Lost Opportunities: Canada and Renewable Energy

A Cross-Country Comparison of Government Support for Renewable Energy

September 1999

About the Pembina Institute

The Pembina Institute is an independent, citizen-based organization involved in environmental education, research, public policy development and corporate environmental management services. Its mandate is to research, develop, and promote policies and programs that lead to environmental protection, resource conservation, and environmentally sound and sustainable resource management. Incorporated in 1985, the Institute's main office is in Drayton Valley, Alberta with another office in Ottawa, and research associates in Edmonton, Calgary, and other locations across Canada.

The Pembina Institute's Eco-efficient Technologies Program is a response to the growing need to evaluate society's technology choices and advocate for appropriate energy and waste management alternatives. The Program identifies and advocates the removal of policy barriers, actively markets appropriate technologies, and provides networking opportunities for technology providers and potential customers. Staff work closely with the Institute's other program areas to aid in the adoption of appropriate technologies leading to more sustainable industrial, residential and transportation systems. This paper was prepared in collaboration with Climate Change Program staff. The Institute's Climate Change Program works to design, develop, promote and implement actions that protect the climate through improvements in the efficiency of fossil fuel energy production and use, and through a transition to the renewable energy that will power the world's economy in the 21st century.

For more information on the Pembina Institute's work, please visit our website at **www.pembina.org**, or contact:

The Pembina Institute
124 O'Connor Street, Suite 505
Ottawa, ON K1P 5M9
tel: 613-235-6288 fax: 613-235-8118
e-mail: roberth@pembina.org

Acknowledgements

This brief was written by Andrew Pape, Co-Director of the Pembina Institute's Eco-efficient Technologies Program, with assistance from Robert Hornung, Director of the Institute's Climate Change Program, and Jamie Cowan, Climate Change Research Assistant.

Contents

What is Renewable Energy?

Renewable energy can be used to provide heating, cooling or electricity services to consumers as an alternative to, or in combination with, conventional energy resources such as coal, natural gas, nuclear energy and large hydroelectricity. Large hydroelectric projects are often not considered to be an environmentally acceptable form of renewable energy because the flooding of lands or watersheds required by large reservoirs has significant negative impacts on the environment. These impacts occur mainly through methane emissions from decomposing trees and soil, loss of habitat for organisms, and dramatically altered watershed hydrology.

Renewable energy technologies utilize non-exhaustible energy resources like the wind, the sun, moving water and biomass. Some examples of renewable energy technologies include:

- wind generated electricity,
- solar heating or solar generated electricity (e.g., photovoltaics),
- environmentally-desirable hydroelectricity,
- geothermal energy,
- biomass resources (if harvested and utilized in a sustainable manner),
- water velocity energy (freestream tidal, wave, or river velocity turbines), and
- water thermal energy (e.g., ocean thermal energy).

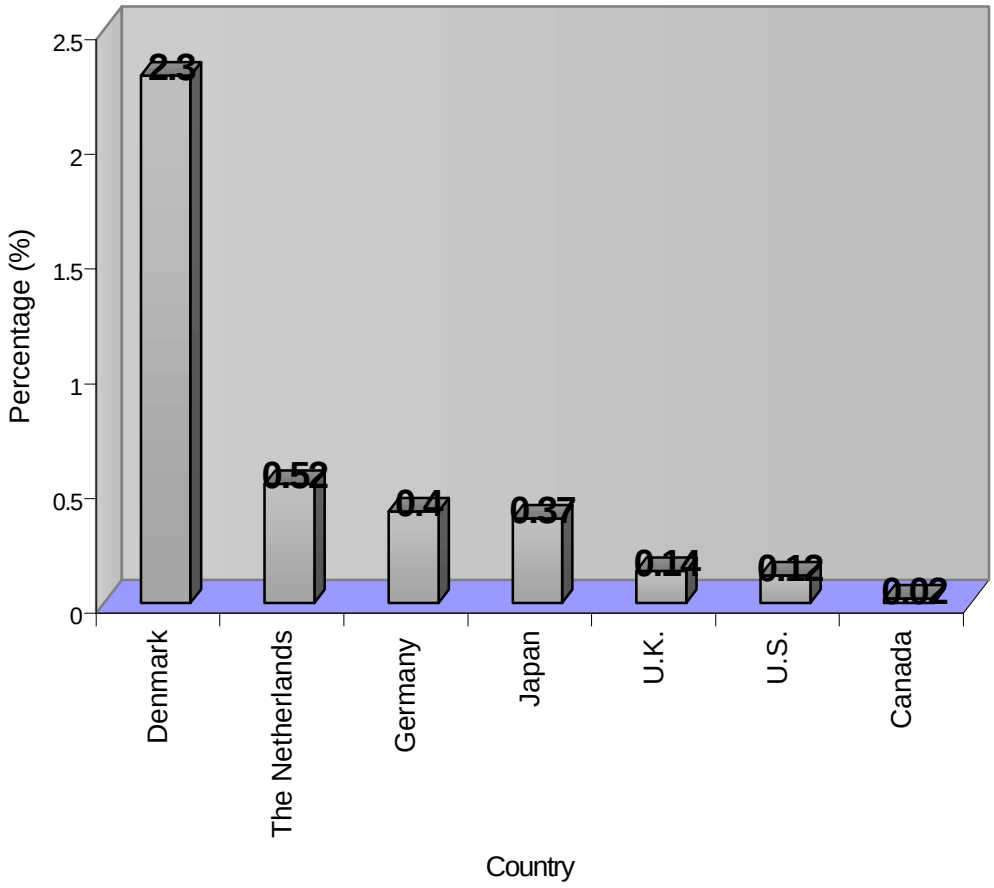
Canada and Renewable Energy

Canada, like most industrialized countries, currently uses only a small amount of non-hydroelectric renewable energy. In fact, Canada derived only 3.8% of its total energy needs from these renewable energy sources in 1996. Although the overwhelming majority (99%) of this energy was produced from biomass, the technology is only truly "renewable" if biomass is harvested and combusted in a sustainable manner. These conditions are not always met in Canada as a result of unsustainable logging practices and inefficient and incomplete combustion of biomass.

The most environmentally benign renewable energy technologies are solar, wind, and micro-hydro (river, tidal, wave) power facilities.[1] All of these technologies can be used to generate electricity and Figure 1 shows the percentage of total electricity generation provided by these technologies in several major industrialized countries. As the Figure illustrates, Canada has the lowest installed capacity among the countries that were compared. Even if electricity produced from biomass energy sources is included in the percentage calculation, Canada remains at the bottom of the list.

[1] The Pembina Institute is releasing a series of Guidelines for Defining Green Power in October 1999, outlining the relative performance of various types of Renewable Energy resources and technologies and their relative impact on the environment. Within that report, solar, wind and micro-hydro (including tidal and wave power) are considered to be among the most environmentally benign.

Figure 1. Solar, Wind, Wave and Tide Energy as a Percentage of Total Electricity Generation (GWh production in1996)



Source: International Energy Agency. 1997.

Canada's installed capacity of renewable electricity as defined in this paper is small relative to other countries, in absolute terms. For example, at the end of 1998, Canada had 83 MW of installed wind power capacity. This can be compared to installed wind power capacity in Germany (2874 MW), the United States (1952 MW), Denmark (1450 MW), India (968 MW), Spain (834 MW), the Netherlands (363 MW), the United Kingdom (334 MW), Italy (180 MW), and Sweden (150 MW).[2]

Although Canada generated 62% of its electricity from hydroelectric facilities in 1996, most of this power was produced through large hydroelectric projects that carry a significant environmental cost because flooding of reservoirs destroys habitat and dramatically alters watershed ecology.

[2] These data were obtained from the Canadian Wind Energy Association.

Why Should Canada Make the Development of Renewable Energy Sources a Priority?

While renewable energy sources currently account for only a small portion of the total energy supply in most industrialized economies, they will play an increasingly important role in the global energy economy of the 21st century. In fact, Royal Dutch Shell recently concluded that renewable energy sources could supply 50% of the world's energy by the middle of the next century.[3]

Increased production and use of renewable energy sources will provide a wide range of benefits to Canada's environment, economy and society. Some of the most important reasons Canada should support the development of renewable energy technologies include:

- Renewable energy technologies are environmentally benign when contrasted with the environmental impacts of conventional energy technologies. They do not contribute to climate change,[4] urban air pollution, acid deposition, or large-scale habitat destruction, and they do not face the safety and waste disposal issues characteristic of nuclear power.
- Canada has a virtually unlimited supply of widely available renewable energy resources.
- Renewable energy technologies can be implemented cost-effectively[5] in a number of applications, including solar water heating, space heating and cooling with heat pumps, passive solar design, micro-hydro electricity generation and remote power generation with solar and wind technologies.
- Renewable energy technologies have low operating costs – fuel costs are typically zero and many technologies require little maintenance.
- Renewable energy technologies can usually be developed in a modular fashion with small capacity increments and short lead times.
- Renewable energy development is labour intensive – studies show that a million dollars invested in renewable energy development will produce in excess of 50% more jobs than equivalent investments in conventional energy development.[6]
- Renewable energy sources can help diversify Canada's energy portfolio – an important consideration, as Canada's carbon-intensive economy will become a liability with the implementation of the Kyoto Protocol.
- Renewable energy sources are the fastest growing energy sources in the world – the quantity of electricity produced by wind and solar power globally has increased by 20% and 16% per year, respectively, in the 1990s.[7]

---

[3] Worldwatch Institute. Press release from July 16, 1998.

[4] Although the combustion of all biomass resources produces greenhouse gas emissions, the sequestration and storage of carbon through biomass growth can offset those emissions if the biomass is harvested in a sustainable fashion.

[5] Meaning they make sense on purely financial grounds.

[6] Pembina Institute. *Comparative Analysis of Employment from Air Emission Reduction Measures.* 1997.

[7] Worldwatch Institute. Press releases from August 14, 1996 and July 16, 1998.

Barriers to Implementing Renewable Energy Technologies

There are many reasons why it makes sense for Canada to increase its use of renewable energy, but a number of barriers have prevented renewable energy from making greater inroads in this country. Some of the most important barriers are:

Failure to Provide Market Access

- Energy markets in Canada are almost exclusively controlled by regulated or unregulated monopoly firms, both government and privately owned. Most electric utilities are monopolies, and even though natural gas, propane, and other energy markets are open to competition, few suppliers are competing for residential and commercial sector consumers. As a result, renewable energy companies are forced to deal with monopolistic utilities to promote their products, and Canada's major energy companies have traditionally shown little interest in renewable energy technologies as they are defined in this paper.

Failure to Provide Consumer Choice

- In the electricity sector, no consumers currently have the right to choose their supplier of electricity.[8] As such, consumers are forced to purchase the mix of resources that are provided by their electric utility. Electric utilities do not actively communicate information on their resource mix to customers. Only four electric utilities – West Kootenay Power, ENMAX, EPCOR, and Toronto Hydro – currently offer customers the right to choose renewable energy sources from solar, wind, biomass and small hydro. Only one natural gas utility, Enbridge Consumers Gas, is actively promoting renewable energy to consumers.

Failure to Account for Environmental Externalities

- The environmental impacts of conventional energy technologies are not reflected in their price. Although environmental impacts are caused by specific energy facilities such as a coal-fired power station or a hydroelectric dam, the costs of those impacts are generally borne by society as a whole through government programs to reverse or address impacts on ecosystems and human health. Renewable energy resources are largely environmentally benign but the cost of environmental impacts is not reflected in the relative costs of different energy technologies.

Failure to Address Implementation Barriers

- There are numerous barriers to the development and installation of renewable energy systems, even when the applications are cost-effective. These include a lack of financing options for covering the capital costs of smaller systems, the imposition of cumbersome requirements by utilities and building inspectors for installations, and complex bureaucratic and legal procedures for developing new resources.

Why Must Governments Play a Role in Renewable Energy Development?

The International Energy Agency has outlined the important role governments can play in overcoming these non-technical barriers to the implementation of renewable energy. They state that "… achieving a significantly higher share for renewable energy requires governments giving a strong, long-term commitment and policies to give the renewable energy industry enough time to mature and compete on an equal footing with the conventional fuel industry."[9]

---

[8] Alberta and Ontario have enacted legislation that will give retail consumers choice over the next three years.

[9] IEA Renewable Energy Working Party. *The Evolving Renewable Energy Market*. 1999. page 12.

Canada's federal and provincial governments have not yet been willing to make such a long-term commitment. They have for the most part failed to implement any significant policies to encourage the development of renewable energy in Canada. Indeed, Canada is one of the only countries in the G7 without a comprehensive program to promote the development of a market for renewables. Yet, without new federal and provincial government support, the Canadian renewable energy industry is unlikely to expand significantly beyond current levels.[10]

This failure to act ignores the fact that many other energy sources developed in Canada have received significant government support. Canada's oil sands, off-shore oil and nuclear industries would not exist today had federal and provincial governments not provided generous research and development support as well as significant direct financial contributions, low-interest loans, loan guarantees, or special tax treatment to the implementation of specific projects.

As the International Energy Agency notes, "… renewable energy can play a much bigger role [in the market] and the pace of installation can be accelerated … but that will occur only if renewable energy gets the same policy advantages that conventional fuels have received and continue to receive."[11]

How Does Canada Compare?

Federal and provincial governments could implement a broad range of initiatives to support the development of renewable energy in Canada.[12] In particular, governments could implement supportive regulatory and fiscal policies, and provide funds for research, development and demonstration of renewable energy technologies. While Canada continues to do little in this area, however, a survey of current initiatives shows that other countries are moving rapidly to support the development and deployment of renewable energy technologies.[13]

Regulatory Mechanisms

Governments can implement regulatory mechanisms that mitigate barriers to the implementation of renewable energy through direct intervention in energy markets. Some regulations are designed to guarantee a market for renewable energy by requiring utilities to derive a specific share of the electricity they generate from renewable energy sources. In some cases, the price to be paid for renewable energy by the utility is also specified by the regulations.

Other regulatory mechanisms are designed to simply "level the playing field" between competing energy resources and technologies by restructuring energy utility markets, ensuring that private power producers have access to the electrical grid, or simplifying technical or bureaucratic requirements for renewable energy producers to better reflect their scale.

The table below compares Canada's regulatory regime for renewable energy with the situation in a number of other leading industrialized countries. As it shows, Canada is currently taking no significant regulatory action to promote the use of renewable energy, while all other countries have implemented one or several regulations designed to increase the presence of renewable energy in the marketplace.

---

[10] Pape, A. Implementing Sustainable Energy under Competitive Electricity Markets. Graduate Research Project. School of Resource and Environmental Management. Simon Fraser University. 1997.

[11] IEA. 1999. page 10.

[12] Canada's major renewable energy industry associations have identified 11 measures Canada's governments could take to promote renewable energy. *(Low Impact Renewable Energy: Options for a Clean Environment and Healthy Canadian Economy*, 1999).

[13] OECD/IEA. *Renewable Energy Policies in IEA Countries: Volume II: Country Reports.* 1998.

Country	Utility Purchasing Requirement	Other Regulatory Measures
Canada		
Denmark	• Utilities are required to purchase wind power at a set price.[14] • Utilities are required to use a certain amount of straw and wood chips (biomass) in coal-fired plants.	• District heating systems that use biomass are specifically encouraged by a prohibition on electric heaters in specified residential areas.
Germany	• Utilities are required to purchase wind & solar power at a set price.[15]	• Net metering[16] is required nationally through legislation.
Japan		• Net metering is required nationally.
The Netherlands	• Solar Photovoltaic installation target of 7.7 MW in the year 2000 (legal agreement).	
United Kingdom	• Several "Renewable Orders" requiring renewable energy purchases by electricity suppliers.[17]	• Full retail competition in all electricity markets.
United States	• Renewable Portfolio Standards or Set-asides in several States.[18]	• Restructuring of the electricity markets – gradually toward retail competition. • Net metering is offered in 26 States and has been proposed nationally.

[14] In 1992 a parliamentary resolution required utilities to undertake fuel substitutions, including uptake of biomass, wind and other types of renewable electricity at a set price. The government has also required municipalities to elaborate plans for future wind turbine siting.

[15] The Electricity Feed Law required utilities to buy renewable electricity generated from third parties at prices between 65-90% of consumer electricity prices. These high buy-back rates have made renewable electricity a commercially attractive option. Wind capacity went up from 2MW in 1990 to 2874 MW by the end of 1998.

[16] Net metering allows consumers that produce electricity with their own renewable energy systems to "bank" any surplus electricity by feeding it into the grid and running their electrical meter backwards, thus crediting their utility bill. There is typically a limit on the capacity of such systems.

[17] The Non-Fossil Fuel Obligation (NFFO) originated in 1989 during the privatization of the electricity supply industry. Since 1990, there have been four renewable Orders in England and Wales, two Scottish Renewables Orders, and two Orders in Northern Ireland. NFFO Orders are financed through the "fossil fuel levy" on electricity bills. The contractual time scale for the NFFO runs for 15 years. Total approved capacity for all of the Orders to the end of 1997 was 2,317 MW, with a total of 619 projects. Prices paid for renewable energy have declined between subsequent Orders.

[18] Arizona, Connecticut, Iowa, Maine, Massachusetts, Minnesota, Nevada, New Jersey, Wisconsin. The Clinton Administration is proposing a national renewable portfolio standard of 7.5%, excluding hydroelectricity, by 2010.

Fiscal Mechanisms

Governments can implement fiscal mechanisms that support the development and deployment of renewable energy technologies. These can be directed at producers or consumers of renewable energy and can take various forms:

- subsidies, low-interest loans, loan guarantees, or special tax treatment to reduce the capital costs associated with the construction and installation of renewable energy technologies,
- taxes on conventional energy sources that make renewable energy sources more competitive, or
- credits awarded on a "per unit of energy" basis to either producers or consumers of renewable energy.

The table below compares Canada's fiscal regime for renewable energy with the situation in a number of other leading industrialized countries. While Canada does provide some financial assistance for a limited group of renewable energy technologies under the Renewable Energy Deployment Initiative, it is clear that other countries are investing significantly more to provide incentives for both the production and consumption of renewable energy.

Country	Capital Cost Subsidy	Other Fiscal Measures
Canada	• Provides a 25% capital cost rebate for limited applications[19] over 3 yrs.	• Tax write-off for pre-development expenses for renewable energy facilities.[20]
Denmark	• 30-50% subsidy for some renewable energy developments including CHP.[21]	• 15-30% subsidies are available to consumers for the purchase of solar hot water heating systems. • Producers receive a credit of 0.1-0.27 DKr/kWh.[22] • Carbon tax has been implemented.
Germany	• 100 million DM[23] capital subsidy program for solar, heat pumps, small hydro, wind, and biomass.	• Low interest loans provided for wind, hydro, biomass and solar installations through public bank.[24]
Japan	• Incentives representing 10% of cost for small-hydro, 20% for geothermal, 50% for wind and up to 67% for solar PV in buildings.	• Subsidies of 11.1 billion Yen in 1997 for solar PV, totaling 12,900 systems.[25]

[19] Solar and biomass thermal technologies – mostly in the commercial sector, excluding solar pool heating.

[20] Canadian Renewable Energy and Conservation Expense (CRCE). Only a small part of total project expenses are eligible.

[21] Combined heat and power.

[22] On average in 1997, US$1 = 6.604 DKr.

[23] In 1997, US$1 = 1.734 DM

[24] The Deutsche Ausgleichsbank.

[25] In 1997, US$1 = 121 Yen.

Country	Capital Cost Subsidy	Other Fiscal Measures
The Netherlands	• Tax deductions of 40-52% on capital costs of renewable energy technologies.	• Renewable energy exempted from energy taxes and value added taxes. • Carbon tax has been implemented.
United Kingdom	• Grants for biomass production.	• Non-fossil fuel obligation (NFFO) levy charged on conventional electricity systems to subsidize renewable energy systems.
United States	• Investment credit for solar and geothermal projects.[26]	• Several producer and consumer subsidies funded through levies.[27] • Production tax credit for biomass and wind.[28]

Research, Development and Demonstration Programs

Governments can support renewable energy through research, development, and demonstration (R,D&D) programs designed to develop the next generation of renewable energy technologies and improve the technical performance of existing ones. Demonstration programs, including government procurement of renewable energy, improve consumer confidence in technologies and set an example for others to follow.

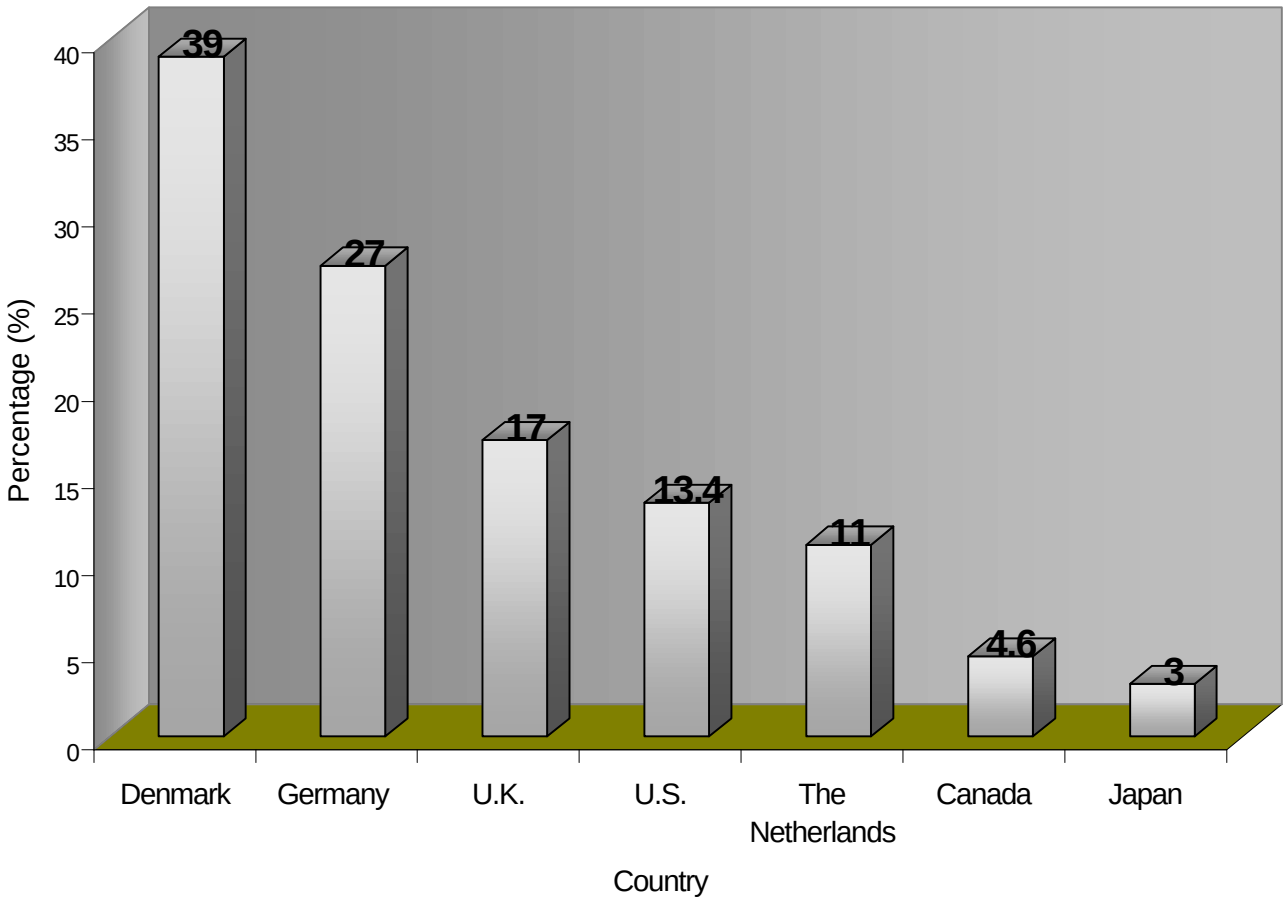
Figure 2 demonstrates the percentage of government energy research and development spending directed to renewable energy technologies in a number of important industrialized countries in 1995. Once again, Canada is near the bottom of the list.

[26] The investment credit (Section 1916 of the Energy Policy Act of 1992) provides a 10% investment credit for most solar and geothermal technologies.

[27] California, Connecticut, Illinois, Massachusetts, Montana, New Jersey, New York, Pennsylvania, and Rhode Island.

[28] The production tax credit (Section 1913 of the Energy Policy Act) supports wind and closed-loop biomass for electricity produced in stations brought on line before July 1, 1999. The Clinton Administration has proposed a five-year extension.

Figure 2. Percentage of Total Government Energy R&D Spending on Renewable Energy (1995)



International Energy Agency. 1996. IEA Research and Development Statistics, 1974-1995.

Canada's performance has improved somewhat in recent years and, in 1997 the percentage of energy research and development spending devoted to renewable energy technologies had increased, but was still less than 10%. This still, however, leaves Canada near the bottom of the pack.

The table below lists initiatives that are being taken to promote the demonstration of renewable energy technologies. While Canada is doing some work in this area, other countries are doing as much or more to demonstrate the viability of renewable energy technologies.

Country	Demonstration Programs	Others
Canada	• Programs to demonstrate renewable energy technologies (solar PV, wind, micro-hydro, biomass) in northern and remote regions.	• Green power procurement by the federal government (currently 0.4% of total electricity use).
Denmark	• Seven demonstration biogas plants and one geothermal plant have been developed.	• Overseas Development Assistance funding for promoting wind technologies in developing countries.
Germany	• Solar water heating demonstration in public buildings, especially in the former GDR.	• 50,000 solar roofs initiative to promote solar PV installations.
Japan	• Solar PV demonstration projects of 30 MW in 1997 with a year 2000 target of 400MW.[29]	• Multinational research on, and demonstration of PV power systems in Nepal, Mongolia, Thailand, and Malaysia.
The Netherlands	• Demonstration of a 100MW offshore wind station.	• 80,000 solar water heater installations by 2000.
United Kingdom	• Development and testing of wave energy devices in the sea.	• The R&D program includes promotion of technologies and expertise to overseas markets.
United States	• Numerous demonstration projects through the National Renewable Energy Laboratory and other government agencies.	• Million solar roofs initiative to promote solar PV and water heating systems.

[29] The New Energy and Industrial Technology Development Organization is responsible for implementing renewable energy policy via the "New Sunshine Project."

Conclusion

Energy is the lifeblood of the economy. However, as a result of scientific assessments around climate change and other environmental issues it has recently become clear that the environmental impacts associated with conventional energy sources will necessitate a shift to cleaner and less carbon-intensive renewable energy technologies. This represents a significant economic opportunity for the countries that develop and successfully deploy these technologies.

Canada, like other industrialized countries, currently makes relatively little use of renewable energy technologies as they are defined in this paper. Nonetheless, it is clear that the penetration of these technologies into the marketplace is proceeding more slowly in Canada than in many other industrialized countries. Much more distressing, however, is the fact that Canada's federal and provincial governments are doing little to support the further development and deployment of renewable energy technologies in Canada.

A number of other major industrialized countries are proceeding with regulations mandating the use of renewable energy and fiscal policies that provide clear incentives for both the production and consumption of renewable energy. If Canada fails to do the same, we run the risk of playing a significantly less important role in the global energy economy of the 21st century.