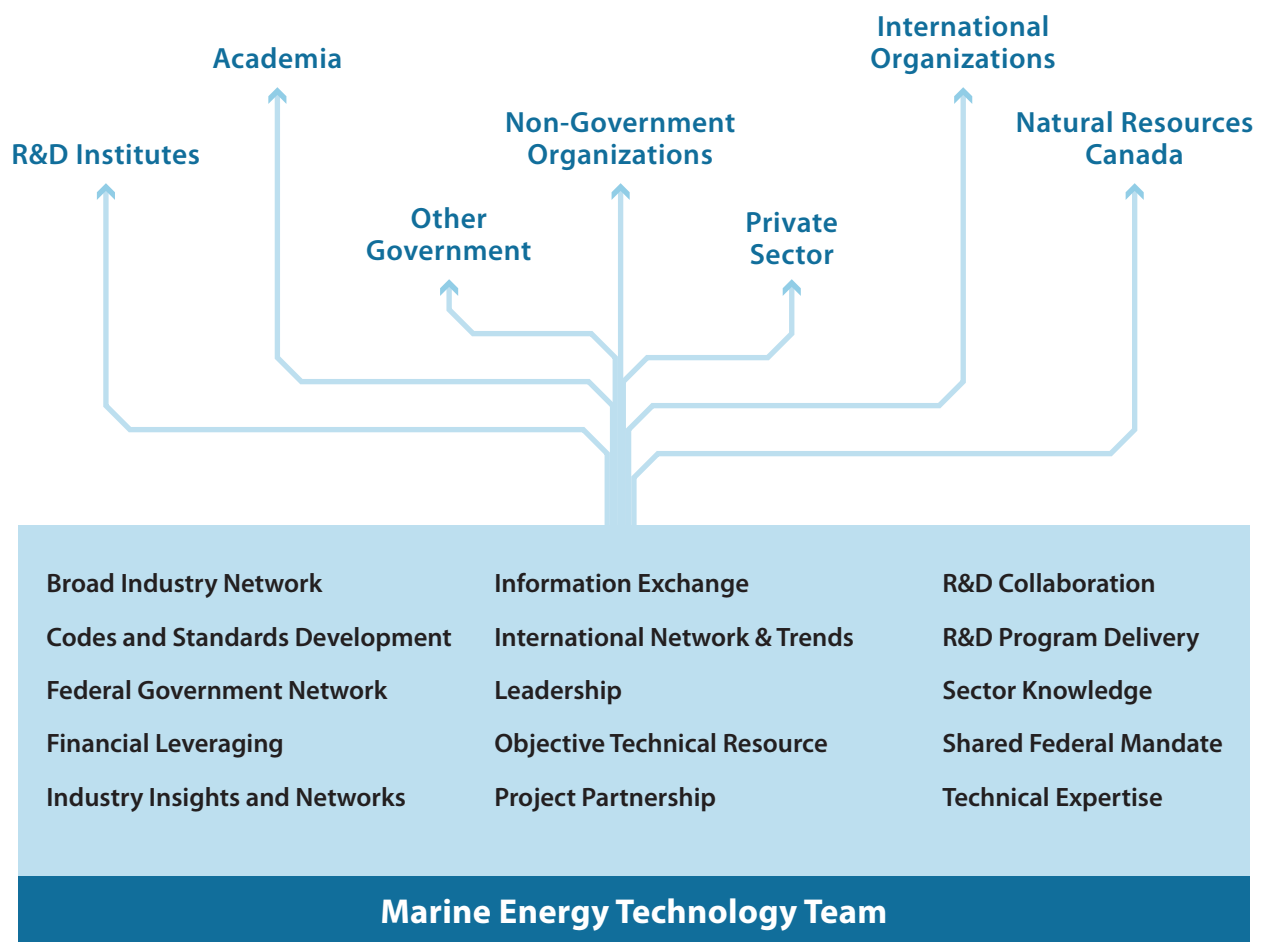
<sup>1</sup> *Ocean Energy Opportunity and Needs: The Business Case for Ocean Energy in Canada*, OREG

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<sup>2</sup> *Ibid*

## Canada's marine energy stakeholders

Canada's marine energy sector is comprised of R&D organizations, non-governmental organizations, several government departments including Natural Resources Canada, international governments and a diversity of private-sector players.





## Needs and challenges

Despite the rising interest in marine renewable energy, few concrete targets or commitments have been set by governments to actively spur its development. Public debate continues over the possible impact of marine energy deployments on coastal environments. As a still-young organization tasked with supporting technology development in an evolving sector, the Marine Energy Technology team faces a number of internal and external challenges in pursuing its vision.



## Internal challenges

As is the case for any young organization, one of the first tasks before the Marine Energy Technology team is to raise awareness of our offering among stakeholders within and outside of government. This requires internal resources—the time and effort of skilled personnel. Consequently, expanding our team is a challenge we must also address: specifically, attracting and retaining qualified staff members who will provide us with the long-term capacity and technical capability to seize upon emerging opportunities. We will have to be competitive and creative in this respect, given that talent is highly sought after in all sectors today.

More broadly, for the sake of the whole sector, we will work with industry and academia to ensure the availability of personnel with the right skills to drive innovation and commercialization.

Stable ongoing funding will be key to meeting our human resource (HR) needs—and to our ability to support the industry in its work. Marine energy technology development and large-scale demonstration are extremely capital-intensive. To ensure our relevance and to deliver real value to industry—and ultimately all Canadians—we recognize we must be strategic and selective in targeting our funds, directing them where we know we can have the greatest impact.

Relevance hinges also on our ability to improve understanding of marine energy technology in an incremental way—achieving step-by-step advances that strengthen Canada’s marine energy position and propel the country’s industry toward market success.

## External challenges

Validating marine energy technology through large-scale, real-world demonstrations will be critical to the success of Canada's industry in the five-year period from 2010 to 2015—proving its viability and also, for government funders and private investors alike, to demonstrate an acceptable return on investment to secure ongoing support. As mentioned previously, such demonstrations are complex, costly and require extensive collaboration.

Conventional energy remains a priority in Canada. We will work to increase the focus on marine renewable energy and to encourage the participation of traditional power producers in this nascent sector—to attract investment and encourage the sharing of technology and experience.

Regulation and standards are other areas requiring attention. In Canada, electricity production is regulated by the provinces, yet marine energy generation will occur largely in federal waters, particularly on the west coast. Our team will need to better inform policymakers and political leaders on the considerations involved. Standards will be essential to guiding and sustaining long-term growth for offshore renewables.



## Opportunities

Our Marine Energy Technology team has a solid foundation from which to address the challenges facing the sector. We are the national body that can bridge the pockets of activity across the country, identifying complementarities between developing technologies thanks to our unique view of the entire sector as a whole. We can help harmonize and guide investment through our contribution of expert knowledge, awareness of international trends, and close links to industry.

We have an opportunity to entrench ourselves as the federal leader in marine energy R&D by building on our record of achievement and technical expertise—strengthened further by CanmetENERGY's broader reputation in renewable and clean energy technology. Moreover, we maintain positive relationships with partners through several national and international networks, and are part of several bi- and multi-lateral mechanisms for collaborative research, development and demonstration. All of these linkages deepen our knowledge of—and voice in—marine energy developments around the world, creating opportunities to deliver Canadian discoveries to the world and vice versa.

Clearly, momentum is building: marine energy technology is beginning to attract private-sector investment in Canada. By acting on the opportunities before us and addressing the challenges outlined above, we can help identify and exploit possible areas of marine energy specialization that will allow Canada to establish a leadership role and relevance on the world stage.

# Marine Energy Strategy Map 2015

Strategic Objectives	Strategic Thrusts (Near-term)
<p><b>Mitigation of Technical Barriers to Demonstrations in Canada</b></p> <p>To address the technical barriers to the continuous, 12-month commercial-scale operation* of wave, tidal and river current technologies in Canada.</p>	<p><b>Strategy 1:</b> Set new R&amp;D focus areas for 2011 – 2015 that best achieve objective</p> <p><b>Strategy 2:</b> Selection of projects, partnerships, and financing to 2015 within defined areas of focus</p>
<p><b>Better-Informed Policy</b></p> <p>To increase awareness of the value of marine energy innovation in Canada, accelerate the development of a regulatory framework and promote responsible investment in the public interest.</p>	<p><b>Strategy 1:</b> Strengthen interdepartmental relationships and raise awareness with policy and programs, at all levels and across departments</p> <p><b>Strategy 2:</b> Develop a strategy to support policy and regulatory development through the provision of information, codes and standards, and industry insights</p>
<p><b>People &amp; Expertise</b></p> <p>To increase internal capacity, experience and knowledge in renewable marine energy research and development</p>	<p><b>Strategy 1:</b> Develop HR plan and business lines to better align expertise/core competencies with stakeholder needs</p> <p><b>Strategy 2:</b> Offer professional development opportunities and exchanges.</p> <p><b>Strategy 3:</b> Communicate about the team and its expertise to stakeholders</p>
<p><b>Global Leadership</b></p> <p>To provide leadership within international forums and represent Canada's competitive advantage in marine energy innovation</p>	<p><b>Strategy 1:</b> Provide leadership to set a foundation for innovation and growth within the marine energy sector</p> <p><b>Strategy 2:</b> Develop a plan with key partners for fostering R&amp;D exchanges and economic opportunities for Canadian marine energy technology innovation</p>

\*Implies replicable technology that meets energy demand via grid-connection or battery load.



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# Our strategy

The Marine Energy Technology team has defined four strategic objectives to guide its activities from 2010 to 2015. These directly address the internal and external challenges faced by the organization—and realize our vision of becoming Canada’s science and technology leader within the marine energy space. Each of the objectives includes strategies for implementation against which progress will be measured.



## **OBJECTIVE 1: Mitigation of Technical Barriers to Demonstrations in Canada**

To address the technical barriers to the continuous 12-month commercial-scale<sup>3</sup> operation of wave, tidal and river current technologies in Canada.

## **OBJECTIVE 2: Better-Informed Policy**

To increase political and policy-related awareness of value of marine energy innovation in Canada, specifically by accelerating development of a regulatory framework and promoting responsible investment in the public interest.

## **OBJECTIVE 3: People and Expertise**

To increase internal capacity, experience and knowledge in renewable marine energy research and development.

## **OBJECTIVE 4: Global Leadership**

To provide leadership within international forums and represent Canada’s competitive advantage in marine energy innovation.

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<sup>3</sup> Implies replicable technology that meets energy demand via grid-connection or battery load.

## Strategies in detail

### OBJECTIVE 1: Mitigation of Technical Barriers to Demonstrations in Canada

To address the technical barriers to the continuous, 12-month commercial-scale operation of wave, tidal and river current technologies in Canada

This objective addresses the overarching need for renewable marine energy technology (wave, tidal current and hydrokinetic) to be proven out in the Canadian context. Concentrating on the technical challenges involved, the Marine Energy Technology team will set new areas of focus for research and development in the period from 2011 to 2015. This will build on activities under the previous technical strategy that supported the establishment of the Marine Energy program.

The team will select projects and seek partnerships and financing for the period to 2015. This will be done in cooperation with other government stakeholders and the team's Technical Advisory Committee (TAC) made up of industry, academia and government representatives.

### Strategies

**Set new R&D focus areas** to support full-scale demonstrations of marine energy technologies. This involves identifying technical barriers and reassessing current projects against 2015 deployment objectives in light of known cross-cutting barriers.

Through this process, the team will establish criteria for selecting projects—identifying promising technologies, selecting sites, flagging barriers, and noting beneficial alignments with its core competencies and business lines.

**Select projects, partnerships and financing** to 2015 within the defined areas of focus and according to the established criteria, identifying key project partners and funding sources.

### Key Performance Indicators

1. Focus areas and project-selection criteria and R&D priorities validated by industry and government stakeholders.
2. Selected projects meet the criteria and deliver measurable advances toward full-scale technology demonstration.
3. Percentage of successful project completions (criteria to be set following formalization of project planning).

## OBJECTIVE 2: Better-Informed Policy

To increase awareness of the value of marine energy innovation in Canada, accelerate the development of a regulatory framework and promote responsible investment in the public interest.

With this objective, the Marine Energy Technology team aims to capitalize on its unique position within Canada's federal landscape to address the regulatory and policy-related challenges facing the sector, and to ensure that Canadian taxpayers' dollars are well spent on marine energy research.

To do this, the team will strengthen its relationships within NRCan and with other government departments—at all levels—to raise its profile among policymakers. Through work on codes and standards, technology research and development, and collaborative private/public-sector projects, the team will better engage policy and program groups in information sharing, and will help strengthen and accelerate the development of policies and regulations required for the nascent Marine renewable energy sector to grow sustainably and responsibly.

### Strategies

**Strengthen interdepartmental relationships and raise awareness** of the Marine Energy R&D team at all levels and across all departments. To achieve this we will establish a communications plan for reaching out to political and policymaking stakeholders, and will collaborate closely with energy policymakers and the Marine Renewable Energy Committee.

**Engage with NRCan policy and program groups and develop a strategy to support policy and regulatory development** through the provision of information, codes and standards and industry insights. As part of this effort we will enable policy relationships at the senior management level, will contribute to regulatory and policy needs from a science and technology perspective, and will implement mechanisms to formalize working relationships between R&D and policy and programs.

### Key Performance Indicators

1. Increased awareness and R&D client satisfaction as measured by appropriate market research methods and tools (i.e., surveys).
2. Number of policy documents and programs that incorporate the technical input of the team.
3. Number of technical documents made available and accessed by stakeholders.



### OBJECTIVE 3: People and Expertise

To increase internal capacity, experience and knowledge in renewable marine energy research and development

As identified in the Needs and Challenges section of this plan, the Marine Energy Technology team seeks to continue to develop its internal capacity—further deepening its marine-specific experience and knowledge, and ensuring its capability to respond to emerging opportunities.

Going forward, the team will develop an HR plan and discrete business lines that align expertise and competencies with stakeholder needs to deliver the greatest possible value. As well, it will identify projects and maintain networks with sector representatives that afford opportunities for professional development and thereby strengthen the team's capabilities on an ongoing basis. Specifically in this regard, the team will seek opportunities to work hands-on at project sites and to formalize linkages with research laboratories encouraging professional development. These partnerships will at the same time make the team's knowledge and expertise more immediately available and create stronger connections between innovators in the field, the team and Canada's renewable energy policymakers at the federal level.

A final strategy will be to externalize awareness-raising efforts, communicating the team's mandate, value and expertise to stakeholders.

### Strategies

**Develop HR plan and business lines to align expertise and core competencies with stakeholder needs** to increase value. This will involve evaluating the team's current internal core capacity and external needs related to executing its mandate. The team will define its business lines clearly, and develop timelines for any external hiring required to increase capacity. As well, it will identify external experts who could be called on for future standing offers to provide additional expertise if required.

**Offer professional development opportunities and exchanges** through networks of sector representatives. The team will identify opportunities for professional development (including shadowing) associated with selected R&D projects, strengthen the training plan for marine renewable energy team including training and certifications not necessarily part of R&D projects (e.g., project management, PMP, P.Engs.), and will identify, create and maintain working relations with national and international networks.

**Communicate about the team and its expertise to stakeholders**—supported by the development of a communication plan encompassing online, conference, Technical Advisory Committee and print distribution channels. Specifically, the team will aim to make its R&D activities electronically available through various forms of media.

### Key Performance Indicators

1. Number of professional development opportunities identified and acted on.
2. Number of available information outlets (e.g., brochures, websites, books) containing reference to the team's technical input.
3. Brand awareness measured by appropriate market research methods and tools (i.e., surveys).

## OBJECTIVE 4: Global Leadership

To provide leadership within international forums and represent Canada's competitive advantage in marine energy innovation

As the global marine energy industry is likely to evolve significantly over the next five years, an important strategic objective is to ensure Canada has the chance to advance its marine energy technology and realize its potential to be among the world leaders in this space. The Marine Energy Technology team will provide the leadership necessary to foster innovation and growth within the sector, and will develop a plan with key partners to open up technology R&D exchanges and economic opportunities for Canadian technologies. Part of this work will involve creating a market infrastructure—for example, using participation in international committees to establish marine energy standards that objectively validate the effectiveness and reliability of Canadian innovations. As well, the team will work with university research networks to align research activities and support the development of an industry roadmap.

### Strategies

**Provide leadership to set a foundation for innovation and growth within the marine energy sector**—in part by initializing, leading and facilitating the development of a sector profile and industry-led Canadian technology roadmap. As well, the team will lead and work with international organizations such as the IEA and IEC to establish technical guidelines and standards, and will represent Canada's interests by voicing the country's needs at the international level. To help direct future investments, the team will work to identify areas of Canadian competitive advantage in the global marine energy space, and will strengthen its leadership role within government to ensure marine energy technology innovations and opportunities are well understood.

**Develop a plan with key partners to foster economic opportunities for Canadian marine energy renewable technology innovation**—identifying key partners (e.g., DFAIT, EDC, Industry Canada) and available funding programs, and by developing an information package on marine energy for those partners.

### Key Performance Indicators

1. Publication of a Canadian marine energy technology roadmap.
2. Publication of technical guidelines and standards.
3. Percent of industry engaged in domestic and international networks (in all forms of engagement).
4. Number of economic partnerships established.
5. Percentage of R&D projects that result from network participation.



Marine energy offers **unrivalled** clean energy output with a small ecological footprint.



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# Taking the vision forward

Canada has the potential to become a leader in marine energy. That leadership is likely to be defined by excellence in specific niche areas. In the next five years, the industry's challenge is to discover those niches and carry out the research, development and demonstration projects necessary to fully explore their possibilities.

## **An objective knowledge resource**

The Marine Energy Technology team serves as an objective and impartial source of scientific information to support the industry's efforts, applying its extensive expertise in research and intellectual property generation. Our involvement brings credibility and stability to high-risk projects that, in turn, attract financing and further partners—all key ingredients in propelling capital-intensive real-world demonstrations of marine energy technology.

## **Clear value—from strong values**

Our team is committed to delivering quality research and development, with quality determined by its relevance, impact and objectivity. In a sector brimming with innovation, we appreciate the need for discretion and, while transparent and accountable in our conduct, are respectful of technology developers' trade secrets. Our own work environment is defined by openness, responsibility and collaboration—and by adaptability to new circumstances, essential in such a fast-changing technology space.

## **Charting new waters**

In implementing this strategic plan, our team will take on a strong role in marine energy research, development and demonstration, helping prioritize investments and drive technological advancement. We recognize that as the industry grows and develops, our strategy must adapt and respond, remaining a dynamic, living reflection of the sector's evolution. In partnership with the full variety of stakeholders, we will contribute the expertise required to demonstrate the feasibility of marine energy power generation in Canada—for the country's competitive advantage in the global economy, with the best interest of its citizens in mind.

## Mitigation of Technical Barriers to Demonstrations in Canada

Address the technical barriers to 12 months continuous commercial scale operation of wave, tidal, and river current technologies within Canada

### Technology R&D

Advance and expand the science and technology for electricity generation from renewable energy sources

Research reliability, efficiency and optimization of power take-off system options

Evaluate, model and test mooring and foundation designs

Evaluate and develop control systems to monitor performance of devices

Research and develop deployment and retrieval procedure, techniques and technology

Model rotor wake and inter-device spacing requirements

Evaluate hydrodynamic performance of technologies by conducting CFD modelling

Collaborate with other renewable energy technology teams to evaluate storage options

### Resource & Environmental Assessment

Characterize the resource and ensure its development is completed in an environmentally responsible manner

Conduct National resource assessment of the technical energy potential

Study neutrally buoyant debris and potential impacts of submerged hazards

Study turbulence and eddy effects and impacts on device performance

Develop tools to predict and forecast resources at the site specific and regional level

Model sediment and hydrodynamic impacts of wave and tidal energy farms

Evaluate operational monitoring of demonstration projects for electro-magnetic frequency and noise impact

Study and monitor marine life behaviours in areas of deployment

### Market Readiness

Enable an innovative, competitive, and sustainable economy to ensure adoption of a technology

Perform market assessments and technology road mapping

Study barriers (fishing, shipping, etc.) for deployment in multi-use sites

Identify and assess O&M costs

Lead and develop international and national standards

Develop pre- feasibility assessment tools such as RetScreen & Atlases (incl. economics)