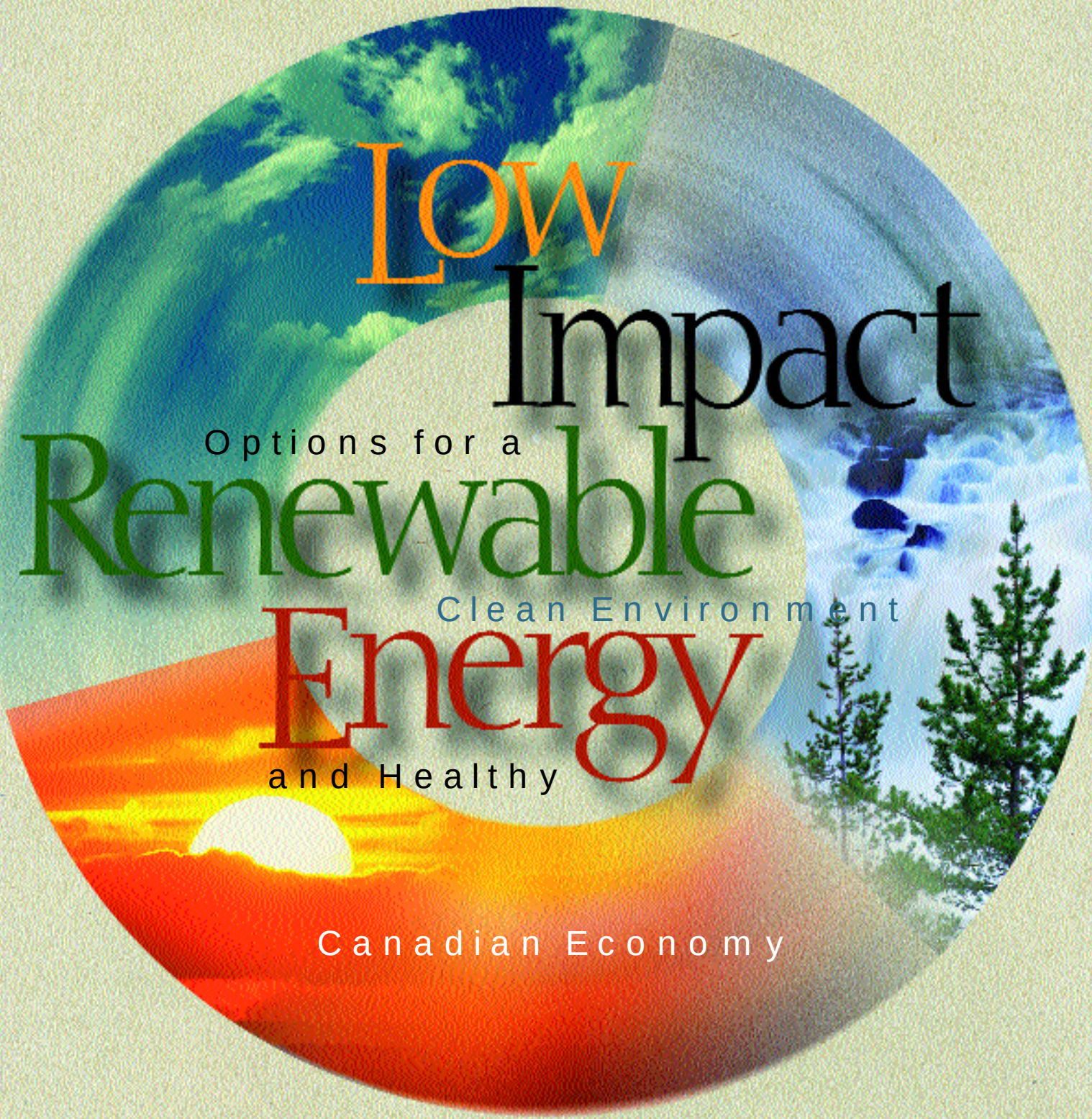


Low Impact Renewable Energy

Options for a Clean Environment and Healthy Canadian Economy

Canadian Wind Energy Association (CanWEA)

Solar Energy Society of Canada Inc. (SESCI)

Earth Energy Society of Canada (EESC)

Canadian Solar Industries Association (CanSIA)

Canadian Association for Renewable Energies (CARE)

Low impact Renewable Energy Technologies

Solar energy can be captured directly by several technologies. **Solar thermal** technologies convert solar energy into thermal energy for water and air heating. Applications include solar water heating systems as well as solar walls for large-scale space heating. The cost of most solar thermal technologies are easily paid back in fuel savings over the life of the technology. **Photovoltaics (PV)** convert the sun's energy into electricity. PV technology provides operational cost savings in many on and off-grid applications. In recent years, the annual global growth rate for PV sales has averaged over 25%. **Passive solar** uses building design techniques to capture and store the sun's energy for temperature regulation in residential and commercial buildings.

Photo: courtesy Natural Resources Canada

Wind energy is the fastest growing form of energy in the world and has achieved cost reductions of more than 50% over the last decade. Wind turbines are used to capture the energy of the wind and convert it into electricity. They come in all sizes and many European manufacturers are now building individual wind turbines big enough to provide the electricity for more than 500 homes.

Photo: courtesy
Vision Quest Windelectric Inc.

Earth energy is solar energy absorbed by the earth and stored just a few meters below the surface. This free energy can be recovered and upgraded to useful temperatures using a ground-source heat pump. This heat can then be delivered as hot air or water for residential or commercial scale space heating. The process can also be reversed for air-conditioning. In many cases, the cost of earth energy systems are easily paid back in fuel savings over the life of the technology.

Photo: courtesy Natural Resources Canada

Run-of-river hydro uses a turbine to generate electricity from naturally flowing water, without building a dam to store water specifically for electricity generation. With a suitable site that is close to the electricity load, run-of-river hydro generation is economical over the long-term and can produce significant amounts of electricity. **Micro and minihydro** technologies, which also use free flowing water, are often economical for smaller-scale generation in rural or remote locations.

Photo: courtesy
Canadian Hydro Developers

Biomass fuels are produced from a variety of agricultural crops as well as wood and agricultural wastes. Ethanol is one example of a biomass fuel that is already commonly used as a gasoline additive. Most vehicles could burn a fuel with a much higher ethanol content without affecting vehicle performance while at the same time reducing harmful emissions.

Photo: courtesy Natural Resources Canada

Executive Summary

Low-impact renewable energy is the fastest-growing form of energy in the world. Although it currently takes a back seat in Canada to more traditional energy industries, our key trading partners and several of the world's largest multinationals are investing hundreds of millions of dollars in low-impact renewable energy to prepare for the coming change in global energy markets.

As Canada debates ways to address climate change, the country's low-impact renewable energy industries want to ensure that Canadians are provided with all of the options available to them. Accordingly, they have come together to create ***Options for a Clean Environment and Healthy Canadian Economy***. Recognizing there is no "silver bullet" solution to climate change, this document identifies an important suite of measures that, along with others, will allow Canada to achieve its long-term economic and environmental goals.

The measures described in this document represent an investment in Canada's future. If implemented, they will reduce annual greenhouse gas (GHG) emissions by more than 12 million tonnes (Mt) by the year 2010 (roughly 8% of Canada's reduction target[1]), create thousands of new jobs, and reduce health-care costs by millions of dollars each year. The most significant dividends from these measures, however, will occur after 2010 as a result of having set in motion fundamental changes in the attitudes of Canadians and the nature of the Canadian energy market. By 2020, the spin-off actions prompted by these measures will likely have resulted in GHG reductions twice as great as those achieved in 2010.

This document highlights the opportunities associated specifically with Canada's low-impact renewable energy resources. These are non-fossil-fuel resources that are replenished through the earth's natural cycles and have a minimal impact on the environment and human health. They include wind, solar, earth energy, run-of-river hydro and sustainable biomass fuels. These resources can replace fossil fuels in a variety of areas, including electricity and space and water heating. Fuel cells, although not a renewable resource in themselves, are a promising technology that in combination with renewables have the potential to deliver versatile low-impact electricity. The document also identifies opportunities associated with the increased use of passive renewable energy and energy efficiency in buildings.

The following are some key messages that Canada's low-impact renewable energy industries would like to share with Canadians:

- ***The technology that exists today can make a significant contribution to Canada's emission reduction commitments.*** While targeted R&D spending is necessary for some technologies, the current priority should be to develop and enhance the markets for clean technologies already demonstrating strong growth in market share in other countries.
- ***The options available to tackle climate change can result in a net economic benefit for Canada.*** Many of the measures outlined in this document are "no-regrets" solutions, meaning that other benefits such as job creation and reduced health-care costs justify their implementation regardless of their potential to reduce GHG emissions.
- ***The earlier Canada implements measures to deal with climate change, the greater the benefit to Canadians.*** All the measures identified in this document can be implemented immediately and will reduce the costs of tackling climate change in the future by helping build Canada's capacity to reduce and avoid emissions early on.

1 Canada's official projection is that GHG emissions will be 140 Mt above the level required under the Kyoto Protocol. The Kyoto Protocol requires Canada to reduce its GHG emissions to 6% below 1990 levels averaged over the 2008-2012 period.

The following are three key options identified by Canada's low-impact renewable energy sector and their potential contribution to reducing the country's greenhouse gas emissions. For each of these options a set of complementary measures has been developed.

1. Stimulate the Development of a Low-Impact Renewable Electricity Market (4.1 Mt)

a) Consumer information on electricity products (enabling measure)
b) Market-wide incentives for low-impact generation (consumer credit, production credit, RPS) (2.3 Mt)
c) Green power procurement (0.4 Mt)
d) Removal of tax barriers to renewable generation (1.4 Mt)

2. Support Consumer-Based Renewable Technology Use (6.1 Mt)

a) Net metering (0.1 Mt)
b) Consumer credit for rural renewable electricity generation (0.5 Mt)
c) Municipalities and federal government 50,000 solar roofs partnership (0.4 Mt)
d) Accelerated financing for on-site renewable space and water heating (2.0 Mt)
e) Minimum biomass fuel content in gasoline (3.1 Mt)

3. Encourage Greater Passive Renewable and Energy Efficiency Use (3.2 Mt)

a) Low-cost financing for R-2000 homes (0.5 Mt)
b) Low interest loans or tax incentives for residential energy efficient retrofits (1.4 Mt)

The measures described in this document represent an investment in Canada's future. If implemented, they will significantly reduce annual greenhouse gas emissions, create thousands of new jobs, and reduce health-care costs by millions of dollars each year.

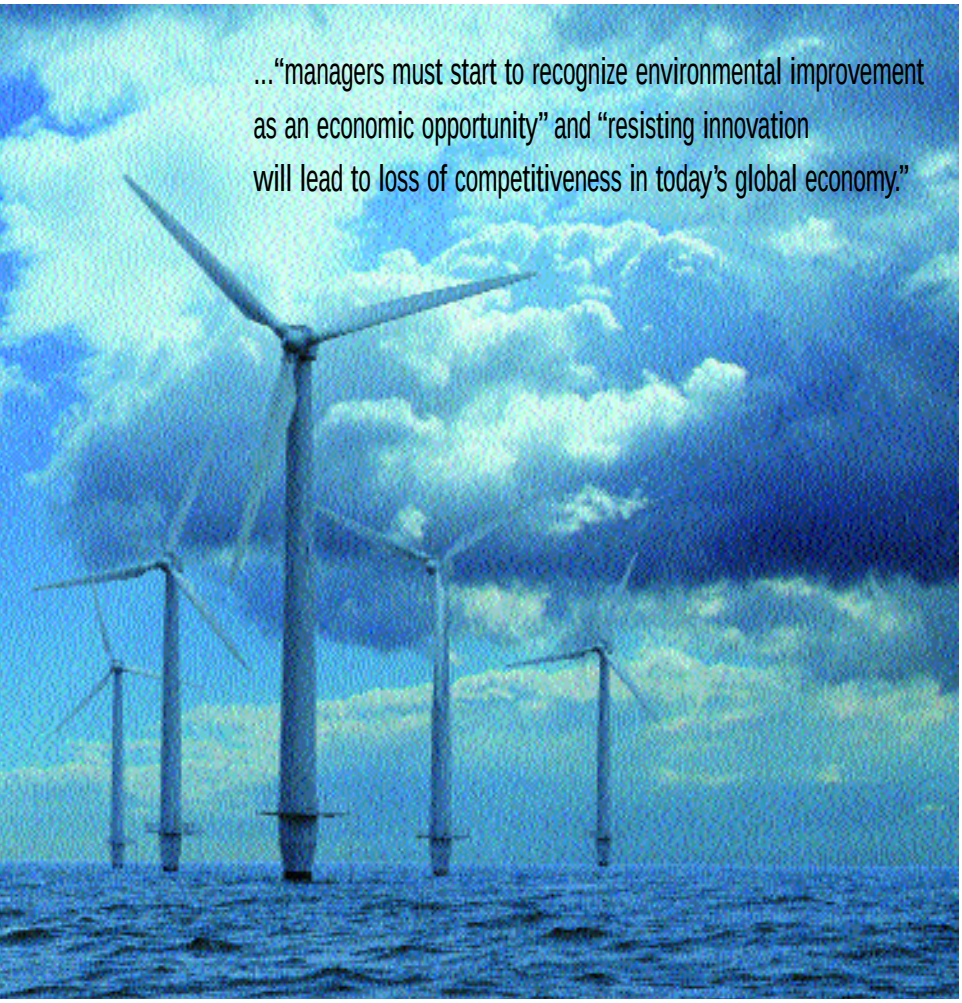
Wind turbines off the coast of Sweden (Photo: courtesy NEG Micon)

The Coming Energy Revolution

The world is on the verge of an energy revolution. Shell International's assessment of global trends indicates that significant market changes will occur in the world's energy industry over the next few decades. In fact, both Shell and BP-Amoco have stated that they will invest hundreds of millions of dollars to prepare themselves for a market in which, they believe, renewable energy will provide 5%-10% of the world's energy supply by 2020 and 50% by 2050.

In an article titled "The Future of Energy", The Economist magazine suggests the rapid decline in the cost of renewables could force the mighty $1-trillion-a-year fossil-fuel industry into retreat early in the next century.[2] The article says wind energy "is within nudging distance of price equality with fossil fuels," with costs roughly half of what they were in 1990. Conversely, the article sees a bleak future for nuclear and large hydro, even though governments in most industrialized countries still spend significantly more of their energy R&D budgets on nuclear than they do on renewables.

While some people with a vested interest in Canada's fossil-fuel industry warn that the measures required to address climate change will lead to economic disaster, many others believe they will create opportunity. As Michael Porter and Claas van der Linde argue in their article "Green and Competitive" in the Harvard Business Review, pollution is a product of inefficiency and well-designed environmental policies can trigger innovation and lower costs.[3] The authors state that "managers must start to recognize environmental improvement as an economic opportunity" and that "resisting innovation will lead to loss of competitiveness in today's global economy."



These arguments apply not only to corporations, but also to nations. Countries like the U.S., Britain, Japan and Germany are in the process of implementing, or have already implemented, strong regulatory measures to encourage the development of domestic renewable energy markets. Canada, on the other hand, has taken what would be generously described as "baby steps" towards preparing itself for the coming energy revolution.

Canadians have a choice to make. We can embrace the coming energy revolution and secure early-mover advantages in our economy and our environment. Or, we can continue to allow our economic liabilities and social costs to grow, and import the solutions to climate change at a much higher price in the future.

2 "The Future of Energy." The Economist, October 7, 1995: pg. 23-26
3 Michael Porter and Class van der Linde, "Green and Competitive: Ending the Stalemate". Harvard Business Review, September-October 1995: pg. 120-134

The Health Benefits of Renewable Energy

The emissions from the fossil fuels used for electricity and heating that have the greatest impact on human health are nitrogen oxides (NOx), sulphur dioxide (SO_2), and particulate matter (PM). Recent studies indicate that approximately 1 out of every 13 non-traumatic deaths occurring in Canadian cities can be attributed to air pollution from the burning of fossil fuels.[4] This results in enormous costs to Canadians and the Canadian health-care system.

Recent studies indicate that approximately 1 out of every 13 non-traumatic deaths occurring in Canadian cities can be attributed to air pollution from the burning of fossil fuels.[4]

A 1997 report compiled for the National Air Issues Coordinating Committee estimates that reducing SO_2 emissions by 50% in eastern Canada (approximately 1 million tonnes) would avoid 950 premature deaths, 1,530 emergency room visits, and 209,350 asthma symptom-days. Economists estimate the value of these avoided health costs to be between $1 and $7 billion per year.[5]

Similarly, a 1995 study carried out for the U.S. Environmental Protection Agency estimates that if the U.S. achieved its Clean Air Act target of reducing 10 million tonnes of SO_2 by 2010, the annual savings in health-care costs would be between $12 and $78 billion.[6]

If implemented, the measures identified in this paper will reduce emissions of both NOx and SO_2 by approximately 20,000 tonnes[7]. Although the resulting health-care savings are difficult to quantify, the studies cited above suggest they could total between $20 and $140 million per year[8].

The Employment Benefits of Renewable Energy

In a 1997 study for Environment Canada, the Pembina Institute found that investment in energy efficiency and renewable energy produce substantially higher levels of employment than equivalent levels of investment in conventional energy supply.[9] The report found that for every million dollars invested, an average of 36.3 jobs are created in the energy efficiency sector or 12.2 in the renewable energy sector. For every million dollars invested in conventional energy, an average of only 7.3 jobs are created. Based on this information, the measures identified in this document would result in a total net increase of more than 100,000 person years of employment.[10]

...investment in energy efficiency and renewable energy produce substantially higher levels of employment than equivalent levels of investment in conventional energy supply.[9]

Building of a run-of-river hydroelectric turbine (Photo: courtesy Natural Resources Canada)

According to the Pembina report, the main reasons for the higher employment levels are the relative labour intensity of the work and the jobs created from the re-spending of energy savings. Another advantage lies in the type of jobs created. Renewable energy and energy efficiency investments result in jobs that have broad regional distribution, are ongoing in nature, and involve modest employee relocation.

The report also found that moderate levels of government investment in energy efficiency and renewable energy can leverage significant private investment. On average, every million dollars of government spending was found to result in six million dollars of private-sector spending.

4 R.T. Burnett et al., "The Effect of Urban Ambient Air Pollution Mix on Daily Mortality Rates in 11 Canadian Cities", Canadian Journal of Public Health 89-3 (May-June 1998): p. 152-156

5 Towards a National Acid Rain Strategy. Submitted to the National Air Issues Coordinating Committee by The Acidifying Emissions Task Group, July 1997.

6 Human Health Benefits from Sulfate Reductions Under Title IV of the 1990 Clean Air Act Amendments. Prepared for the U.S. Environmental Protection Agency by Hagler Bailly Consulting Inc., November 1995.

7 The ratio of CO_2 emissions to SO_2 and NOx is on average roughly 1000 to 2 based on the emission coefficients from Alberta based coal-fired and natural gas thermal electricity plants - data from Full Fuel Cycle Emissions Analysis for Existing and Future Electric Power Generation Options in Alberta, Canada (available from Alberta Department of Energy).

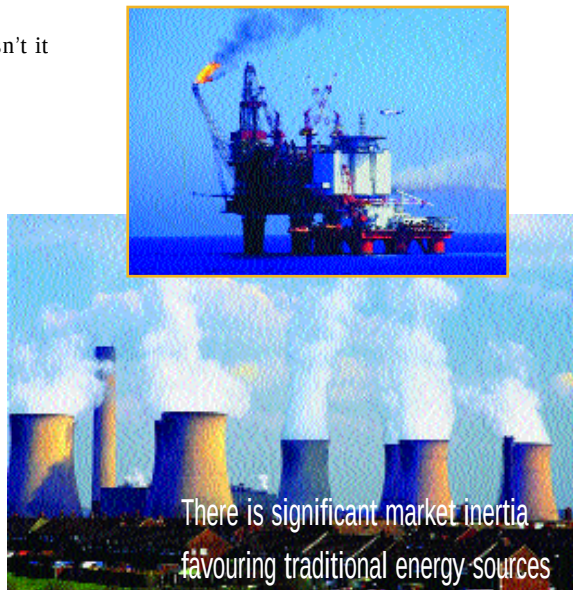
8 The avoided SO_2 emissions as a result of the proposed measures would likely be more dispersed than in the studies quoted. However, the health care savings as a result of reductions in other potentially harmful pollutants (NOx and PM) have not been included in the analysis, nor have the health benefits as a result of the emission reductions caused by an increased use of biofuels.

9 Comparative Analysis of Employment from Air Emission Reduction Measures, Pembina Institute, 1997.

10 See table Overview of Measures for calculation of net jobs created.

The Barriers to Renewable Energy in Canada

If low-impact renewable energy can help Canada reduce emissions at a relatively low cost as well as provide health and job creation benefits, why hasn't it made greater inroads into Canada's energy market?



- The structure of most electricity markets in Canada is not conducive to distributed generation, private-sector innovation or customer choice. The deployment of low-impact renewable electricity applications is still largely up to the discretion of regulated monopolies, which have little incentive to do so.
- There is significant market inertia favouring traditional energy sources in terms of investor comfort, utility expertise, market structures, and energy delivery infrastructure.
- Public funding for research and development of fossil-fuel, nuclear and large hydro resources in Canada has dwarfed and continues to dwarf the support for renewables. Although currently in decline, federal support between 1990 and 1999 for fossil fuels and nuclear power totaled more than $2.8 billion and $1.4 billion respectively.[11]
- In many cases, federal and provincial tax systems inadvertently favour the development of fossil fuels over renewable energy sources.
- There is significant institutional momentum within government that continues to favour traditional energy sources over renewables, despite strong economic, environmental and health arguments to the contrary.

Climate Change Solutions that Make Sense for Canada

Canada must choose climate change solutions that not only reduce GHG emissions, but support long-term economic stability and a healthy environment in general. Accordingly, the options identified by Canada's low-impact renewable energy sector are consistent with the following principles:

Construction of a wind turbine in Southern Alberta. (Photo: courtesy Vision Quest Windelectric Inc.)

Avoid Transferring Environmental and Health Burdens - We will do Canadians a disservice if we simply switch to forms of energy that have low GHG emissions (e.g. large hydro and nuclear) without taking into account the broader range of associated environmental and health impacts.

Include Canadians in the Solutions to Climate Change - Solutions should not focus on industry alone, but also empower individual Canadians to take action. If Canadians are not engaged in the solution, consumer attitudes will be slow to change and underlying consumption patterns will remain.

Reduce (first), Refuel (second), and Remediate (last) - Our first choice should be to reduce consumption. Our second choice should be to refuel with cleaner energy sources. Our last choice should be to implement end-of-pipe solutions. For example, capturing CO_2 and injecting it into the ground may look like a good solution in the short-term, but will likely increase Canada's economic and environmental liabilities in the long-term.

11 Government Spending and Regulatory Regimes for the Canadian Energy Sector. Prepared for The Commissioner of the Environment and Sustainable Development by Marbek Resource Consultants, April 1999.

Low-impact Renewable Energy Options

Canada's low-impact renewable energy sector has identified three key options for reducing greenhouse gas emissions:

1. Stimulate the development of a low-impact renewable electricity market
2. Support consumer-based renewable technology use
3. Encourage greater passive renewable and energy efficiency use

For each of these options, a set of complementary measures has been developed. If implemented, these measures will build our country's capacity to deal with climate change and reduce the costs of emission reductions in the future. These measures do not involve open-ended subsidies. Instead, they focus on developing a healthy long-term market for renewable energy and empowering Canadians to participate in the solutions to climate change.

10 MW Akolkolex run-of-river hydroelectric plant near Revelstoke, B.C. (Photo: courtesy Canadian Hydro Developers)

1. Stimulate the Development of a Low-impact Renewable Electricity Market

Approximately 20% of Canada's electricity comes from the burning of coal, oil and natural gas, resulting in roughly 17% of Canada's greenhouse gas emissions.[12] Low-impact renewable energy, on the other hand, currently contributes less than 1% of Canada's electricity supply, despite the fact that Canada has significant low-impact renewable resources with large emission reduction potential. In Europe, where wind resources are not as good as in Canada, wind energy produces enough power to serve the domestic electricity needs of more than 5 million people.[13] The potential emission reduction benefits of low-impact renewable electricity also reach far beyond the electricity sector. In fossil-fuel intensive sectors like transportation, there are opportunities to reduce emissions by switching from fossil fuels to electricity.

The following measures are designed to help develop a sustainable market for grid-connected low-impact renewable electricity. The goal of these measures, therefore, is to begin redirecting the current market inertia away from fossil fuel consumption and towards cleaner energy sources.

Measure A) Consumer Information on Electricity Products

Description

This measure requires mandatory disclosure of information on generation source and emissions characteristics by retailers of electricity. A measure of this nature has received support from the National Climate Change Process Electricity Issue Table.

Electricity product information will help Canadians understand the impact of electricity generation and empower them to make smarter choices about how much and what type of electricity to consume. Ontario is in the process of developing mandatory uniform labeling for electricity products, several U.S. states have already implemented it, and the U.S. Administration's proposed Comprehensive Electricity Competition Act will require it in all states.

GHG Impact

Although it is difficult to quantify the resulting reductions, this measure is a critical building block in developing a renewable electricity market.

Electric Power Content Label

Energy Resource	Electricity Product "A" (example)	1996 Ontario Power Mix (for comparison)*
Low-Impact Renewable		
- Wind	25%	<1%
- Run-of-River Hydro	25%	<1%
Coal	5%	13%
Nuclear	15%	54%
Natural Gas	5%	4%
Large Hydro	25%	28%
Other	0%	<1%
TOTAL	100%	100%

Similar in concept to food labeling, power content labeling would empower Canadians to make smarter choices about how much and what type of electricity to consume.

**Based on figures in Electric Power in Canada 1996, Canadian Electricity Association*

12 Foundation Paper on Climate Change - Electricity Sector. Hager Bailly Consulting Inc., October 1998.
13 A Plan for Action in Europe: Wind Energy The Facts, European Commission, 1999.

Costs and Implementation

The costs are small and could be paid for by government, utilities or consumers. They are administrative in nature, and involve tracking the supply of electricity by generation source and altering billing systems to incorporate generation information. In many jurisdictions, these administrative capabilities are already in place.

Although consumer protection legislation and utility regulation are provincial matters, the federal government might want to play a role in initiating and harmonizing disclosure requirements across the country to ensure consistency. Labeling requirements could be developed through an industry association or by governments, as is the case in Ontario and many U.S. states.

Measure B) Market-Wide Incentives for Low-Impact Renewable Generation

Description

This measure identifies three possible market-wide incentives to increase the proportion of low-impact renewable electricity in Canada's generation mix. They are: **1) a green power consumer rebate or credit; 2) a low-impact renewable production rebate or credit; and 3) a low-impact renewable portfolio standard.** All three of these incentives have been discussed by the National Climate Change Process Electricity Issue Table.

Because of Canada's diverse political and economic landscape, one of these incentives may be more suited to a particular region than the others. For example, Alberta's electricity market might be best served by a consumer rebate or credit, whereas Saskatchewan's might be better off with a renewable portfolio standard. In general, the goal should be to have one of these incentives implemented in each Canadian province.

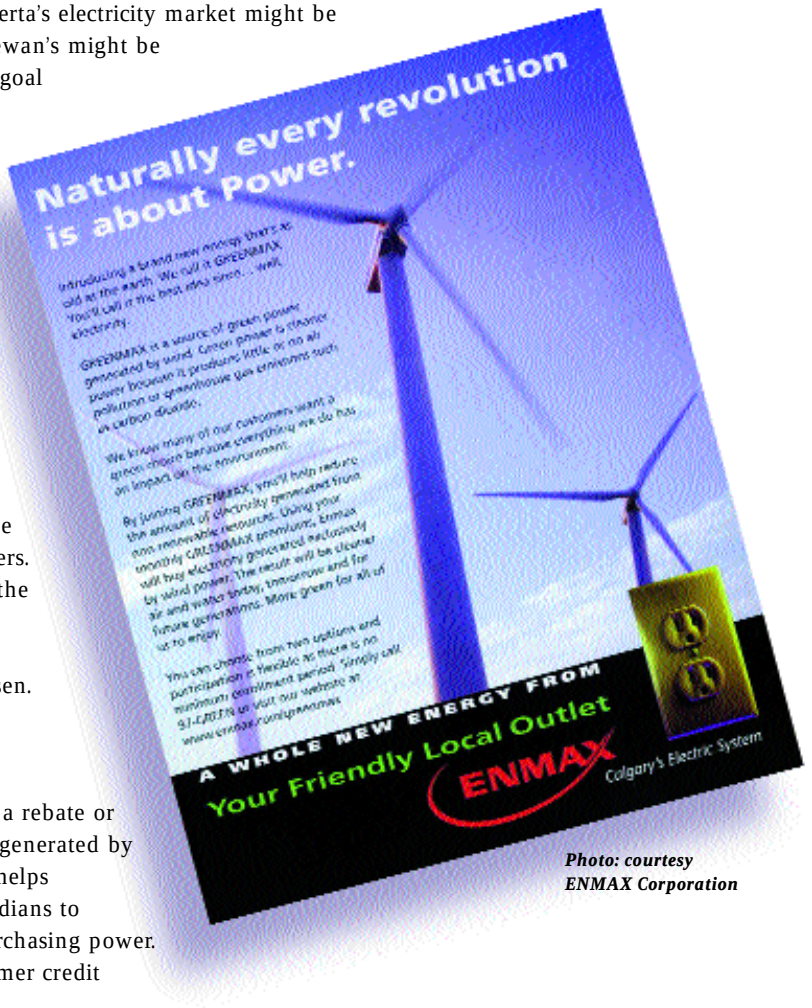


Photo: courtesy ENMAX Corporation

GHG Impact (2.3 Mt)

This measure assumes that for each of the three possible incentives, the net benefit to low-impact renewable electricity generators is a reduction in production costs of 2.5 cents/kWh. Analysis by the National Climate Change Process Electricity Issues Table indicates this would result in GHG reductions of 2.3 Mt a year by 2010.

Costs and Implementation

For each of the three possible incentives, the costs could be shared between the federal government and, depending on the incentive, either provincial governments or Canadian consumers. If the federal government were to provide the full amount of the incentive, modelling by the National Electricity Table indicates the cost would be approximately $60 million per year. Implementation would differ depending on the incentive chosen. The three incentives are described in more detail below.

1)Green Power Consumer Credit

This measure requires the federal government to provide a rebate or tax credit to those electricity consumers who purchase power generated by certified low-impact renewable energy sources. This not only helps stimulate the market for renewables, but also empowers Canadians to participate in the solution to climate change through their purchasing power. Consumers in California have responded positively to a customer credit program of this nature.

In California, of the 1% who have switched service providers since deregulation, approximately half purchased a renewable energy product. In Pennsylvania, it is estimated that almost 10% of the state's residents have switched to a new service provider, and 20% of those have selected a green power product.[14] Green marketers in the U.S. expect to garner 0.5%-2% of the residential market in the first year of deregulation and 4%-5% after five years. Canada has two green power programs offered by the Calgary (ENMAX) and Edmonton (Edmonton Power) electric systems who are preparing for electricity deregulation in Alberta in 2001. In the first three months of the Calgary program mote than 1000 customers signed on to purchase wind power.

A cost-sharing arrangement for this incentive might see the federal government provide a 1.5 cent/kWh credit, while consumers cover the additional 1.0 cent/kWh premium. A 1.0 cent/kWh premium represents an increase of about $5-$10 per month for the average Canadian household, if all its electricity came from low-impact renewable sources. If this incentive is implemented across Canada, it requires the participation of only 3% of residential consumers and 2% of commercial consumers to achieve the full 2.3 Mt of reductions. This measure requires that Canadian consumers have the option to buy low-impact renewable electricity in either deregulated or regulated markets.

2)Low-impact Renewable Production Credit

This incentive provides low-impact renewable electricity generators with a credit proportional to their output. It could be delivered as a tax credit or outside the tax system as a rebate, depending on the extent of the producer's taxability. The benefits of this incentive are that it is administratively simple and encourages operating efficiency. The U.S. has offered several tax incentives for low-impact renewable energy over the last two decades, well beyond the accelerated depreciation offered in Canada. Most notable is the 10-year, 1.5 cent/kWh production tax credit implemented in 1992 to encourage wind energy development.

The cost of this measure would likely be shared between the federal and provincial governments, as it would mean new economic activity, employment and tax revenues within a province.

3)Renewable Portfolio Standard

A renewable portfolio standard requires a certain percentage of electricity sold in a province to be generated from renewable energy. This quota approach would have a significant effect on emissions and dramatically accelerate the commercialization of emerging technologies. In order to limit costs, a system of tradeable "renewable energy credits" could be developed to allow retailers to purchase reductions from least-cost sources anywhere in Canada. In addition, the program could be terminated at a fixed point in the future. An RPS could be implemented in either regulated or deregulated electricity markets.

In order to achieve a reduction of 2.3 Mt of GHG emissions, every province would have to receive approximately 1% of its electricity from low-impact renewable sources. The U.S. Administration has proposed an RPS of 7.5% for all electricity retailers between 2010-2015, and other bills in the U.S. House and Senate propose quotas of 10-20%.

The federal government could share the additional costs of an RPS with either the provincial governments or Canadian consumers. This, however, is not consistent with the existing or proposed programs in the U.S. and Europe, which involve little cost to government. The quota is simply mandated and consumers pay the additional cost. These additional costs are not large because they are shared so widely.

Because of their jurisdiction over electricity regulation, provincial governments would be responsible for establishing renewable portfolio standards. However, if there were a system of nationwide tradeable RPS credits, it would require coordination between provincial governments on a national scale.

Wind turbines in southern Alberta provide the electricity for Natural Resources Canada's and Environment Canada's Alberta facilities (Photo: courtesy Vision Quest Windelectric Inc.)

Measure C) Government Green Power Procurement

Description

This measure would see federal, provincial and municipal governments make a commitment to buy a portion of their electricity from renewable energy sources. A similar measure has received general support at the National Climate Change Process Electricity Issue Table.

14 Ryan Wiser et al., Green Power Marketing in Retail Competition: An Early Assessment, Ernest Orlando Lawrence Berkeley National Laboratory, February 1999.

In 1994, the federal government's Task Force on Economic Instruments and Disincentives to Sound Environmental Practices recommended the government purchase a specific percentage of its electricity (15-20%) from "green power" sources. By doing so, the Task Force suggested, the government would demonstrate leadership, reduce the impact of its operations, and support the development of renewable energy. So far, two federal departments, Natural Resources Canada and Environment Canada, have taken up the challenge by pledging to buy between 15% and 20% of their electricity from renewables by 2010. The purchase of green power by these two departments for their Alberta facilities has helped stimulate the initial market for renewables in the province. However, in order for Canadian governments to encourage a stable market for renewables and accelerate cost reductions, a more significant commitment is required.

GHG Impact (0.4 Mt)

If the federal government alone were to purchase 15% of its total electricity supply from low-impact renewable sources by the year 2010, it would result in reductions of 0.4 Mt[15]. If provincial and municipal governments did the same, the reduction in emissions would more than double.

Costs and Implementation

The additional cost to the federal government for purchasing 15% of its power from green sources (assuming a 2.5 cent/kWh premium for renewable electricity) would be $11.2 million per year for 10 years.

Measure E) Remove the Effect of Tax-Induced Barriers to Renewable Energy

Description

Currently, fossil-fuel based companies and their investors enjoy greater access to federally-legislated tax write-offs than low-impact renewable energy companies. As a result, companies that explore, develop and use fossil-fuels are encouraged by the tax system to make the necessary investments to grow while low-impact renewable energy companies are not. The two underlying causes for this incentive to pollute are: 1) the existing tax write-offs for renewable energy companies are "trapped" and cannot be used to the same extent as the write-offs available to their fossil-fuel counterparts; and 2) the tax system treats capital and operating costs differently, and because renewable energy companies have a higher proportion of capital costs than their fossil-fuel counterparts, their proportional tax write-offs are smaller.

This measure proposes the federal government eliminate the effect of tax-induced barriers to the development of low-impact renewable energy. Regardless of how this is achieved, this oversight in the tax system requires a resolution or it will continue to significantly disadvantage low-impact renewable energy companies and limit Canada's ability to reduce emissions.

This issue has been identified by the National Climate Change Process Electricity Issue Table, and the Canadian Electricity and Canadian Gas Associations in their 1999 federal budget submissions. All of these groups recommended that the issue be addressed immediately.

GHG Impact (1.4 Mt)

Industry experts estimate that removing federal tax barriers to renewable energy will reduce costs by 1.5 to 2 cents/kWh.[16] In analysis by the National Climate Change Process Electricity Issue Table, a cost reduction of 1.5 cents/kWh for renewable energy resulted in 1.4 Mt of reductions.

Costs and Implementation

The cost of this measure is unknown. However, it is arguable that the additional new tax revenues resulting from growth in an emerging industry would outweigh the lost tax revenues. The federal government needs to sit down with industry stakeholders to find a solution that both removes the tax barriers and maintains the integrity of the tax system.

15 Based on a Passmore Associates International report following the federal government Green Power Procurement Workshop (September 27, 1995), it is assumed that total electricity purchases by the federal government are 3000 Gwh per year (15% = 450 Gwh). It is also assumed that the emissions factor for the electricity displaced by the green power is 1 kg of CO_2 per kWh or 1000 tonnes of CO_2 per Gwh.

16 Pers. Com. Vision Quest Windelectric, Calgary Alberta, June 1999.

2. Support Consumer-Based Renewable Technology Use

Greenhouse gas emissions from the residential and commercial sectors represent approximately 10% of Canada's total. These result from using fossil fuels directly for space and water heating, as well as fossil-fuel-generated electricity for lighting, cooking, heating and appliances. Greenhouse gas emissions from passenger transportation represent approximately 15% of Canada's total.

In many aspects of residential, commercial and agricultural energy use, there are significant opportunities to reduce emissions through the use of renewable technologies such as solar panels, solar hot water heaters, wind generators, ground-source heat pumps and biofuels. The following measures identify opportunities to increase the use of low-impact renewable energy technologies by Canadian consumers and companies, allowing them to participate directly in the solutions to climate change.

A ground-source heat pump provides earth energy to heat a building in Ottawa (Photo: courtesy Natural Resources Canada)

Measure A) Net Metering

Description

Net metering involves giving credit to electricity consumers whenever their on-site generation from solar, micro-hydro or wind exceeds their electricity use. Credit is given to consumers by reversing the direction of their electricity meter and crediting them the same price for the electricity they feed onto the grid as they pay for the power they take from the grid. This measure has been explored by the National Climate Change Process Electricity Issue Table.

At least 26 states in the U.S. have adopted net metering and the U.S. Administration's proposed electricity act would require it in all states. Japan and Germany have net metering nationally. Ontario Power Generation and Toronto Hydro currently have net metering pilot programs underway. This measure provides an economic incentive for Canadians to invest in renewable technologies without requiring government funding.

GHG Impact (0.1 Mt)

Based on the average level of customer uptake in existing net metering pilot programs in the U.S. and Canada, it is estimated that net metering would result in enough on-site renewable systems to provide electricity to approximately 30,000 Canadian homes. Assuming these systems are installed in those provinces with the best renewable energy regimes, it would result in 0.1 Mt of reductions.[17]

Costs and Implementation

The cost of purchasing renewable energy equipment and connecting to the grid is paid for by the customer. In general, the cost to the electricity provider is small, but depends on the characteristics of the renewable energy source and customer.

This measure requires that all retailers of electricity offer a net metering tariff to their customers. This will have to be regulated by provincial governments, with reasonable connection requirements regarding safety, technology specifications, and liability.

Measure B) Consumer Credit for Agricultural Renewable Electricity Generation

Description

This measure provides a rebate or credit to rural electricity consumers for their on-site renewable generation. This measure complements net metering by further decreasing the payback time for on-site renewable technologies such as wind turbines, solar PV and micro-hydro. Like many of the other measures identified, this measure empowers Canadians to participate in the solutions to climate change and allows them to take responsibility for the impact of their own consumption.

GHG Impact (0.5 Mt)

For example, if farmers received a 1.5 cent/kWh rebate or credit for small-scale wind generation, it would decrease the payback time on the average wind generator by 30%. This translates into a payback period of less than 15 years for a 50 kW turbine and less than 10 years for a 10 kW turbine. Assuming this resulted in 5% of Canadian farmers (or 7% of farms in Alberta, Saskatchewan and Ontario) installing wind generators, 0.5 Mt of reductions would occur.

17 Based on data from existing net metering pilot programs in the U.S. and Canada in the report Clean Power at Home (Andrew Pape, May 1999). It is assumed that the emissions factor of the electricity displaced by low-impact on-site renewable technologies is 0.5 kg/kWh.

Costs and Implementation

For the GHG reduction stated above, the cost to government of this measure is roughly $11 million per year for 10 years. This measure requires net metering and involves a partnership between the federal government, electricity suppliers and Canadians living in rural areas. It could be administered as either a rebate through the electricity supplier or a as a credit through the federal income tax system.

Measure C) Federal Government and Municipalities 50,000 Solar Roofs Partnership

Description

This measure involves a partnership between the Canadian government, municipalities and large commercial electricity consumers. The goal is to have 50,000 large solar PV systems installed on municipal and commercial buildings across Canada by 2010. Large-volume electricity consumers benefit by cutting down their peak load when electricity is most expensive (often reaching 25 cents/kWh). This volume of solar installations would drive cost reductions in solar PV technology and create significant Canadian expertise and employment in an industry that is growing rapidly worldwide.

Students and teachers at King City Secondary School near Toronto celebrate the installation of the school's 2 kW solar PV system.

GHG Impact (0.4 Mt)

If the federal government provided a 3 cent/kWh credit to those municipalities and commercial consumers that install large solar systems, it would reduce the payback period to under 25 years. If 50,000 systems were installed by 2010, it would result in 0.4 Mt of reductions[18].

Costs and Implementation

The cost to the federal government for this measure would be roughly $17 million per year for 10 years. It requires the federal government to work with municipalities and businesses to identify the lowest-cost opportunities for solar systems.

Measure D) Accelerated Financing for Space and Water Heating Renewable Technologies

Description

This measure helps Canadian consumers reduce the burden of capitalization when they choose to purchase a renewable technology for space or water heating purposes, such as a solar hot water or a ground-source heat pump. The federal government would guarantee fixed financing rates for purchases of specified small-scale solar and earth energy technologies. These technologies are also practical on a larger scale and a similar measure could be implemented for commercial and public buildings.

A solar thermal wall provides space heating for one of Bombardier's Montreal facilities (photo courtesy of Natural Resources Canada).

GHG Impact (2.0 Mt)

For example, if the government offered guaranteed financing at 7% on a 10-year loan for the purchase of specified renewable systems, it would change the current costs from a simple payback of 7 years into a net reduction of monthly energy costs from day one. Based on predictions by Natural Resources Canada, this would result in at least 8% of Canadian homes, or 660,000 households, installing Solar Domestic Hot Water, with a resulting reduction in emissions of approximately 2.0 Mt[19].

18 Based on personal communication with the Solar Energy Society of Canada Inc. (SESCI). The measure assumes that a 10 kW PV system will produce 11,500 peak kWh/yr and that the systems will displace electricity with an emission factor of 0.7 kg/kWh. This emission factor is based on the fact that the best solar regimes are in the most carbon-intensive provinces.

19 Emission reductions were based on data from a Natural Resources Canada report titled Active Solar Heating in Canada to the Year 2010, August 1992. The reductions were calculated using more conservative uptake figures than in the NRCan report and adopted the low emission reduction scenario proposed by NRCan.

Costs and Implementation

Based on the GHG impact described above and assuming that 10-year lending rates average 9% between 2000-2010, the cost to government of the 2% spread would be approximately $16 million per year for 10 years. Implementation of this measure would be similar to the initiative administered under the Small Business Loans Act, involving both the federal government and private-sector lenders.

Measure E) Minimum Biomass Fuel Content in Gasoline

Description

This measure would see the federal government mandate that gasoline sold for transportation purposes contain a minimum percentage of biofuels. Biofuels, such as ethanol, are produced from a variety of agricultural crops as well as wood and agricultural wastes. Although combustion of biofuels does produce greenhouse gases, they are significantly less carbon intensive than gasoline. Despite the fact that Canada is a world leader in the production of agricultural and forest fibre products, we are not one of the world's top 10 biomass fuel producers. It is estimated that Canada currently produces less than 5% of the country's readily available biomass fuel resources.[20]

GHG Impact (3.1 Mt)

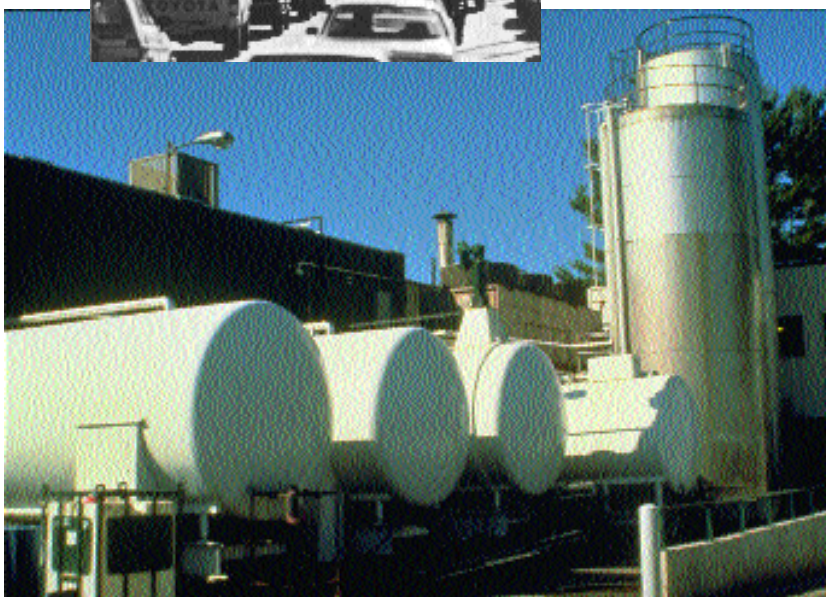
If the federal government were to mandate that all gasoline used for transportation contain 5% biomass fuel by 2010, it would result in annual greenhouse gas reductions of 3.1 Mt from projected levels.[21]

Costs and Implementation

The cost to government of this measure alone would be small but would likely need to be complemented with other measures such as tax breaks for biomass fuels and loan guarantees for construction of biomass fuel production facilities in order to achieve the proposed 5% target by 2010.

The federal government currently provides an excise tax exemption for alternative transportation fuels and has provided some loan guarantees to ethanol producers. It is arguable that a continuation of the excise tax exemption would be revenue neutral or net positive for the government as a result of new economic activity created by the biomass fuel industry.

Canada's transportation sector is responsible for 27% of our GHG emissions. Cars and light-duty trucks are the single biggest contributor to these emissions.



An ethanol plant in Ottawa converts agricultural and wood wastes into fuel (Photo: courtesy Natural Resources Canada)

20 Canadian Solutions, Pembina Institute and David Suzuki Foundation, October 1998.

21 This measure was modelled by the Energy Forecasting Division of Natural Resources Canada based on the description in Pembina Institute and David Suzuki Foundation report Canadian Solutions. The modelling assumed that the production of biofuels and gasoline are equally carbon-intensive and as a result likely underestimated the potential GHG reductions from the measure.

3. Encourage Greater Passive Renewable and Energy Efficiency Use

More than half of all homes in Canada were built before 1980. Since then, many cost-effective technologies have been developed to significantly improve the energy efficiency of older buildings. In addition, new building techniques and technologies have been developed in the residential sector that significantly increase the passive use of solar energy and energy efficiency over what is achieved by most of the houses built today. As a result, the potential to reduce greenhouse gas emissions through energy-efficient retrofits and new building techniques is considerable.

The following measures would encourage significant improvements in the use of passive solar and energy efficiency techniques in both existing and new Canadian homes. Again, this measure would allow Canadians to participate directly in the solutions to climate change while helping to change long-term energy consumption patterns.

Measure A) Reduced Financing Costs for R-2000 Homes

Description

This measure would see the federal government guarantee preferred mortgage rates for Canadians who choose to build R-2000 homes. A measure to strengthen Canada's R-2000 Program has also been discussed by the National Climate Change Process Buildings Issue Table.

Natural Resources Canada estimates that a new home built to R-2000 standards would reduce energy use by 26% relative to the average new home built in 1994.[22] Because R-2000 homes are slightly more expensive than conventional housing, however, those who choose to minimize their impact on the environment must take on a larger financial burden, both in terms of debt and property taxes. By removing this disincentive to save energy, the government would not only empower Canadians to reduce emissions, but also decrease the future cost of energy-efficient housing through the widespread adoption of R-2000 building methods. The Yukon Housing Corporation supports this concept through its recent initiative to provide a 1% reduction in mortgage rates for new homes or renovations that rate 80 on the Canadian Energuide Scale.

...a new home built to R-2000 standards would reduce energy use by 26% relative to the average new home built in 1994.[22]

GHG Impact (0.5 Mt)

If the government were to guarantee a 0.5% reduction on 5-year mortgage rates it would save the new R-2000 home owner approximately $4,000 and reduce the length of his or her mortgage by roughly two years.[23] If this resulted in 15% of all new homes being built to R-2000 standards, GHG emissions would be reduced by 0.5 Mt relative to projected levels for 2010.[24] If provincial governments were to mandate the R-2000 standard as the building code for all new homes constructed after the year 2000, it would result in 3.7 Mt of GHG reductions by the year 2010.[25]

Costs and Implementation

The federal government would need to work in cooperation with the financial community to provide preferred mortgage rates. Assuming the federal government could establish the necessary partnerships with lending institutions, the cost of implementing this measure would be small.

22 Household Energy Consumption Benchmarks for 1994 Newly Constructed Houses and its Associated Potential Energy Savings for both National Energy Code for Housing (NECH) and R-2000 Upgrades. Natural Resources Canada, August 1998.
23 Based on CMHC data on average median new house prices in Canadian Metropolitan areas during the months of June 1998 through May 1999.
24 Based on the Pembina Institute and David Suzuki Foundation report Canadian Solutions. These calculations are consistent with preliminary analysis (June 1999) by the National Climate Change Process Buildings Issue Table that found that a 10% penetration rate for R-2000 homes would result in 330 kilotonnes of reductions in 2010.
25 Canadian Solutions, Pembina Institute and David Suzuki Foundation, October 1998.

Measure B) Incentives for Residential Energy Efficient Retrofits

Description

This measure involves a combination of incentives to encourage energy-efficient retrofits in residential buildings. These incentives should include improved access to financing and tax breaks for homeowners who invest in energy-efficient retrofits. The National Climate Change Process Buildings Issue Table has discussed a similar measure.

GHG Impact (1.4 Mt)

If, by the year 2010, the above incentives resulted in 25% of existing Canadian homes improving their energy efficiency by 20%, it would result in 1.4 Mt of GHG reductions.[26]

Costs and Implementation

If the costs of this measure were shared evenly with provincial governments, the cost to the federal government would be in the order of $27 million per year.[27] The measure would involve an expansion of NRCan's residential energy efficiency program and require the federal government to establish partnerships with financial institutions and Canadian homeowners.

26 Based on the Pembina Institute and David Suzuki Foundation report Canadian Solutions. Their calculations were based on data provided by NRCan's Office of Energy Efficiency.

27 Based on preliminary analysis (June 1999) by the National Climate Change Process Buildings Issue Table. Calculations using the Table's numbers assume the level of reductions are directly proportional to the amount of incentives provided.

Conclusion

The analysis in this document and preliminary analysis carried out through the National Climate Change Process indicates, without a doubt, that existing low-impact renewable energy technologies can make a significant contribution to Canada's greenhouse gas reduction targets over the next ten years. The estimates of potential GHG reductions achieved by the measures proposed in this document are conservative. By 2010, the spin-off actions caused by these measures would likely result in reductions far greater than the estimated 8% of Canada's reduction target. By 2020, the dividends would likely double. In addition, the development of low-impact renewable energy resources would create thousands of additional jobs and result in a considerable reduction in health care costs.

The cost of low-impact renewable technologies has dropped dramatically in the last decade and continues to drop as industrialized nations and multinationals invest heavily in their development. In fact, some low-impact renewable technologies are close to achieving price equity with fossil-fuel based technologies without even taking into account their environmental and health benefits.

Canada has the opportunity to prosper in a renewable energy future. **Our country has some of the world's best low-impact renewable energy resources and a proud history in energy resource development. We must act now to develop a strong domestic market for low-impact renewable energy. This will significantly reduce Canada's economic and environmental liabilities and help keep our nation competitive in the rapidly changing global energy market.**

The political, economic and environmental events of the last decade clearly indicate that nations around the world are choosing a path towards cleaner energy sources and healthier economies. Canada's low-impact renewable energy industries call on Canadians and Canadian governments to do the same.

Overview of Costs and Benefits for Low-Impact Renewable Energy Measures

Mean health-care savings per year	$80 million
Value of net jobs created per year ($40,000 per job)	$406 million
Total cost to government per year (over 10 years)	($112 million)
Total net benefit per year	$272 million

Overview of Measures

Measure	GHG Impact (Mt/year by 2010)	Cost to government per year for 10 years (millions)[28]	Total investment dollars per year for 10 years (millions)[29]	Total (incremental) number of person years of employment created per year[30]
Consumer information	enabling measure	unquantified but likely small		
Market-wide incentives for renewable electricity	2.3	30	270	1,890 (270)
Green power procurement	0.4	11	19	134 (19)
Removal of tax barriers	1.4	unquantified but likely small	200	1,400 (200)
Net metering	0.1	unquantified but likely small	16	128 (32)
Agricultural renewable	0.5	11	98	784 (196)
50,000 solar roofs partnership	0.4	17	400	3,200 (800)
Accelerated financing for renewable heating	2.0	16	132	3,300 (2,640)
Minimum biomass fuel requirement	3.1	unquantified but likely small	170[31]	1190 (no data available)
Preferred mortgages for R-2000 homes	0.5	unquantified but likely small	52	no data available
Incentives for energy efficient retrofits	1.4	27	300	7500 (6000)
Total	12.1	112	1,487	18,336 (10,157)

28 These cost do not include program implementation. The cost of implementation will vary greatly from measure to measure but the incremental costs in many cases should be minimal due to existing government service delivery infrastructure.

29 Large scale wind is assumed to have an average capacity factor of 32% and cost $1.2 million per installed MW. Domestic solar hot water systems are assumed to cost $2,000. 10 kW solar PV systems are assumed to cost $80,000.

30 Total person years of employment created for each year of a ten year program. (Incremental) indicates jobs above and beyond what would have been created with the same level of investment in traditional energy sources. Figures based on estimates contained in Comparative Analysis of Employment from Air Emission Reduction Measures, Pembina, 1997. Jobs per million (JPM) is defined in the report as direct, indirect, induced and respending person years per $1 million in capital and operating costs, in 1996 Canadian dollars. For the purposes of this analysis, wind generation is assumed to create on average 7 JPM of which 1 is incremental (replacing natural gas generation 6 JPM). Solar thermal systems are assumed to create 25 JPM, of which at least 20 are incremental. On-site renewable electricity systems are assumed to create 8 JPM of which 2 are incremental (replacing natural gas generation 6 JPM). Residential energy efficiency is assumed to create 25 JPM, of which at least 20 are incremental. Biomass fuel production is assumed to create 7 JPM and the number of incremental jobs is unknown.

31 Pers. Com. Jeff Passmore, IOGEN Corp., July 1999. 5% of gasoline consumption in Canada for cars and light trucks in 2010 is assumed to be approximately 2 billion litres. This requires approximately 1.7 billion dollars of investment between 2000 and 2010.

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