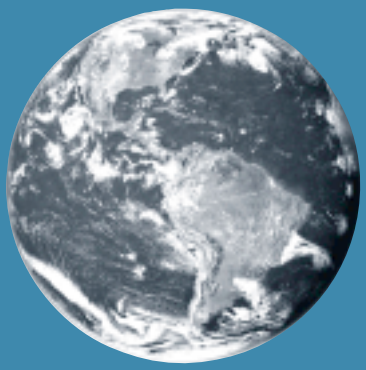
# Kyoto and Beyond



## The Low Emission Path to Innovation and Efficiency

Canada can reduce its greenhouse gas emissions by almost half by 2030, surpassing the Kyoto target along the way, and putting the nation on course for even further emission reductions in the long term.

We can make these reductions using existing technology, with annual energy savings for industry and consumers of $30 billion by 2030.

This effort will build on the gains we have already made. Since 1970, efficiency and conservation have been a more important source of new energy for Canada than all other new sources combined. Canadians have pocketed billions of dollars in savings on their energy bills, and have avoided significant air pollution as a result.

At Interface, we take considerable pride in making the best carpets and flooring on the market. It's a big part of how we make our living. But a successful business needs other priorities too, such as energy efficiency, protecting the natural environment, and maintaining a healthy workplace. For nearly a decade, Interface has built on a vision of becoming the world's first environmentally restorative corporation. We adopted this vision because it makes good business sense – and because it is the right thing to do.

Our Canadian operation offers a good example of how a company can learn to make better use of energy resources. Interface Canada reduced its energy consumption by 70 per cent during the 1990s by reviewing every one of our business activities, from electricity consumption at our Belleville plant to trucking procedures and executive travel. This is currently saving us more than $600,000 per year in energy costs. We have directed part of these savings to promote green power, signing an agreement with Ontario Hydro to purchase a quarter of our electric power from certified green sources. By cutting its energy use, Interface Canada has reduced greenhouse gas emissions by 64 per cent from the peak, and made money in the process, in no small measure because our customers support environmental responsibility. We are also helping our employees reduce their personal emissions through a home energy savings program and alternative travel programs, making their participation in the company vision more affordable.

I commend the David Suzuki Foundation and the Climate Action Network for advancing similar far-sighted and positive climate change solutions for Canada – to take your country to its Kyoto target and beyond. As the report points out, we can all help to safeguard the environment by combining consumer awareness, corporate responsibility, profitable innovation and facilitation by government. We are building a cleaner, more energy-efficient world – and a better and more hopeful world for our children and grandchildren.

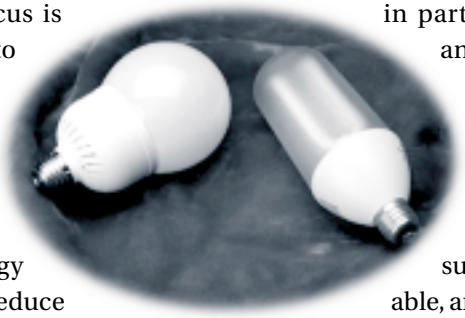
**Ray Anderson, Chair**
Interface, Inc.

*Interface, Inc, based in Atlanta, is the world's largest carpet manufacturer, with production facilities on four continents and annual sales of over $1 billion (U.S.)*

# Climate Change and the Case for a 50 Per Cent Reduction

Most Canadians agree that climate change is a serious long-term problem. The world will need to make large and continuing reductions in greenhouse gas emissions to stabilize and then roll back the concentration of these gases in our atmosphere. There is little argument about whether Canada should act. The question, rather, is how fast we should move, and how we should allocate the costs and benefits of shifting to a sustainable, low-emission economy.

More and more, the transition to a sustainable energy economy is emerging as an opportunity rather than a burden. The focus is shifting to setting priorities, to choosing the technologies and programs that will pay off. In this report, we suggest clear and practical ways to reduce Canada's emissions by half. A concerted effort to cut energy consumption and waste will reduce energy bills for businesses and individual consumers, and channel that spending into other goods and services. The shift to cleaner energy and more efficient and innovative industrial processes will create jobs in energy-related design and manufacturing, deliver health benefits and help protect the environment – but only with careful management and broad public support.



The Kyoto Protocol calls on Canada to reduce greenhouse gas emissions by six per cent relative to 1990 levels. Since we have delayed in attacking the emissions problem, the size of the reduction required will actually be closer to 22 per cent from 2004 levels. The international process for implementing Kyoto will reduce emissions and help to create a joint framework for responding to global warming. Even with U.S. participation, however, implementing Kyoto will not stop the rise in atmospheric concentrations of greenhouse gases. We need a long-term plan for deeper reductions – for both short- and long-term reasons. It is not enough to say that "a six per cent reduction will put us on the road to 50 per cent." In fact, a six per cent reduction that is carried out as an end in itself will be very different from a six per cent reduction that is part of a bigger plan. The opportunities will be different, and so will the investment plans and the policy responses.

Ratifying Kyoto is important for Canada, in part to protect our reputation as an environmentally responsible nation. Developing an effective implementation plan focused on opportunity is even more important. A careful long-term plan will show that the shift to a sustainable economy is manageable, and that all regions of Canada can benefit. This approach will support the priority of Canadian governments for technological and industrial innovation. It will also deliver on other important national priorities, such as health benefits from improved air quality, environmental protection, and the revitalization of cities through investment in transit and infrastructure.

This document is a summary of a broad-based technical report.[1] The full report presents a detailed, end-use oriented analysis of the Canadian energy economy, using 2004 as a base year and looking out to 2030. By considering each sector of the economy (residential, commercial, transportation, industry, electric power, non-energy sources), we identified options for reducing emissions by adopting new, efficient technologies or switching to low- or zero-emission fuels. The objective was to find the best

1 "Kyoto and Beyond" is available at www.davidsuzuki.org, www.climatenetwork.org, and www.torriesmith.com

ways to cut Canadian emissions by half. Here are some of the key policy principles that shaped the report's conclusions:

- In a rational economy, energy is developed and used in response to the demand for goods and services, not for its own sake.
- Emission reduction strategies should be based on existing technologies that have been shown to be effective and economic.
- In the future, Canadians will continue to expect economic growth and social mobility. Our low-carbon scenario anticipates a 50 per cent per capita increase in GDP.
- The implementation plan should not rely on punitive energy taxes. However, it should reflect the full cost of each energy option, including the subsidies that currently flow to petroleum and nuclear production as well as health and environmental costs.
- Energy from local, small-scale sources will encourage greater self-reliance and insulate consumers from geopolitical crises and large-scale system failures.

Working from these principles, Canada can achieve the following with existing technologies and within current economic assumptions:

- A doubling of the thermal efficiency of residential and commercial buildings;
- A doubling of the fuel efficiency of the truck fleet, and a tripling of the efficiency of the passenger car fleet;
- A doubling of the average efficiency of electrical devices, including lighting, motors and appliances;
- A one per cent per year improvement in the energy efficiency of industrial output; and,
- A phasing out of coal- and nuclear-powered electrical generating plants as demand for electricity subsides and new co-generation and renewable opportunities arise.

In achieving such objectives, Canadians can reduce their greenhouse gas emissions by almost 50 per cent from 2004 to 2030. From an anticipated 727 megatonnes of greenhouse gas emissions in 2004, we would move down to 529 MT in 2012 and 368 MT in 2030. We estimate annual savings to consumers at $30 billion by 2030.[2]

**TABLE 1 DEMOGRAPHIC AND ACTIVITY DRIVER OUTLOOKS**

| | 2004 | 2012 | 2030 |
|---|---|---|---|
| Population (millions) | 31.6 | 33.6 | 37.1 |
| Households (millions) | 13.8 | 14.5 | 15.2 |
| GDP (billions of 1986$) | 695 | 805 | 1,225 |
| Per capita GDP (thousands of 1986$) | 22 | 24 | 33 |
| Commercial Floor Area (millions of sq. metres) | 579 | 667 | 842 |
| Industrial GDP (billions of 1986$) | 205 | 255 | 387 |
| Person-kilometres of travel | 665 | 698 | 729 |
| Tonne-kilometres of freight movement (billions) | 551 | 608 | 964 |

The *Kyoto & Beyond* scenario for 2030 assumes that growth rates for population, GDP and other activity drivers will fall within the conventional range of "business as usual" outlooks. 2030 was chosen as a target as it allows sufficient time for the natural replacement or retirement of most energy using equipment and power plants, as well as for renovation of the building stock. The intermediate (2012) scenario describes a Canadian economy that is meeting the Kyoto target as part of a long-term plan to reduce emissions by 50 per cent.

2 This figure assumes a $15-per-gigajoule cost saving from improved energy productivity using 1986 dollars.

# Kyoto and Beyond – Learning from the Canadian Experience

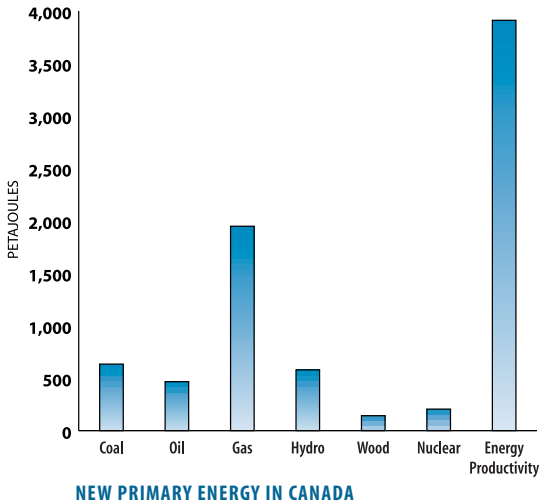
The core strategy for reducing greenhouse gas emissions is to reduce the burning of fossil fuels by using them more efficiently. Opponents of the Kyoto Protocol say this would cause net economic damage. They ignore the immense benefits that Canadians have enjoyed from 30 years of energy conservation.

Over the past generation, Canada's most important source of new energy has been increased energy productivity – that is, energy saved through conservation and a more efficient economy. This trend produced more new energy (3,900 petajoules from 1970 to 1998) than all other sources combined (3,800 PJ.)[3]

New energy technologies are a part of today's more attractive and efficient buildings and homes, improved appliances and cleaner industrial processes. Cost savings for Canadian consumers totalled more than $50 billion from 1970 to 1998. Many times this amount in capital investment would have been required to generate equivalent amounts of energy from new oil, gas, coal, hydro and nuclear sources. The additional burning of oil and coal would have dumped 200 megatonnes of $CO_2$ per year into the atmosphere, increasing current emissions output by a quarter, and would have increased urban smog by 20-25 per cent at a health cost in the billions of dollars.

All of this has taken place with no sustained national strategy to reduce greenhouse gas emissions or conserve energy. The gains occurred in the face of heavily subsidized competition and highly organized lobbying for oil, gas and nuclear power. Just imagine what Canada could do if we tried, collectively, to reduce emissions.

The interest of energy producers in this debate is clear. In the low-carbon, energy efficient scenario, the consumption of oil, coal and electric power will drop. Energy producing communities will be affected, and governments will need to prepare retraining and transition programs for possible use. Consumers, however, including industry, will enjoy short and long-term benefits from increased energy productivity. Billions of dollars in cost savings from energy efficiency will be reallocated throughout the economy, creating new jobs and opportunities across Canada, including those related to the production of ethanol and bio-diesel fuels on the prairies. Further, consumer exposure to energy price shocks will be reduced with the development of more diverse and localized energy sources.

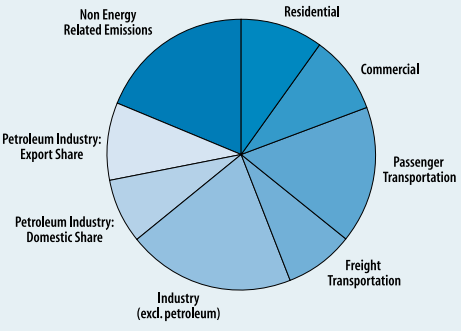



**NEW PRIMARY ENERGY IN CANADA**
1970-1998

3 With current patterns of use, one petajoule will provide heat and hot water to 8,000 Canadian houses.

# Greenhouse Gas Emissions in Canada – an Overview

The concentration of $CO_2$ in the atmosphere has increased sharply in the industrial era, from 280 parts per million (ppm) in 1750 to 370 ppm today. At current rates, the amount of atmospheric $CO_2$ that we have contributed will double by 2040, taking total levels to about 450 ppm, and triple by 2075. Even holding emissions at the 450 ppm level will require an ongoing, world-wide program of emission reductions.




**EMISSIONS BY SECTOR** 2004

Total emissions of greenhouse gases in Canada[4] are currently about 700 megatonnes per year, up from 606 megatonnes in 1990.[5] Seventy-eight per cent of this total is $CO_2$, mostly from fossil fuel production and consumption. Fossil fuel use also produces methane and nitrous oxide ($N_2O$), accounting for 7 per cent of emissions; industrial processes, agriculture and waste dumping also generate various greenhouse gas emissions.

The recent growth in emissions has come above all from three sources: the increasing use of light and heavy trucks, increasing emissions from fossil fuel production and refining, and the commissioning of new fossil-fuel driven power plants. Fossil fuel production and the burning of oil and coal to make electricity are both massive sources of greenhouse gas emissions in Canada.

Table 2 shows emission factors[6] for common energy sources and for the electric power industry. In particular, it points to the high level of emissions from the coal burning electric utilities of Alberta, Nova Scotia, Ontario and Saskatchewan. The solution is energy conservation, the development of co-generation facilities, fuel cell technologies and renewable sources, and more inter-provincial trade in hydro power. This would allow coal-fired power plants to be phased out over the next 10 years, and the nuclear power program to be wound up as existing plants are retired.

An effective long-term plan to move to a sustainable energy economy will show that in every sector, there are similar straightforward measures that will significantly reduce greenhouse gas emissions.

**TABLE 2** KGS OF $CO_2$ PER GJ

| SOURCE | EMISSION FACTOR |
|---|---|
| Energy Productivity | 0 |
| Wind | 0 |
| Micro Hydro | 0 |
| Natural Gas | 49.7 |
| Propane | 60.1 |
| Gasoline | 67.4 |
| Fuel Oil | 76.6 |
| Diesel | 80.2 |
| Coal | 86.5 |
| Provincial Electricity Systems | |
| Alberta | 260 |
| British Columbia | 15 |
| Manitoba | <3 |
| New Brunswick | 125 |
| Newfoundland | 62 |
| Nova Scotia | 261 |
| Ontario | 87 |
| PEI | 140 |
| Quebec | 3 |
| Saskatchewan | 222 |

4 Besides $CO_2$, common greenhouse gases include methane, nitrous oxide, hydrofluorocarbons and sulfur hexafluoride.

5 Canada's Greenhouse Gas Inventory, 1990-1999, Environment Canada, April 2001

6 The "emission factor" indicates kilos of $CO_2$ emissions per gigajoule of energy. A gigajoule is the amount of energy in 28 litres of gasoline. There are 1,000,000 gigajoules in a petajoule.

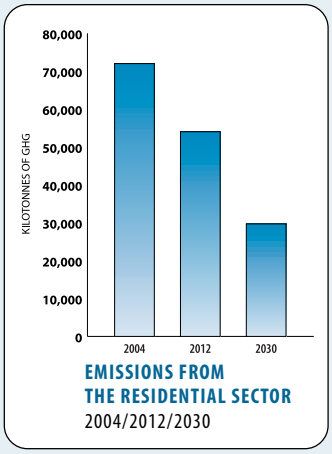
S O L U T I O N S

# The Residential Sector

IN TOTAL, GREENHOUSE GAS EMISSIONS FROM Canada's 13.8 million households are expected to reach 72 megatonnes in our base year, 2004. These emissions result from space heating, hot water heating and appliance use. Space heating produces half of these emissions, while water heating accounts for a surprising 28 per cent. The average detached home produces 50 per cent more emissions than the average apartment or condominium.

The emission intensity of Canadian households (the level of emissions in relation to the level of activity) is dropping by about 20 per cent from 1990 to 2004. Average emissions from space heating will decline by 21 per cent in this period because of better insulation and furnaces; from appliances, by up to 45 per cent, generating annual consumer savings by 2004 of more than $4 billion. Countervailing trends include population growth and the rising number of appliances per household, especially dishwashers and air conditioners. On balance, emissions are declining slightly in the residential sector.

Using existing technologies, Canada can reduce total residential emissions by 25 per cent from 2004 through 2012, and by 59 per cent by 2030. This includes an 82 per cent reduction in emissions associated with water heating. Policy measures to achieve this would include:




**EMISSIONS FROM THE RESIDENTIAL SECTOR**
2004/2012/2030

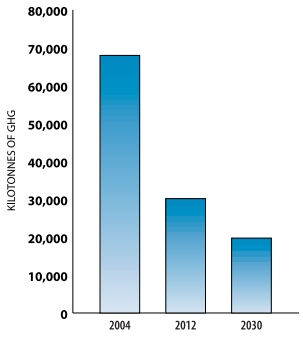
- Energy efficiency standards that require highly efficient insulation, doors and windows, and plumbing fixtures.
- A national retrofit program to provide practical energy-efficiency retrofits to Canadian homes, including effective and low-cost treatments such as weather stripping. Work would begin in 2005, and the program would be reaching 460,000 single-family and 2,000 multi-family buildings per year by 2013. Overall, this would reduce the consumption of energy for space heating by one third.
- Industrial incentives to bring fuel cell technology to the mass market. Stationary fuel cells could produce electricity for space heating, water heating, air conditioning and appliances in 20 per cent of Canadian homes and 35 per cent of apartments by 2030.
- The application of Energy Star standards to all home appliance sales after 2004; the phasing out of sales of mid-efficiency furnaces, as was done with low-efficiency furnaces in 1990; the phasing out of low-efficiency water tanks; the phasing out of fuel oil as a residential heat source by 2030.
- Standards for multi-family buildings to make use of solar heat and waste heat from appliances in space heating.

**The Dumont house,** *a private home in Saskatoon, consumes about a third of the average amount of natural gas for space heating in Saskatchewan, even though it has 3,500 square feet of living space. It accomplishes this by super-insulating the walls, attic, and basement floor, using triple-glazed low-e argon filled windows, construction techniques designed to reduce air leakage and the use of passive and active solar heating. The cost for custom inclusion of this technology in a new house is $13,000, for a relatively long payback period of 16 years at current gas prices. However, installation costs and the payback period would drop sharply with mass production, which could be induced through standards and incentives.*

S O L U T I O N S

# The Commercial and Institutional Buildings Sector

BUILDINGS IN THIS CATEGORY – SUCH AS OFFICE buildings, shopping centres, hospitals, schools and hotels – produce about 68 megatonnes of greenhouse gases per year in Canada. Space heating accounts for about 40 per cent of this total, followed by lighting (15 per cent), auxiliary equipment (13 per cent), auxiliary motors (12 per cent), water heating (10 per cent), and space cooling (9 per cent). There have been efficiency gains in all of these areas of use, but this is a fast-growing sector and overall emissions are forecast to increase by 18 per cent from 1990 to 2004.




**EMISSIONS FROM THE COMMERCIAL/ INSTITUTIONAL SECTOR**
2004/2012/2030

Some newly-constructed offices and stores in Canada use less than a third of the energy per square metre than the average building stock, with no cost premiums. In the existing stock, retrofits and better energy management systems can reduce energy costs by 25 to 50 per cent. Commercial buildings have a balance of space heating, lighting and appliance needs that is well-suited to fuel cell and on-site combined heat and power systems,[7] and these technologies will be used increasingly in the years ahead to reduce demand on the general power grid.

By 2030, commercial floor space in Canada is expected to have increased by almost 50 per cent from 2004.[8] However, in the shift to a sustainable energy economy, we can reduce greenhouse gas emissions from this sector by 56 per cent by 2012 and by 71 per cent by 2030. Policy measures to achieve this would include:

- A "best available technology" standard for all new buildings and major renovations after 2004, with appropriate training for architects and engineers;
- Standards to maximize use of waste heat, solar power for space heating, fuel cells and combined heat and power systems;
- Phasing out of lighting that is inferior to today's federal T8 standards, and new efficiency standards for light fixtures;
- Phasing in of Energy Star standards as a requirement for all office equipment sold;
- A national revolving fund to finance building upgrades and retrofits, modeled on the City of Toronto's successful Better Buildings Partnership.

**Mountain Equipment Co-op,** *with over $150 million in sales in 2001, makes social and environmental responsibility a key priority. The co-op's "green buildings" program has reduced energy costs at its retail outlets and head office. Overall, Mountain Equipment Co-op has reduced energy consumption per square metre by 40 per cent since 1991. The new Ottawa store was the first retail building in Canada to meet federal C2000 standards, and features highly efficient insulation, furnace, lighting, ventilation and office equipment. The target for the store is to consume half as much energy as the average retail store of the same size, with anticipated energy cost savings of $22,679 per year.*

7 A combined heat and power system produces both electricity and useful heat. Such systems are common in Europe, where they typically connect several buildings. New fuel cell and micro-generation technologies now allow CHP systems to be deployed at the individual building level.

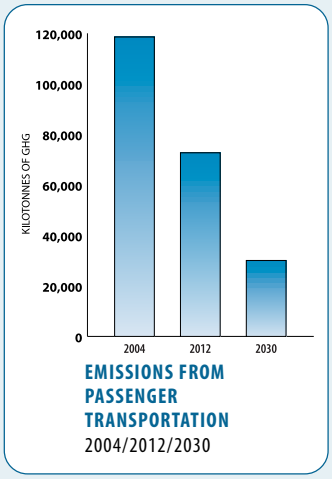
8 Derived from Government of Canada estimates of GDP growth to 2030.

S O L U T I O N S

# Passenger Transportation

FROM 1990 TO 2004, CANADA'S GREENHOUSE gas emissions from passenger transportation (including private vehicles, transit, rail and air) are forecast to increase by about 24 per cent, to almost 119 megatonnes. This is due primarily to the increased personal use of light trucks, vans and SUVs (up 130 per cent from 1990 to 2004), and also to increased air travel (up 79 per cent). The rise in emissions is being offset by various efficiencies, especially in the design of passenger cars. There has also been a decline in the carbon intensity of fuel stocks because of switching to propane and other lower-emission fuels.

Canada can reduce greenhouse gas emissions from passenger transportation by 39 per cent before 2012 and by 75 per cent by 2030. An aging population, telecommuting and urban densification will support these objectives, although total travel is still forecast to climb by 10 per cent. In our scenario, with cars and light trucks at least twice as fuel-efficient on average as they are today, ethanol blend fuels will account for 40 per cent of the energy used in this sector in 2030, and fuel cells for another 20 per cent. Recommended policy measures include:




**EMISSIONS FROM PASSENGER TRANSPORTATION**
2004/2012/2030

- Replacement of voluntary fleet efficiency standards for motor vehicle manufacturers (established 1985) with mandatory standards;
- "Feebates": that is, incentives to reward the purchase or operation of fuel efficient vehicles;
- Investment in public transit, stressing low-emission alternatives;
- Industrial incentives to encourage production of ethanol blends, new bio-blends for diesel and jet use, and fuel cells. The expanded manufacture of ethanol products would provide new opportunities for agriculture, especially on the prairies.

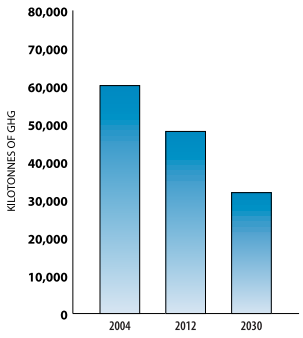
**Gasoline-electric hybrid sedans** *now on the market achieve about 4.8 litres or less per 100 kilometres, or 62 miles to the imperial gallon; hybrid two-seaters achieve 3.8 litres/100km. This compares with an average (in the U.S) of 9.3 litres/100km for all cars and 12.5 litres/100km for SUVs.[9] For each 20,000 kilometres travelled, therefore, the driver of an average car who switches to a hybrid such as the Toyota Prius above will cut fuel costs in half, saving perhaps $600-650. The U.S. government currently provides a $2,000 tax rebate (U.S.) for the purchase of these vehicles. Such incentives and new fleet standards will spur mass production, which will reduce per-unit manufacturing costs.*

9 Polk Automotive Intelligence (www.polk.com)

S O L U T I O N S

# Freight Transportation

THE FREIGHT TRANSPORTATION SECTOR – trucking, railways, aircraft and marine – is expected to produce about 60 megatonnes in greenhouse gas emissions in 2004. Emissions have increased by roughly 20 per cent since 1990, as with passenger transportation. The key trend here is a 50 per cent increase in trucking activity, partly due to "just in time" delivery systems replacing warehousing, and partly because of a shift away from rail. As in all other sectors, there have also been break-throughs in energy efficiency, especially in the design of railway engines but also with heavy trucks.




**EMISSIONS FROM FREIGHT TRANSPORTATION**
2004/2012/2030

Canada can reduce emissions from the freight sector by 20 per cent before 2012 and by 47 per cent by 2030. This assumes an increase in freight transportation activity of more than 60 per cent up to 2030. Using existing technologies, the energy efficiency of light, medium and heavy trucks as well as aircraft could be doubled during this period. These efficiencies would be combined with an increase in rail's market share, a switch away from gasoline and diesel fuels to fuel cells (45 per cent of all fuel use in 2030), bio-diesel and bio-diesel blends (28 per cent), aviation bio-fuels, and ethanol.

Policy measures would include:

- Incentives to encourage a shift to rail freight transportation;
- Industrial incentives to encourage production of ethanol blends, new bio-blends for diesel and jet use, and fuel cells;
- Fleet efficiency standards for truck manufacturers.

*Package delivery companies are engaged in a major energy efficiency push.* **Canada Post's prototype Azure Dynamics vehicles** *consume 40 per cent less fuel than the corporation's current diesel vans, and 60 per cent less than their gasoline-fuelled vans. $CO_2$ emissions from the Azure hybrid are 91 per cent per cent lower than emissions from the diesel vans. FedEx, meanwhile, is working with sustainable energy specialists to reduce emissions from its next generation of delivery vehicles by 90 per cent. The new vehicles are to go into service in 2004. FedEx operates 45,000 trucks across North America.*

S O L U T I O N S

# The Industrial Sector

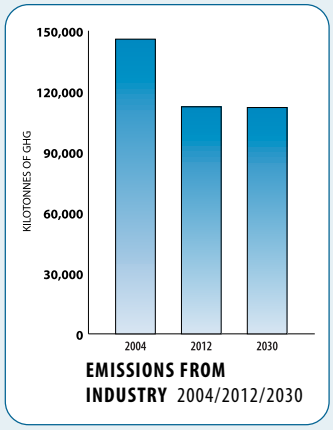
CANADIAN INDUSTRY, NOT INCLUDING ELECTRIC power plants and fossil fuel production, emits about 147 megatonnes of greenhouse gases each year from energy-related activity. $CO_2$ emissions have been fairly constant since 1990, despite rising output. Firms are producing more value per unit of energy used, partly due to more energy efficient technologies and advanced production design and controls.

The industrial sector has shown that economic growth is not tied to energy use or a need to pollute the air. During the 1990s, the value of industrial output per unit of energy required increased nearly 14 per cent. The largest gains came in the manufacture of electrical and electronic products and in printing and publishing, but every sub-sector made some gains, and none of them showed energy growth tracking the value of product.

A survey of the literature, for example from the Canadian Industry Program for Energy Conservation[10], shows that there are still opportunities ahead. Decreasing the intensity of energy use is cost beneficial to industry and the communities it serves. Most industrial participants in the CIPEC, have a target to improve energy efficiency by 1 per cent per year for at least the short term. The challenge, of course, is to ensure that these targets are achieved.

Under the low-carbon energy scenario, industrial emissions of $CO_2$ would drop by 22 per cent by 2012 and then level off, with gains in efficiency in productivity continuing to offset growth in real output. Policy measures to achieve overall energy-related emission reductions would include:

- The establishment of robust targets for each industrial sub-sector. The steel industry, for example, could achieve a 10 per cent gain in energy efficiency through the increased use of electric arc furnaces[11]; the pulp and paper industry can produce efficiency gains of 90 per cent at half its mills.[12]
- Higher standards and incentives to support fuel switching. In the cement industry alone, a shift away from carbon-based fuels, especially coal, would reduce emissions by 3.4 megatonnes per year.
- Combined heat and power. Already in widespread use such systems could generate 2,000 megawatts by 2012 and 4,000 by 2030. This would reduce $CO_2$ emissions by 27 megatonnes, save industrial consumers a projected $1.8 billion annually in fuel and power costs, and assist the phasing out of coal-fired and nuclear power plants.



**EMISSIONS FROM INDUSTRY** 2004/2012/2030

**Sterling Pulp Chemicals Ltd.** *has reduced its fossil fuel consumption by more than 94 percent at its facility in Buckingham, Quebec, through an innovative plan to turn waste hydrogen into fuel for its steam plant. With a $1.1 million investment, SPC has reduced the plant's fossil fuel use by about 6.5 million litres per year, for annual savings of $2.28 million. The waste hydrogen is captured from one of the plant's manufacturing units. First planned in 1994, the system went on stream in 2001 and has exceeded expectations. The Buckingham operation reduced greenhouse gas emissions from 19,600 tonnes in 1995 to 1100 tonnes in 2001 despite an increase in production. The conversion has also reduced oil tanker truck traffic through the community, and the associated emissions.*

*The success of the project has resulted in similar initiatives being planned at other SPC sodium chlorate plants.*

10 *1999/2000 Annual Report*, Canadian Industry Program for Energy Conservation

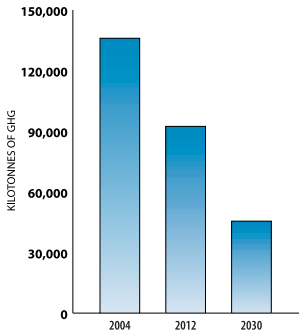
11 Minerals and Metals Working Group – Industry Table, Iron and Steel Plant Level Analysis and Options Paper Final Report, 1999

12 Estimates prepared for Forest Sector Table of the National Climate Change Process

S O L U T I O N S

# Non-Energy Emissions

In addition to $CO_2$ emissions from energy use and production, other greenhouse gases are emitted from a variety of sources. While the absolute amount of these gases is quite small in comparison to the millions of tonnes of $CO_2$, they are extremely important as contributors to climate change due to their long atmospheric lives. Nitrous oxide ($N_2O$), which has a global warming potential 310 times greater than $CO_2$, is released during the production of fertilizer, explosives and other chemicals. Significant amounts of $N_2O$ are also released during the production of adipic acid used for manufacturing nylon. Sulphur hexafluoride ($SF_6$) with a global warming potential 23,900 times $CO_2$,is used as an insulator gas for high voltage equipment. $CO_2$ is also released during the manufacture of cement. Hydrofluorocarbons (HFCs) with a potential ranging from 140-11,700 times $CO_2$, are used throughout the economy, primarily as a coolant in refrigeration. Perfluorocarbons (PFCs) with a potential 6,500 to 9,200 times $CO_2$ are released during circuit board and electronics production. Methane, with a potential 21 times greater than $CO_2$, and $N_2O$ are also released from agricultural production. Municipal landfills and sewage treatment plants are also major sources of methane emissions.




**EMISSIONS FROM NON-ENERGY EMISSIONS**
2004/2012/2030

Under our scenario, annual emissions from non-energy sources can be reduced from 136 to 47 megatonnes. This includes the elimination of HFCs and significant reductions in emissions of $SF_6$, $N_2O$, PFCs and methane. Measures to reduce greenhouse gas emissions from non-energy sources would combine incentives and regulation. Some examples:

- Replacement of HFCs with other refrigerants by 2030.
- Reduction of PFC emissions in the aluminum industry[13] through installation of new control technologies and monitoring equipment. In the same industry, reduction of $CO_2$ emissions by replacing carbon based anodes in the smelting process.[14] In 1999 this source produced nearly 4.5 megatonnes of $CO_2$.
- Reduction of $N_2O$ emissions from industrial processes through measures including catalytic destruction, thermal destruction, and $N_2O$ recycling.
- Through standards and incentives for agriculture, promote changes in livestock feed composition, manure management and soil management.
- Eliminate methane emissions from municipal landfills and sewage operations by adopting methane capture for electricity generation.

13 Based on the Aluminium Industry Options Paper, National Climate Change Secretariat, 1999.

14 See http://www.alcoa.com/global/investment/annual_report_2001//news/news_04.asp (Accessed September 23, 2002.)

S O L U T I O N S

# The Fossil Fuel Industry

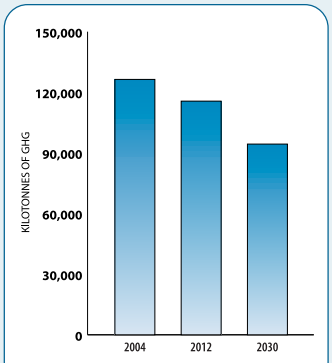
IN 2004, THE NATURAL GAS, CRUDE OIL, REFINED petroleum products, and coal production sectors of the fossil fuel industry are projected to emit 126 megatonnes of $CO_2$, roughly 17 per cent of Canada's national emissions. About 45 per cent of these emissions are the result of the production of oil and gas for Canadian consumers; the rest is associated with the production of oil and gas for export. Emissions occur through the lifecycle of production: in drilling, well servicing, processing, pipelines, and distribution to end users.

The emission profile of the crude oil industry is changing significantly as conventional reserves are used up and heavy oil production increases. Oil sand extraction is especially energy-intensive. There is also considerable flaring of waste gases in the crude oil sector, although this is expected to diminish.

**BP,** *one of the world's largest energy producers, announced in March 2002 that it had reduced its greenhouse gas emissions by over 9 megatonnes in just three years – eight years ahead of its target. The company plans to hold emissions at this level through 2010 despite projected output increases of 5.5 per cent per year.*

*BP estimates that energy efficiency measures have added $650 million (U.S.) in value to its operations. Emissions will be contained through continuing internal efficiencies, and by reducing the carbon content of the fuels that BP sells. Chief executive Sir John Browne said, "By applying existing knowledge across the span of our operations, and selective new investment in areas such as co-generation, we believe we can achieve a 10 to 12 per cent improvement in the efficiency of our energy use."*

The emission intensity of crude oil production is currently forecast to increase by about 15 per cent up to 2030, largely because of the switch to heavier oils. In our scenario, the emissions intensity of petroleum production is held at its current level, largely due to the lower demand for oil brought about by improved energy productivity. The emission intensity of natural gas will decline by nearly 20 per cent, with less flaring and more efficient processing and distribution systems.




**EMISSIONS FROM THE FOSSIL FUEL INDUSTRY**
2004/2012/2030

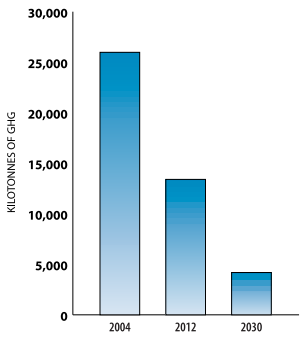
For this analysis, federal government forecasts of fossil fuel exports are unchanged. The result is that emissions from export production would remain about constant. Emissions from oil and gas production for domestic use would decline by a projected 36 per cent because of the reductions in demand that are outlined elsewhere in this report – for example, because of fuel switching in home heating and transportation.

Measures to reduce emissions in this sector would include incentives to support methane capture, leak detection and repair, re-injection of acid gases and $CO_2$, increased use of co-generation in production, heat recovery, and various other efficiency improvements.

S O L U T I O N S

# Electric Power

THE LARGE-SCALE ELECTRIC POWER PLANT IS ONE of the most inefficient inventions of the industrial age. Whether driven by nuclear or fossil fuels, these plants manufacture electricity with efficiencies that rarely reach 40 per cent. For CANDU nuclear plants the number is closer to 30 per cent. Canada would benefit from decentralizing the production of electricity through local co-generation, fuel cells, solar and wind technology and micro hydro.



**EMISSIONS FROM ELECTRIC POWER** 2004/2012/2030

In our low carbon scenario, total production of energy for the grid drops by 35 per cent from current levels – because of increased efficiency in the residential, commercial and industrial sectors as well as co-generation at industrial sites and in commercial buildings. Supply from existing hydroelectric sources – without any new hydro megaprojects – will serve most of Canada's needs. Provinces that lack hydro capacity may fill the gap through imports from other provinces, strategic use of natural gas to produce power, and new wind and renewable sources. Even so, Canada should have some 100 billion kilowatt hours of surplus hydro power available in 2030 for export or for hydrogen production.

In Canada the electricity industry is regulated by the provinces. Inter-provincial movement of power is sometimes constrained by informal trade barriers. Even so, inter-provincial sales will make up about 6 per cent of all electricity demand in Canada in 2004. This can be increased to 10 per cent of a smaller total as energy efficiency measures take hold across the economy. By 2030, Nova Scotia, New Brunswick, Ontario, Saskatchewan, and Alberta would all be significant importers of hydroelectric power from other provinces.

The more efficient use of electricity will allow a much greener electricity grid, with all nuclear and coal-fired power plants shut down and greenhouse gas emissions at 86 per cent below current levels. In 2004, electricity generation for the grid will emit about 114 million tonnes of $CO_2$, mostly at coal- and oil-fired plants. We can reduce this to 43 million tonnes in 2012 and 16 million tonnes in 2030. This improvement will be offset by emissions from the natural gas consumption associated with fuel cell technology, and from on-site co-generation. The net result is that by 2030, emissions from all sources of electricity production will be down 60 per cent, to 46 megatonnes of $CO_2$.

Policy measures to achieve these results should include:

- Implementation of a renewable portfolio standard for power producers;
- Production incentives for co-generation and renewable sources, and measures to facilitate access to the power grid for micro-producers;
- Measures to facilitate inter-provincial trade in hyrdoelectric power.

*A new 27-megawatt* **wind energy complex** *near Pincher Creek, Alberta will produce enough power to supply 8,000 homes and reduce $CO_2$ emissions by 80,000 tones per year. The facility opened in June 2002. Construction of the Canadian Hydro wind plant, the largest in western Canada, took nine months. Canadian wind energy producers such as Canadian Hydro and Vision Quest now have the capacity to generate well over 200 megawatts of power. For each megawatt-hour generated by a wind turbine instead of a power plant fueled by coal, one tonne of $CO_2$ emissions is avoided.*

# Implementation

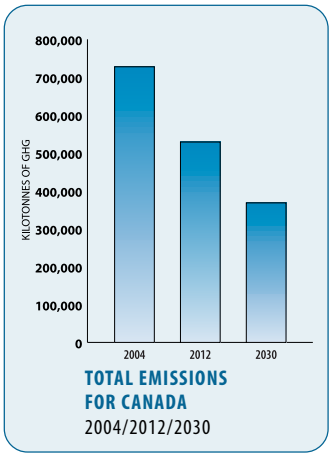
Under the Kyoto Protocol, Canada's greenhouse gas emissions should be at least six per cent lower than they were in 1990 by 2012. This equals an 18 per cent reduction in emissions from today's levels. To protect the climate this must be followed with continued and vigorous measures to further reduce emissions.

The action plan suggested in this report does not call for punitive taxes on consumers or producers. Instead, it contemplates a series of changes in the way we use energy. To stimulate those changes in a fair and equitable manner, we need to use an array of policy tools including standards, market incentives, such as emissions trading, and targeted public investment.

There is clearly an important role for performance-based standards. Many industries are dominated by a small number of suppliers, making it easier to negotiate effective standards. From automobiles and home appliances to motors, lights and buildings, well-designed standards can bring about technological innovation and emission reductions.

Similarly, determining an appropriate level of emissions for large emitters and allowing the use of emissions trading as a means of achieving those targets can provide a direct financial incentive for innovation, efficiency and emission reductions.

There is also a role for public investment. Contrary to the notion that markets develop and deploy new technologies, many of the fundamental technological changes over the last two centuries came about through government intervention. Railroads, automobiles, airplanes, refrigerators, computers and even the internet were either developed or made possible by public investment. Continuing this practice in response to climate change is more than justifiable in terms of the economic, health and environmental benefits.




**TOTAL EMISSIONS FOR CANADA**
2004/2012/2030

The role of local government is also critical. The influence of local governments on the level and pattern of emissions looms large in our scenario. From waste management to public transit, from land use to development permits, from roads and bridges to green spaces, local government often emerges as the single most powerful institution when it comes to influencing the level of greenhouse gas emissions in the community.

In conclusion, we have the opportunity to dramatically reduce our levels of fossil fuel consumption in Canada. Our study shows that strong domestic measures will reduce greenhouse gas emissions and air pollution while stimulating economic efficiency and innovation. What we now require is the vision and commitment of all decision-makers including governments, businesses, consumers and the public.

*"I suggest that our collective objective be to meet our Kyoto targets while not only protecting our competitiveness, but enhancing it . . . The Government of Canada addressed fiscal deficits, to avoid leaving a burden for future generations. Likewise, it would be irresponsible to leave an environmental deficit of climate disruptions and pollution for future Canadians."*

PRIME MINISTER JEAN CHRETIEN
SEPTEMBER 2001

*"The Kyoto Protocol is about responsibility. In this age where government fiscal responsibility is touted as a commandment, how can we not be environmentally responsible as well? What we need now is to take advantage of Kyoto and meet our commitment in ways that will benefit all Canadians. It is time to accept our responsibility."*

DR. DAVID SUZUKI
SEPTEMBER 2002

**To determine the path to a sustainable, low-emission economy, the David Suzuki Foundation and the Climate Action Network commissioned Torrie-Smith Associates, Canada's leading independent authority on sustainable energy policy to conduct a detailed analysis of energy and technology trends. Torrie-Smith principal Ralph Torrie led and managed the project team. The full report is available at any of the three websites mentioned below.**


**The David Suzuki Foundation**, an internationally recognized authority on climate-related issues, explores human impacts on the environment with an emphasis on finding solutions.

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**CANet Canada** is the national body of the international Climate Action Network. It is made up of more than 100 organizations across the country working to protect the environment from harmful human interference of the atmosphere resulting in climate change.

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**Ralph Torrie** has been studying sustainable energy futures for 27 years. He served on the Royal Society of Canada's blue ribbon panel on greenhouse gas emission reductions, and is the co-inventor of environmental planning software used by over 300 municipalities and companies around the world.

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