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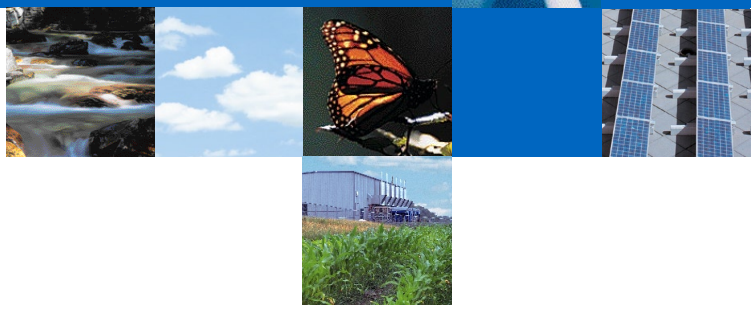

Vision for a Low-Impact Renewable Energy Future for Canada

Recommendations for Government Policy - 2004

The production of energy in Canada is poised to enter an exciting phase of innovation that could lead to increasing international competitiveness. This new phase of energy production will come from low-impact renewable energy forms. Over time, these energy forms could reliably produce as much power in Canada as both thermal and nuclear combined. The push to renewables is happening because carbon is becoming constrained as an energy source and because opportunities exist for Canada to develop lucrative new energy technologies. To make the most of these opportunities, we must develop a vision of where our energy future will take us and how to get there.

To assist in this bid to look into the future, the Clean Air Renewable Energy Coalition[1] has developed this Vision for a Low-Impact Renewable Energy[2] Future for Canada. We focus on low-impact renewable or green forms of electricity. This electricity would not only be used to provide light, heat and power, but would also produce the hydrogen fuel that could be used in the fuel cell technologies that will be poised to replace the internal combustion engine within cars, trucks and buses. When fuel cells obtain their hydrogen from renewable energy sources, water is the only tailpipe emission.

[1]The Clean Air Renewable Energy Coalition (often referred to in the document as the "Coalition") is a confluence of major Canadian corporations, environmental organizations, and Canadian municipalities with a common vision for Canada's electricity future. Our vision sees Canada providing a comprehensive package of government policies that will allow Canada to capture the social, environmental and financial benefits of a strong renewable energy sector that capitalizes on Canada's rich renewable energy potential.

[2]These include the following technologies (not a comprehensive list): solar thermal and solar photovoltaic (PV) technologies, wind power, geothermal energy, run-of-river, micro and mini-hydro technologies, biomass and other low-impact renewables described under the Eco Logo definition from Environment Canada.

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Enbridge • Federation of Canadian Municipalities • Friends of the Earth • International Institute for Sustainable Development •
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Toronto Environmental Alliance • Toronto Hydro

The Clean Air Renewable Energy Coalition's goal is to have low-impact renewable energy account for a minimum of 7 per cent of Canada's electricity production in 2010, and 15 per cent by 2020. Today, it is 1.3 per cent.

To achieve this goal and ensure renewable energy has a strong and meaningful role in Canada's energy sector, the Coalition recommends that Canadian governments take the following steps:

1. **Define a comprehensive Low-Impact Renewable Energy Vision for Canada**
2. **Set long-term targets for Low-Impact Renewable Energy in Canada**
3. **Commit to a package of long-term, broad, market and government incentives**
4. **Develop partnerships between the Federal Government and its Provincial and Territorial counterparts to provide incentives or measures to increase Low-Impact Renewable Energy investments in Canada**
5. **Recognize that Low-Impact Renewable Energy has the potential to contribute to reducing the carbon intensity of Canada's energy supply.**

The Numbers Tell the Story: Demand for Electricity is Increasing

Canada needs electricity. Over the next 50 years, Canada's electricity needs will increase by 60 per cent to 270 per cent.[3]

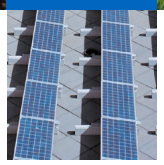
Canada will be influenced by rapidly growing demand for electricity in the United States. Currently 7 per cent of our electricity is exported to the United States. Export opportunities will increase significantly in the next 50 years with increasing U.S. demand for power. **As the U.S. expands its requirements for minimum levels of green power, known as renewable energy portfolio standards (RPS), Canada will need to be in a position to provide that type of energy**.

World wide, it is possible for low-impact renewable energy to provide as much as 24 to 28 per cent of the world's energy needs[4] by 2050. The impetus to provide more green energy comes as consumers demand cleaner power as their concerns over their health and the environment grow. Canada's untapped potential for producing low-impact renewable energy is large. It has the potential of being as large as today's thermal and nuclear generation combined. **The downside of delaying the development of more green energy in Canada is that we lose the opportunity to be a leader both in green-energy exports and in selling green-energy technology that we develop.**

[3] Growth rates expected between 1 and 2 per cent annually.

[4] Shell Scenarios to 2050



The Benefits of Low-Impact Renewable Energy are Clear

Low-impact renewable energy is a non-depleting resource with minimal environmental impacts

It includes:

- the energy of wind captured by turbines,
- the energy of flowing water harnessed through low-impact (run-of-river) hydroelectric facilities,
- the energy in the heat of the earth used to fuel geothermal energy systems,
- the energy released from the combustion of organic wastes in landfills and biomass from agriculture and forestry production,
- the energy of waves and tides captured through converters and turbines, and
- the energy of the sun captured with photovoltaic and solar thermal systems.

Stable cost profile will benefit electricity prices

The main cost of producing low-impact renewable energy is in the capital cost of equipment rather than in operating the equipment once it's there. That means that the cost of renewable energy can be more predictable than the cost of producing fossil-fuel energies. This can help to mitigate the risks of shifting electricity prices and foster price stability of electricity. The benefits may spread even further. A recent CERA study[5] indicated that non-large hydro renewables might be the key to reducing natural gas demand. The study indicated that "even a modest renewable build will relieve some pressure on the gas market leading to lower prices" and "reduced gas prices will soften power prices".

Rapid deployment

Low-impact renewable energy, based on modular, simple installations with a small footprint and few environmental impacts can be in place within a two- or three-year time frame rather than five to 10 years for traditional power generation with larger impacts.

Low environmental emissions

Renewable energy generation produces little to marginal amounts of the emissions associated with acid rain, smog or climate change.

Mixed portfolio of renewables resulting in increased reliability

Low-impact renewable energy sources can diversify Canada's energy supplies in a decentralized and distributed manner that would provide enhanced energy security. Two events in recent Canadian history, the Montreal Ice Storm and the blackout of August 14, 2003 have shown that a diversity of energy supply speeds recovery from such catastrophic events. Quicker recovery can mitigate the economic hardship from such events. Low-impact renewable energy, due to its distributed nature can provide the diversity of power source required for quick recovery, and reduce the probability of grid collapse.

[5] *Renewables: Challenging the Energy Mix, Winds of Change*, Rays of Hope, Workshop III – North America June 26, 2003, Cambridge Energy Research Associates, Massachusetts U.S.

Creating employment and a new industry

Important job creation benefits can be obtained from the promotion of low-impact renewable energy technologies. Manufacturing green power equipment in Canada is critical to help drive down its costs in the near-term and realize the economic benefits that additional low-impact renewable energy development can stimulate over time. This has happened elsewhere. In Germany, the wind industry alone is responsible for 45,000 jobs. In the U.K., 6,000 megawatts (MW) of offshore wind generation capacity will be installed by 2010, creating employment for 20,000 people. In fact the installation of renewable energy in the U.K. is proceeding so rapidly that some fear there will be not be enough skilled workers to maintain the current growth rate.

The development of new green-energy technologies can also drive exports to meet growing international demand. Denmark is a market leader in the wind turbine industry commanding 40 per cent of the world market. The U.K. is investing heavily in offshore wind while Japan is the world's leader in solar photovoltaic energy.

Renewable energy is an intermittent resource, a good match for traditional energy

Several renewable energy sources are intermittent. Just as large-scale hydroelectric production is influenced by precipitation from year to year, wind, solar, and run-of-river power are all affected by nature. That means production will vary according to season and year. For instance, while wind farms produce electricity more than 85 per cent of the time, the amount of electricity they produce will vary based on the wind speed.

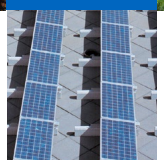
Natural gas generation and large-scale hydro with storage capabilities are perfect matches for these renewables since they have the ability to change production levels quickly to account for changes in renewable energy production levels.

Low-Impact Renewable energy can not be left to the market alone in its infancy

One could argue that since the public is interested in supporting renewables, it should be left up to the marketplace to determine the future of renewables. Countless surveys show a strong willingness by consumers to pay extra for green energy offers. The hitch is that, in practice, only 1 per cent of consumers switch over to green power sources unless the prices are the same as those of conventional electricity.

These low rates of consumer switching can be partly explained by inertia and by consumers' lack of understanding of how the electrical grid works. The most important factor may be that people don't want to pay more for their electricity than their neighbours, preferring the additional cost to be borne by society at large.



The solution is to treat low-impact renewable energy production in the same way other new energy technologies have been treated historically in Canada. At each stage of energy innovation in Canada over the decades, governments have helped foot the cost of emerging technologies. The benefits to Canadian society are that consumers and businesses get access to reliable and homegrown energy, with the potential for energy and technological exports. As well, this solution recognizes that governments, rather than consumers, are ultimately responsible for providing a framework that will put the country's objectives on energy policy into reality.

The costs of Low-impact renewable energy are decreasing as technologies mature

Most electricity markets are priced based on the marginal unit costs, which vary by season, time of day, and market make-up. In Canada, gas and oil prices have a significant influence on electricity prices. Therefore it is difficult to determine electricity long-term pricing without discussing the volatility and long-term pricing for oil and gas.

The cost of power from renewable energy varies by technology and technical maturity. The cost of all low-impact renewable technologies has decreased significantly over the past two decades. For example, the learning curve for wind turbines (cost decrease versus cumulative production) is 12 per cent with a cost reduction of 25 per cent expected by 2010. These cost reductions will make wind power competitive with combined cycle gas power generation when gas is C$5.53/MCF[6]. At today's costs, wind power is competitive with combined cycle gas power generation when gas prices are C$6.77/MCF[7].

Examples of technology at different stages of development are outlined below. Even within the pre-commercial technologies, the costs vary significantly.

Examples of Technology, and Development Phase

Phase	Objective	Technology
RD&D	Establish proof of concept	Tidal, Some Biomass, Heat-Fractured Rock,
Post RD&D	Ramp up to compete with other renewable energy	Wave, Offshore wind, Advanced biomass conversion
Pre-Commercial	Ramp up to compete with conventional fuels	PV, Onshore wind, Some biomass, Run-of-River Hydro, Geothermal
Commercial		Run-of-river hydro, Coal, Gas, Large Hydro

[6] Plant Gate gas price, $10/MWh WPPI, based on wind power generation in Alberta, assumes no value for emission reductions.

[7] Plant Gate gas price, no WPPI, based on wind power generation in Alberta, assumes no value for emission reductions.

The low-impact renewable energy potential in Canada is promising

A comprehensive assessment of Canada's low-impact renewable energy resources is required in order to identify the resources that have significant potential. This assessment should deliver a Canada-specific cost-resource curve for each technology, addressing current cost levels as well as potential future cost levels (taking into account learning-curve effects).

Based on this assessment, it will be possible to set realistic targets for increasing the penetration of those technologies that are most viable for a given region, country or province. Some countries have done this successfully. For example, Brazil has the largest bioethanol market, Denmark 'made' the wind industry, Japan leads on solar PV and Scandinavia is leading the way on biomass to power. This is partly due to having quality resources in these areas and partly because these particular governments were prepared to support the market through incentives.

Based on the limited data available, the Clean Air Renewable Energy Coalition has begun to assess the potential for Canada's low-impact renewable resources. The results shown are both incomplete and conservative. The table below pulls together data on Canada's low-impact renewable resource technical potential from a variety of sources.[8]

Our estimate indicates that Canada's potential for low-impact renewable resources is 122 to 398 TWh p.a. This indicates that those sources could be equivalent to today's production of nuclear and thermal power combined. This is approximately 22 per cent to 71 per cent of Canada's consumption in 2000.

[8]This Table is drawn largely from Promoting Green Power in Canada (Pollution Probe, 2002).

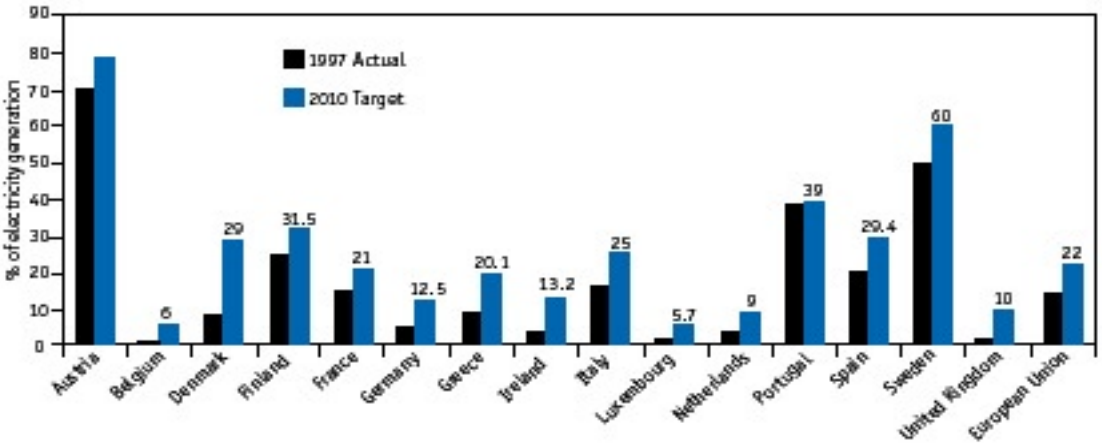
[28]Spinning reserve means that a generating unit is operating at synchronous speed (connected to the grid) but is not generating any electricity. If an operating unit elsewhere in the system should come off line suddenly, the unit on spinning reserve is ready to kick in and make up the shortfall.

Low-impact Renewable Electricity Potentials in Canada (TWh p.a.)[9]

	Current Generation	Potential Generation (Minimum)	Potential Generation (Maximum)
Onshore Wind[10]	1.[11]	12.3[11]	86
Solar PV	0.001[12]		0.012[13]
Small Hydro[14]	4.[15]	15[16]	98[17]
Biomass[18]	1.9[19]	49[20]	154[21]
Landfill gas	0.6[22]	0.9[23]	2.7[24]
Wave / Tidal	0.1	45[23]	56[26]
Geothermal	0		1.1[27]
Total	**7.6**	**122**	**398**
Canadian Traditional Generation Source TWh (2000)			
Large Hydro	346		
Thermal	147		
Nuclear	68		
Total Traditional	**556**		




The need for grid stability, spinning reserve[28] requirements and the ability to handle intermittent generation may limit this potential. Currently there are no studies on the maximum intermittent energy production on a given grid. We can look to other countries for an idea. The European Union set up a new directive in 2001 to increase renewable energy to 22 per cent of electricity consumption in 2010, up from 13.9 per cent in 1997. See chart below.



Source: Directive 2001/77/EC (27 September 2001) on the promotion of electricity produced from renewable energy sources in the internal electricity market including large hydro

[28]Spinning reserve means that a generating unit is operating at synchronous speed (connected to the grid) but is not generating any electricity. If an operating unit elsewhere in the system should come off line suddenly, the unit on spinning reserve is ready to kick in and make up the shortfall.

[9] These figures reflect the fact that different renewable energy technologies have different capacity factors (i.e., different abilities to produce energy consistently).

[10]The technical potential estimate for onshore wind is more than 10 years old and clearly an underestimate in light of technological advances since then. While there is no credible estimate of offshore wind energy potential in Canada, many countries believe the potential for offshore wind is significantly higher than the potential for onshore wind.

[11]Using 310 MW installed as of summer 2003, average capacity factor 35 per cent

[12]Ayoub. Dignard-Baliey, Filion, Photovoltaics for buildings, 2000

[13]Internal Coalition Analysis

[14]Estimated using the current Eco Logo definition of low impact hydroelectric power.

[15]From Eco Logo run-of-river hydro estimates for 2001

[16]Filion, Renewable Energy Options – Overview and Trends, Canmet energy technology Centre

[17]In consultation with BC Hydro, OPG and other Coalition members

[18]As defined by NRCan and Eco Logo definition

[19]Anaerobic Digestion and Biomass to Power, 1999

[20] CERA Study

[21] BioCap Study.

[22] Filion, Renewable Energy Options – Overview and Trends, Canmet energy technology Centre

[23]Coalition members estimate

[24]Filion, Renewable Energy Options – Overview and Trends, Canmet energy technology Centre

[25] Filion, Renewable Energy Options – Overview and Trends, Canmet energy technology Centre

[26] Analysis from BC Hydro and other Coalition members

[27] Coalition internal estimate

Using 15 to 20 per cent as a potential limit on any system, this would allow for 157 to 210 TWh of generation on the Canadian grid as it currently stands. Low-impact renewable energy can meet at least its minimum potential in Canada and still have sufficient spinning reserve. As the grid grows to meet Canada's electricity growth, additional low-impact renewable energy can be added to meet future needs.

Other countries are rapidly expanding their capacity for Low-Impact Renewable Energy

Today's low-impact renewable energy industry produces 7.6 TWh p.a. or 1.3 per cent of Canada's consumption. This is low compared to most OECD countries including the U.S. Throughout the industrialized world, the use of some forms of low-impact renewable energy sources is expanding at a rapid pace. For example, the production of wind power and solar power (from photovoltaics) increased in industrialized countries through the decade of the 1990s at an annual rate of 22 per cent and 29 per cent, respectively. Denmark now gets 17 per cent of its electricity from low-impact renewable energy sources, and the corresponding figure for Finland is 12 per cent. In Germany, Italy, Spain, Sweden and the United States, these energy sources make two to three times the contribution to total electricity production as in Canada.

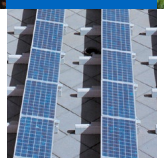
Our goal is to have low-impact renewable energy account for a minimum of 7 per cent of Canada's electricity production in 2010, and 15 per cent by 2020.

The barriers to Low-Impact Renewable Energy are diverse but not insurmountable

Despite its potential, and the significant environmental and air-quality benefits associated with its use, several barriers prevent an increase in generation of electricity from low-impact renewable energy sources in Canada. These include:

- higher cost relative to conventional power sources due, in part, to limited production that reduces economies of scale,
- market failures that mean that the environmental and social benefits of renewable energy supplies are not reflected in the price of energy. This means that the playing field for low-impact renewables is not level compared to that of conventional energy sources,
- unfamiliarity of the transmission authorities on intermittent generation technology. Generation dispatch requirements cannot be met by some low-impact renewable energy production profiles,
- information barriers, including lack of awareness about low-impact renewable energy among the public and energy sector stakeholders and lack of information about resource locations and potential, and
- lack of interest by consumers who do not want to pay more for electricity than their neighbours, preferring the additional cost of low-impact renewables to be borne by society at large.



While governments in other countries are developing comprehensive strategies to address these barriers, federal, provincial and territorial governments in Canada have pursued a limited and ad-hoc approach. The results are clear:

Canada is missing its opportunity to lead in the international effort to develop and deploy the sustainable energy technologies of the 21st century. In fact, we are falling behind.

Clean Air Renewable Energy Coalition Recommendations for Canada

1. Define a comprehensive Low-impact Renewable Energy Vision for Canada

Specifically, the Coalition believes a plan should identify:

a) The need for a **comprehensive renewable energy resource assessment** that would deliver a cost-resource curve for each low-impact renewable energy technology and support the setting of realistic targets for increasing the penetration of technologies most viable for a given region.

b) The need for **R&D money for early-stage technologies**

c) The need for **differentiated guaranteed prices** for technologies that have left the demonstration phase and have entered the market, but cannot compete with least-cost pre-commercial renewable energy.

d) The important role **renewable energy will play in a carbon-constrained economy**.

2. Set long-term targets for Low-Impact Renewable Energy in Canada

Most OECD countries have set targets to increase penetration of indigenous renewable energy production in the short term. Examples include:

- Targets geared toward a specific technology (e.g. one million solar roofs program in the U.S)
- the EU target to increase Renewable Energy to 22 per cent of electricity in 2010
- Renewable Portfolio Standards (RPS)
- "feed-in tariffs" to support low-impact renewable energy until it becomes competitive with conventional energy sources
- tax incentives to create market demand for green power.

Our largest trading partner to the south has been moving on this front. In the U.S., federally led legislation is being discussed to set a national target of 10 per cent low-impact renewable power generation of total electricity consumption. A national target allows each region to focus on the energy technology that costs it the least.

Long-term targets with clear, consistent and stable rules and incentives can allow market participants to establish forward price curves with a reasonable degree of certainty.

Specially, the Coalition supports: A low-impact renewable national energy target accounting for a minimum of 7 per cent of Canada's electricity production in 2010 (approximately 30 per cent of new capacity between 2000 and 2010 – triple the existing federal government target), **and a minimum of 15 per cent of Canada's electricity production in 2020.**

3. Commit to a package of long-term, broad, market and government incentives

Some Renewable Energy technologies are at a near-commercial stage but require long term and broad incentives to compete with traditional sources of power. Because both resource depletion and climate change are long-term issues, a long-term approach is needed.

However not all technologies are at the same place on the long path from research to deployment and they differ in the types of support they need to progress along the path. It is unlikely that a single renewable energy technology will supply all global needs because these technologies are dispersed and local. But over time, energy supply will be more diverse than it is today. Because of this, the approach needs to be broad in order to push all potentially viable renewable energy technologies through Research, Development, Demonstration and Deployment phases rather than prejudge the winning technologies.

Examples of Technology, Phase and Support Frameworks

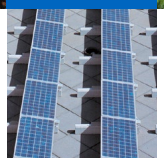
Phase	RD&D	Post RD&D	Pre-Commercial
Objective	Establish proof of concept	Ramp up to compete with other renewable energy	Ramp up to compete with conventional fuels
Support framework needed	R&D money	Premium guaranteed prices	Long term targets, clear stable rules. Incentives based on a MWh basis
Technology	Tidal, Some Biomass, Heat Fractured Rock	Wave, Offshore wind, Advanced biomass conversion	PV, Onshore wind, some biomass, Run-of-River Hydro, Geothermal

Low-impact renewable energy in Canada currently benefits from only modest incentives and has no support from generation or consumption mandates. The Federal Government has spent less than $89[29] million in incentives for domestic Low-Impact Renewable Energy since 2000. The Wind Power Production Incentive still has $214M uncommitted.

This is at odds with the global trend. Internationally, governments are encouraging market players in low-impact renewable energy through supports in the market. By contrast, the Canadian Renewable Energy sector is left to compete with low-cost, aging, traditional power facilities across the country.

[29] Assumes that $25Million of the Market Incentive Program has been spent already.



Specifically, the Coalition recommends:

a) The Federal **Wind Power Production Incentive (WPPI)** be increased to the equivalent level of incentive in the U.S. in order to provide a level playing field for investment (estimated at 2.3 cents /kWh) when the Canadian dollar is equal to $0.75 U.S.).

b) This type of incentive **be extended to other renewable energy technology** at a pre-commercial stage.

c) Federal climate change-related money be used to **expand the Market Incentive Program** funding to $30 million per year, extend it to 2012 and consult with the provinces and territories to develop a broader-based green energy rebate and education program for consumers.

These levels of incentives will be the catalyst for growing the Low-Impact Renewable Energy industry in Canada. This will enable the green energy sector to make a more meaningful contribution towards Canada's climate change commitment, as well as create employment and enhance Canada's economy through investments in the sustainable technologies needed in the 21st century.

4. Develop partnerships between the Federal Government and its Provincial and Territorial counterparts to provide incentives or measures to increase Low-Impact Renewable Energy investments in Canada.

The Federal, Provincial and Territorial governments should work closely to optimize the contribution that low-impact renewable energy can bring towards emission reduction targets.

Specifically, the Coalition recommends:

a) Federal, provincial and territorial governments **commit to purchase a minimum of 30 per cent of their electricity needs from low-impact renewable energy by 2010, and increase that to 80 per cent by 2020**. One way this can be accomplished is through direct purchases or the purchase of "renewable energy certificates" or "green tags" from other parts of Canada. The government of Alberta has already set a target of 90 per cent for its electricity needs by 2020.

b) Provincial and territorial governments **mandate or provide support for a clearly identified minimum level of electricity production** from low-impact renewable energy consistent with national targets and identified through mechanisms like renewable portfolio standards, systems benefits charges, production credits, consumer credits, or preferential tax treatment. Provincial governments regulate electricity. Therefore, they are an important ally in the push for an increased supply of renewables. It is through the provincial regulators that acceptance of renewable portfolio standards and the like will need to be achieved.

c) Federal, provincial and territorial governments collaborate to **do a comprehensive assessment of Canada's full potential for low-impact renewable energy** through initiatives such as a broad Wind Energy Mapping and Measurement Initiative.

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5. Recognize that Renewable Energy has the potential to contribute to reducing the carbon intensity of Canada's energy supply

The proposed rules for the domestic emissions trading and offsets system do not recognize the potential contribution of renewables to avoid greenhouse gas emissions from the energy sector. The Kyoto Mechanisms may encourage the flow of capital for development of renewable energy outside of Canada. Incentives are required to encourage action at home.

Conclusion

Today, low-impact renewable energy occupies a niche in the Canadian energy market. However, because of the coming constraints on using carbon-generated energy, the greater need for flexible sources of electricity and the opportunities for export of green power, the market for low-impact renewables is poised to expand dramatically.

Low-impact renewables are going mainstream. Canada is poised to be a significant player in the development of renewable technologies and in the production of renewable energies. However, the window for Canada to be a market leader in these areas is narrow. Other countries are already seizing the opportunities, armed with comprehensive government strategies to support renewable power. Canada now has an excellent opportunity to do this as well.

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