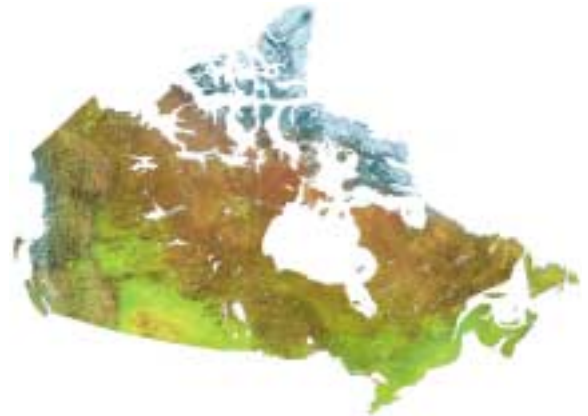




The State of Energy Efficiency in Canada



Office of Energy Efficiency
Report 2001



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Canada

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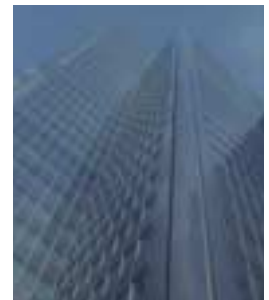
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The Vision of the Office of Energy Efficiency



*Leading
Canadians
to Energy
Efficiency
at Home,
at Work
and on
the Road*

Message from the Minister

Welcome to this fourth edition of *The State of Energy Efficiency in Canada*. From 1990 to 1999, energy efficiency improved by 8 percent, saving Canadians almost \$5.7 billion per year and reducing annual greenhouse gas emissions by some 32 megatonnes.

As a northern nation with a large land-mass and a high standard of living, Canada is a heavy energy user. Our use of energy has a great impact on the environment, adding to greenhouse gas emissions that contribute to climate change. Our international commitment is linked, in part, to our energy performance – to how we use energy and the types of energy we consume.

It is important, therefore, that we use energy more responsibly. This applies to each and every one of us – how we heat our homes and how we drive our cars – as well as to Canadian businesses and public institutions. We must all turn to energy-efficient appliances, buildings and cars, and alternative and renewable energy sources. Natural Resources Canada makes key contributions to improving Canada's energy performance through initiatives related to energy efficiency, renewable energy and alternative transportation fuels.

These programs encourage and help Canadians improve their energy use through information, training, incentives, and innovative research and development.

Last year, the Government of Canada committed more than \$1.1 billion over the next five years to climate change initiatives, many of them energy efficiency and alternative energy measures, to reduce the greenhouse gas emissions from our energy use.

The Government of Canada will continue to lead Canada's efforts to improve its energy performance, putting the tools in place to meet today's energy demands, while building a higher quality of life. And we will continue to work with our partners to ensure that Canada is the world's smartest energy developer and user, and a living model of sustainable development.



Ralph Goodale



Executive Summary



The Office of Energy Efficiency (OEE) is part of Canada's response to its commitment to reduce greenhouse gas (GHG) emissions by 6 percent below 1990 levels by the period 2008–2012. Its mandate is to renew, strengthen and expand Canada's commitment to energy efficiency. In 2000–2001, the OEE managed 17 energy efficiency and alternative fuels programs aimed at the residential, commercial/institutional, industrial and transportation sectors. A further 12 initiatives will be implemented in 2001–2002, thus expanding the OEE's responsibilities.

To track changes in energy efficiency, the OEE developed the OEE Energy Efficiency Index – the only one of its kind in Canada. The OEE Index depicts annual changes in energy efficiency in the Canadian economy and estimates these changes better than the indicator previously used – the ratio of gross domestic product to energy use, commonly referred to as “energy intensity.” The OEE Index shows that even with the many barriers to improved energy efficiency in Canada, strong, measurable progress has been made, due in part to the programs of the OEE. As a result of this improvement, Canadians are saving about \$5.7 billion per year in energy costs. Moreover, energy use

increased by only 12.2 percent instead of 20.2 percent between 1990 and 1999. And energy-related GHG emissions are more than 32 megatonnes lower than they would have otherwise been.

In December 1997, Canada joined 160 other nations in negotiating the Kyoto Protocol, which sets out specific emissions-reduction targets for the world's 38 industrialized nations. The *Government of Canada Action Plan 2000 on Climate Change*, announced in October 2000, is the government's contribution to *Canada's First National Climate Change Business Plan*. *Action Plan 2000*, which contains several energy efficiency measures, targets key sectors that account for more than 90 percent of the country's GHG emissions. When fully implemented, it will reduce GHG emissions by about 65 megatonnes per year during the commitment period. The plan will also take Canada one-third of the way to achieving the target established in the Kyoto Protocol.

Between 1990 and 1999, the amount of energy that Canadians used to heat and cool their homes and workplaces and to operate their appliances, vehicles and facilities increased by about 12.2 percent. This was primarily due to the growth in economic activity in each end-use sector. GHG emissions associated with this energy use (including electricity) increased by about 11 percent. Overall, energy consumption for these purposes – known as “secondary energy use” – accounted for about 64 percent of all GHG emissions in Canada in 1999.

In 1995, the Government of Canada committed to “getting its own house in order” by reducing GHG emissions from its operations by at least 20 percent from 1990 levels by the year 2005. To date, the Government of Canada already has reduced its GHG emissions by over 19 percent. *Action Plan 2000* strengthened the Government of Canada’s leadership role by updating the target to 31 percent below 1990 levels by 2010. This goal will be achieved by improving the energy efficiency of buildings, putting the “federal garage in order,” switching to cleaner fuels and buying more renewable energy.

The Office of Energy Efficiency



The OEE was established in April 1998 as part of Natural Resources Canada (NRCan). Its mandate is to renew, strengthen and expand Canada's commitment to energy efficiency. The OEE is part of Canada's response to its commitment to reduce GHG emissions by 6 percent below 1990 levels by the period 2008–2012, as agreed under the Kyoto Protocol. It builds on efforts by NRCan over the past three decades to promote energy conservation, energy efficiency and alternative sources of energy as ways to protect the environment and strengthen Canada's economic competitiveness.

To the end of the 2000–2001 fiscal year, the OEE managed 17 energy efficiency and alternative fuels programs aimed at the residential, commercial/institutional, industrial and transportation sectors.¹ In 2001–2002, another 12 initiatives will be implemented, expanding the OEE's responsibilities. Guided by the OEE's vision statement of "Leading Canadians to Energy Efficiency at Home, at Work and on the Road," these programs target all energy consumers and emphasize partnerships and economic investments. They aim

to overcome the market barriers of inadequate information and knowledge, institutional deterrents in energy end-use markets and financial and economic constraints on energy users.

The OEE is also responsible for collecting and analysing data on energy end-use and developing new measures to increase the impact and reach of NRCan's support for energy efficiency improvement. Other responsibilities of the OEE include the following:

- modifying its existing programs to increase their effectiveness or efficiency;
- reporting annually on the state of energy efficiency in Canada and communicating up-to-date energy efficiency information through its publications and Web site at <http://oee.nrcan.gc.ca>; and
- managing Canada's Energy Efficiency Awards.

¹ The OEE's alternative transportation fuels programs encourage the transition to less carbon-intensive energy sources in the transportation sector.

The OEE plays a key role in administering the Public Education and Outreach (PEO) program of the Government of Canada's Climate Change Action Fund (CCAF). PEO projects promote public awareness and understanding of climate change and encourage Canadians to take action to reduce GHG emissions and adapt to climate change. The OEE's staff participate in evaluating project proposals and manage energy efficiency projects funded under the CCAF-PEO program.

The OEE is assisted by the National Advisory Council on Energy Efficiency, comprising energy efficiency experts and leaders from all sectors of the economy.

The State of Energy Efficiency in Canada



The OEE has become Canada's foremost centre for collecting and analysing energy efficiency data, analysing trends in energy use and developing key programs that promote energy efficiency in the major energy-using sectors of the economy. One of its goals is to improve Canada's ability to track the influence of its energy efficiency programs on market trends and identify opportunities to further improve energy efficiency.

At the core of the OEE's analytical capacity is its annual assessment of trends in energy use and related GHG emissions in Canada since 1990. The results are published in the technical report *Energy Efficiency Trends in Canada*. Changes in energy efficiency cannot be measured directly at the sectoral or economy-wide level. To track changes in energy efficiency, the OEE developed the OEE Energy Efficiency Index, the only one of its kind in Canada.

The OEE Index depicts annual changes in energy efficiency in the Canadian economy. Moreover, it identifies these changes more accurately than the indicator previously used – the ratio of gross domestic product to energy use, commonly referred to as “energy

intensity.” This is because energy intensity is influenced by changes in economic structure, the weather and energy efficiency.² Nevertheless, it is important to note that the OEE Index is only an estimate of changes in energy efficiency in the economy. Even after accounting for the other principal factors that influence energy intensity, the resulting estimate of energy efficiency includes some factors not related to efficiency. For example, the estimate of industrial energy efficiency will reflect changes in sub-sector mixes of products or in the products themselves.

The OEE Index shows that even with the many barriers to improved energy efficiency in Canada, strong, measurable progress has been made, due in part to the programs of the OEE. For 1990–1999, the OEE Index shows an increase in value, indicating that energy efficiency improved by 8 percent (Figure 1). As a result of this improvement, Canadians are saving about \$5.7 billion per year in energy costs. Moreover, energy use increased by only 12.2 percent instead of 20.2 percent between 1990 and 1999. In addition, energy-related GHG emissions are more than 32 megatonnes lower than they would have otherwise been (Figure 2).

² For more information on the OEE Energy Efficiency Index, see *Energy Efficiency Trends in Canada 1990 to 1999 – An Update*. To obtain a copy, write to Energy Publications, c/o DLS, Ottawa ON K1A 0S9 or fax (819) 779-2833. This publication is also available electronically from the OEE Web site at http://oee.nrcan.gc.ca/general/trends/36274_eng.pdf.

Figure 1

*The OEE Energy Efficiency Index, 1990–1999
(Index: 1990 = 1.00)*

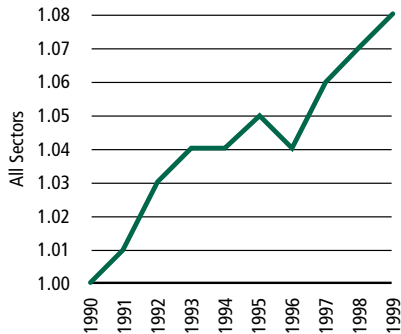
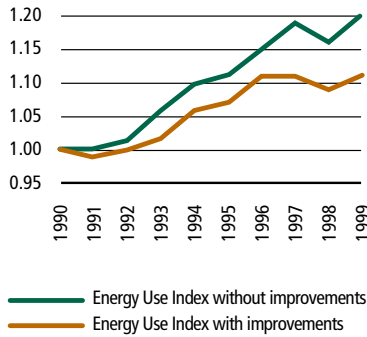


Figure 2

*Impact of Energy Efficiency Improvements
on Energy Use*



Each of the four principal end-use sectors in the Canadian economy (residential, commercial/institutional, industrial and transportation) contributed to this improvement in energy efficiency. Following are a few highlights from the analysis:

- A 13.0-percent improvement in residential energy efficiency, combined with the warm winter of 1999, helped offset the increased demand for houses and appliances. This limited the increase in residential energy use over the review period to only 1.3 percent above 1990 levels.
- The 1.6-percent improvement in energy efficiency in the commercial/institutional sector over the 1990–1999 period contributed to reducing GHG emissions by 0.7 megatonnes.
- Although industrial GHG emissions increased overall, they were 12.4 megatonnes lower in 1999 than they would have otherwise been because of a significant 9.1-percent improvement in energy efficiency between 1990 and 1999.

- Growth in international trade and deregulation have led to increased truck freight activity and energy use. Nevertheless, the freight transportation sector achieved a 12.0-percent improvement in energy efficiency over the review period.
- The passenger transportation sector experienced an energy efficiency improvement of only 3.9 percent between 1990 and 1999. The growth in emissions was largely due to Canadians' increasing preference for minivans and sport utility vehicles.

Energy Use in Canada

Through the National Energy Use Database (NEUD), the OEE collects and analyses energy-use data for all sectors of the Canadian economy – the residential, commercial/institutional, industrial, transportation and agriculture sectors. The NEUD's goal is to

- develop and provide better information on energy use and market trends;
- improve Canada's ability to track the influence of its energy efficiency programs on market trends; and
- help identify opportunities to further improve energy efficiency in Canada.

For more information, visit the Web site at <http://oee.NRCan.gc.ca/dpa/>.

Taking Action on Climate Change

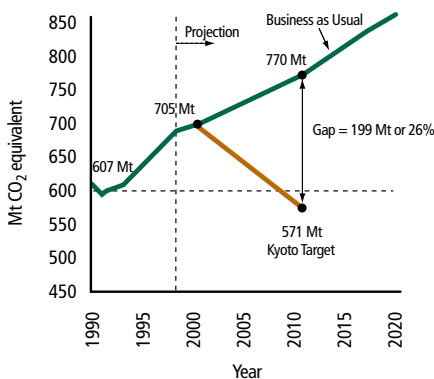
Climate change, caused by a buildup of GHGs in the atmosphere, is one of the most complex and difficult environmental challenges that the world has faced. In Canada, climate change could lead to more frequent and severe flooding in low-lying areas, extended dry seasons, severe winter and summer storms, landslides, the collapse of road and rail systems and more. For more information, visit the Web site at <http://www.climatechange.gc.ca/english/index.shtml>.

Most human-generated GHG emissions are produced through the combustion of fossil fuels. Although Canada accounts for only about 2 percent of the world's GHG emissions, it needs to be part of the solution. In December 1997, Canada joined 160 other nations in negotiating the Kyoto Protocol, which sets out specific emissions-reduction targets for the world's 38 industrialized nations. Canada's target is to reduce emissions by 6 percent below 1990 levels by the period 2008–2012. Given forecasted growth in Canada's economy and population, achieving the Kyoto target could actually require at least a 26-percent reduction in emissions from a "business as usual" scenario for the target period (Figure 3).

The Government of Canada and the provincial and territorial governments established the National Climate Change Process in 1998 to examine the costs, impact and benefits of implementing the Protocol and the implementation options open to Canada. Sixteen Issue Tables/Working Groups examined sectoral approaches to addressing climate change, as well as cross-sectoral approaches (e.g., public education, outreach and domestic emissions trading). The Issue Tables/Working Groups – which comprised 450 experts from governments, industry, academia and other stakeholder groups – proposed mitigation and adaptation options in late 1999.

Figure 3

Canada's Projected GHG Emissions and the Kyoto Target



Mt = megatonnes



Their consolidated work was discussed at a Joint Meeting of Ministers of Energy and the Environment (JMM). This was followed by further analysis of, and national consultations on, these options. The JMM then approved a National Implementation Strategy on Climate Change and announced *Canada's First National Climate Change Business Plan*, containing actions from all jurisdictions to address climate change.

The *Government of Canada Action Plan 2000 on Climate Change*, announced in October 2000, is the Government of Canada's contribution to the *Business Plan*. This \$500-million, five-year program sets Canada on the road to meeting its Kyoto commitment. It covers sectors that account for more than 90 percent of Canada's GHG emissions. *Action Plan 2000* comprises initiatives in transportation, energy production, industry, buildings,

forestry and agriculture, international projects, technology, science and adaptation. It promotes cost-effective measures, encourages actions by industry and consumers, complements actions by provinces and territories and lays the groundwork for long-term changes.

Action Plan 2000 targets key sectors and, when fully implemented, will take Canada one-third of the way to achieving the target established in the Kyoto Protocol. It will reduce GHG emissions by about 65 megatonnes per year during the commitment period of 2008–2012. It contains a number of energy efficiency measures, which are described later in this report. In addition to their contribution to GHG emissions reductions, the measures also encourage the development of innovative technologies and processes that will lead to new economic opportunities for Canada. For more information, visit the Web site at http://www.climatechange.gc.ca/english/whats_new/action_plan.shtml.

Energy Use, Energy Efficiency and Greenhouse Gas Emissions

Canada, like other industrialized countries around the world, depends heavily on fossil fuels to meet its energy needs. These fuels, when burned, release emissions of carbon dioxide (CO₂), nitrous oxide and methane, all of which are greenhouse gases (GHGs). In general, the more energy Canadians use, the more GHG emissions produced and the greater the impact on global climate change.

Several factors affect how much energy the Canadian economy uses. These include the level of economic activity in a sector (e.g., production by industry, floor space in the residential or commercial sector); structure (the mix of activities that consume energy in a sector); the weather; and how efficiently each sector uses energy. By promoting improved energy efficiency, the OEE's programs are helping Canada reduce its GHG emissions.

Between 1990 and 1999, the amount of energy that Canadians used to heat and cool their homes and workplaces and to operate their appliances, vehicles and facilities increased by about 12.2 percent. GHG emissions associated with this energy use (including electricity) increased by about 11 percent. Overall, energy consumption for these purposes – known as “secondary energy use” – accounted for about 64 percent of all GHG emissions in Canada in 1999.

Impact of Other Factors Affecting Energy Use

The increase in Canada's energy use between 1990 and 1999 was primarily due to growth in economic activity in each end-use sector. For example, activity in the industrial sector increased by 27.6 percent during this period. In the residential sector, the number of households and the total floor space of households increased by 18.3 percent. Likewise, the amount of commercial floor space in Canada grew by 15.9 percent over the 1990–1999 period. In the transportation sector, there was a 13.3-percent increase in passenger-kilometres and a 32.7-percent increase in freight tonne-kilometres.

Changes in structure – the mix of activities that consume energy – also contributed to increased energy use between 1990 and 1999. Among the notable trends were shifts in consumer preference toward light-duty trucks (e.g., minivans and sport utility vehicles) and the increase in the amount of freight shipped by trucks.



Figure 4

Energy Use by Sector, 1999 (petajoules)

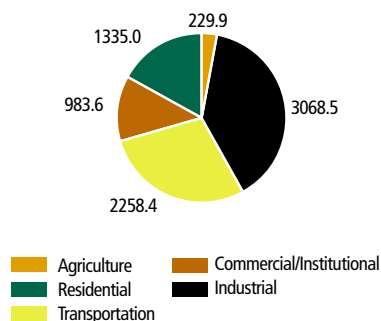
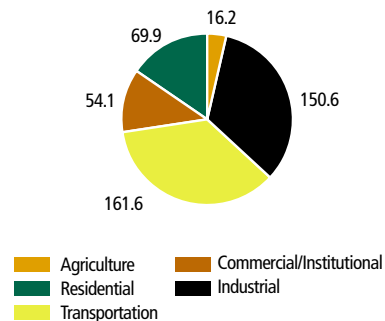


Figure 5

Secondary Energy-Related Greenhouse Gas Emissions by Sector, 1999 (megatonnes of CO₂ equivalent)



The industrial sector accounted for 39 percent of total secondary energy use in Canada in 1999 (Figure 4) and 33.3 percent of secondary energy-related GHG emissions (Figure 5).³ The second largest energy-using sector – transportation – accounted for 28.7 percent of energy use in 1999. However, it also accounted for 35.7 percent of GHG emissions, more

than any other sector. This is because the energy used in transportation, primarily gasoline and diesel fuel, produces more GHG emissions than other energy sources when combusted. Similarly, the agriculture sector produces more GHG emissions than would be suggested by its share of energy use.

³ There are other sources of GHG emissions (e.g., fugitive emissions and non-energy industrial process emissions). For information about these, refer to Environment Canada's Canada's Greenhouse Gas Inventory: 1997 Emissions and Removals with Trends.

Moving the Market Toward Higher Efficiency in the Major Energy End-Use Sectors

The Office of Energy Efficiency Approach

Guided by the vision statement of “Leading Canadians to Energy Efficiency at Home, at Work and on the Road,” the programs of the Office of Energy Efficiency (OEE) target all energy consumers and emphasize partnerships and economic investments. The following five basic policy instruments are employed to overcome the market barriers of inadequate information and knowledge, institutional deterrents in the energy end-use market, and financial and economic constraints on energy users:

- **leadership** by the Government of Canada in reducing emissions from its own use of energy;
- **information programs** to alert energy users to the benefits of energy efficiency and to increase awareness, acceptance and adoption of energy-efficient technologies and practices;
- **voluntary programs** that support actions by energy users to improve their energy efficiency;
- **direct financial incentives** to encourage investment in energy-efficient buildings and building retrofits in order to stimulate more rapid deployment of energy-efficient technologies and practices; and
- **regulations** that set minimum performance standards to eliminate less energy-efficient products from the market.

Reporting on Energy Efficiency and Technology Developments

Another of the OEE’s major tasks is informing key decision-makers in government, industry and the environmental and international communities about Canada’s energy efficiency efforts and successes. One element of this task is reporting on the state of energy efficiency in Canada.

The OEE maintains strong links with NRCan’s research and development programs for advanced energy-efficient technologies. It works closely with NRCan’s Energy Technology Branch to ensure that Canadians are kept abreast of technology developments that can either reduce the consumption of fossil fuels or enable the transition to less greenhouse gas (GHG) intensive energy sources, including renewable energy.



The OEE's Annual Publications and Web Site

- *The State of Energy Efficiency in Canada*
- *Energy Efficiency Trends in Canada*
- *Report to Parliament under the Energy Efficiency Act*
- *Emission Reductions from Federal Operations*

The OEE makes these publications and other documents on energy efficiency available to Canadians and others through a comprehensive Web site that provides details on OEE programs and practical, up-to-date information and tips for all energy users, as well as an electronic *Directory of Energy Efficiency and Alternative Energy Programs in Canada*. For more information, visit the Web site at http://oee.nrcan.gc.ca/neud/dpa/data_e/publications.cfm.

Canada's Energy Efficiency Conference

The OEE has held two energy efficiency conferences, which brought together energy efficiency experts, advocates and stakeholders from across Canada and around the world to share information and expertise. The most recent conference was held in Ottawa in October 2000, under the theme "Energy Efficiency: Infinite Possibilities ... Powered by Innovation." More than 500 delegates attended, including representatives from industry, business, Canadian and foreign governments, environmental groups and other non-governmental organizations. For more information, visit the Web site at <http://oee.nrcan.gc.ca/conference>.

Concurrent with the conference, the OEE hosted Canada's Energy Efficiency Trade Show to give businesses and others an opportunity to showcase innovative products, services and programs. Almost 50 exhibitors participated in the 2000 trade show, including associations, energy service companies, government departments, utilities, manufacturers and consulting engineers. In addition to the exhibitors, participants in the Student Ambassador Program, a joint initiative of the OEE and the Canadian Council for Human Resources in the Environment Industry, held poster sessions.

A highlight of both conferences was the presentation of Canada's Energy Efficiency Awards, which are managed by the OEE to encourage and honour Canadian innovation and achievements in energy efficiency. Drawing on over 150 nominations in 2000, the OEE presented 13 awards in several categories – equipment and technology, housing, buildings, industry, outreach, media and a student competition. For more information, visit the Web site at <http://oee.nrcan.gc.ca/awards>.

Other OEE Initiatives

The OEE participates in the work of the federal, provincial and territorial **Analysis and Modelling Group** (AMG). It was created by, and reports to, the National Air Issues Co-ordinating Committee – Climate Change. The AMG operates openly and transparently in addressing issues related to climate change data, analysis and modelling.

The OEE plays a key role in administering the Public Education and Outreach (PEO) program of the Government of Canada's Climate Change Action Fund (CCAF). The Director General of the

OEE is the co-lead with Environment Canada in overseeing the program. PEO projects promote public awareness and understanding of climate change and encourage Canadians to take action to reduce GHG emissions and adapt to climate change. The OEE's staff took an active role in evaluating project proposals during the interdepartmental review process. They also managed 39 energy-efficiency-related projects funded under the CCAF-PEO program. For more information, visit the Web site at <http://www.climatechange.gc.ca>.

In the municipal sector, the OEE co-ordinates NRCan's participation in the implementation, governance and project approval process of the **Green Municipal Funds** of the Federation of Canadian Municipalities (FCM). Through the FCM, the OEE also co-ordinates the development and implementation of the Municipal Buildings Retrofit Program. For more information, visit the Web site at <http://www.fcm.ca/>.



The Conservation Corps of Newfoundland has been using the EnerGuide for Houses Program as the core of its community-based social marketing of environmental services. Visit the Web site at <http://energuide.nrcan.gc.ca/html/home.html>.

Energy Efficiency in the Residential Sector

Composition and Trends

In 1999, the residential sector accounted for 17.0 percent of secondary energy use in Canada and 15.5 percent of related GHG emissions.

Despite significant growth in activity (more houses and increased floor area), residential energy consumption increased by only 1.3 percent above 1990 levels because of the relatively warm winter in 1999 and significant energy efficiency improvements. Without these improvements, residential energy use would have been 13.0 percent higher in 1999.

GHG emissions from the residential sector were essentially the same in 1990 and 1999. This was due to the relatively small increase in residential energy use and a shift toward less GHG-intensive fuels.

Promoting Energy Efficiency

Newer houses tend to be more energy efficient than those built before 1995, because it is usually more economic to make improvements during construction than after. However, by 2010, houses built after 1995 will represent only about 20 percent of Canadian housing, so the energy efficiency of the existing stock of houses needs to be improved.

More than 80 percent of residential energy is used for space and water heating, and significant potential exists for continued energy efficiency gains in this area. Residential energy-using equipment is an important area for program support because it has a relatively short life (less than 20 years) and is replaced regularly.

With these opportunities in mind, the OEE's approach to the residential sector is to

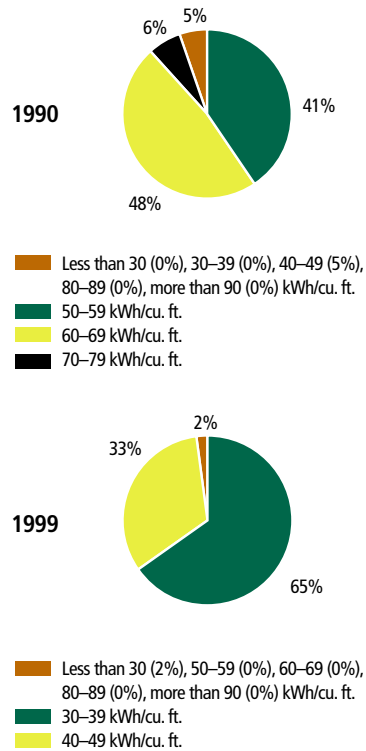
- use regulations and information programs to gradually exclude the least-efficient equipment from the market and to influence consumers to select, and manufacturers to produce, energy-efficient products that outperform the minimum standards; and
- improve the energy performance of new and existing housing by supporting energy codes and the construction of benchmark energy-efficient housing, showing home buyers the economic and environmental benefits of energy-efficient housing and renovation, and increasing builders' knowledge of energy-efficient housing technologies and practices.

Selected Progress Indicators

- Canada's *Energy Efficiency Regulations*, administered by the OEE, apply to more than 20 residential energy-using products that account for nearly 75 percent of residential energy use. The Regulations, along with the EnerGuide for Equipment and HVAC Program, have improved the energy efficiency of new household appliances and equipment on the market. For example, the market share held by refrigerators requiring 49 kilowatt hours (kWh) or less per cubic foot (cu. ft.) per year increased from 5.3 percent in 1990 to 99.6 percent in 1999. By contrast, in 1990, refrigerators consuming between 60 and 69 kWh/cu. ft. dominated the market with a 47.8-percent share (Figure 6). Dishwashers also became more efficient during this period. In 1990, close to 70 percent of dishwashers on the market consumed at least 1000 kWh per year. By 1999, all dishwashers on the market consumed 699 kWh per year or less.
- The EnerGuide for Houses Program encourages Canadians to improve the energy efficiency of their homes, especially when undertaking home renovation and maintenance projects. The program raises consumer awareness of the benefits of energy efficiency, such as cost savings, improved comfort and indoor air

Figure 6

Distribution of Refrigerator Sales by Average Energy Consumption (kWh/cu. ft.)



quality, increased durability and higher resale values for their houses. On average, 75 percent of the Canadian homeowners who retrofitted their homes as participants in the program made half of the recommended energy efficiency improvements. As of January 2001, participating homeowners achieved an estimated annual energy savings of 17.8 percent.

Figure 7

Average Annual Heating Costs for Houses Built to Different Standards (dollars per year)

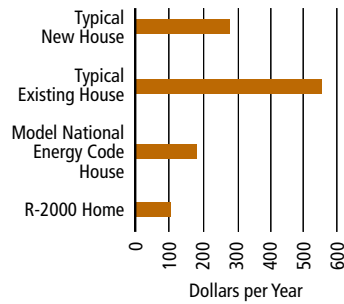
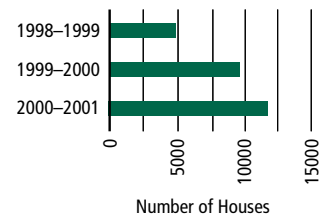


Figure 8

Number of Houses Evaluated and Labelled – EnerGuide for Houses Program



- The R-2000 Standard affects the new housing market by encouraging Canadians to build homes that cost about 60 percent less to heat than conventional new houses (Figure 7). R-2000 practices and technologies are increasingly being adopted in

mainstream construction. Examples include greater use of heat recovery ventilators, high-performance windows and high-efficiency gas furnaces.

OEE Housing Programs

The **R-2000 Program** is an industry-endorsed, voluntary certification program for new houses. It features a technical performance standard for energy efficiency, indoor air quality and environmental responsiveness, and a quality assurance process for industry training, house evaluations and inspections.

For more information, visit the Web site at <http://oee.nrcan.gc.ca/r2000>.

The **EnerGuide for Houses Program** is an energy performance evaluation and rating program. It provides homeowners with the facts they need to make informed decisions about energy efficiency when they are buying a house or improving their present house.

For more information, visit the Web site at <http://oee.nrcan.gc.ca/houses>.

Action Plan 2000 – Housing

The **energy-efficient housing initiative** has two components. One will broaden the EnerGuide for Houses rating system for home energy use to allow full penetration within the low-rise housing market in Canada and to strengthen its links with qualified, trained renovators. The other will promote the construction and purchase of R-2000-certified houses and the energy labelling of new houses using the EnerGuide system.

OEE Equipment Programs

Under the authority of the *Energy Efficiency Act*, Canada's *Energy Efficiency Regulations* require that specified types of energy-using equipment meet or exceed minimum levels of energy performance. The Regulations also require that specified household appliances on sale display an **EnerGuide** label. This label shows the yearly energy consumption rating of an appliance and positions it on a scale between the most- and least-efficient comparable models.

For more information, visit the Web sites at <http://oee.nrcan.gc.ca/regulations> and <http://oee.nrcan.gc.ca/appliances>.

Associated with the EnerGuide program is the **EnerGuide HVAC Energy Efficiency Rating System**. It provides consumers with the information they need to purchase energy-efficient home heating, ventilating and air-conditioning (HVAC) products and provides contractors with the tools to increase sales of energy-efficient HVAC equipment.

For more information, visit the Web sites at <http://oee.nrcan.gc.ca/cooling> and <http://oee.nrcan.gc.ca/heating>.

Action Plan 2000 – Residential Equipment

The **Accelerated Standards Action Program (ASAP)** will build upon the infrastructure developed while administering the current regulatory and labelling programs – notably consensus test standards, conformity assessment rules and industry networks.

It will accelerate the penetration of existing high-efficiency products into the stock of appliances and equipment. To do this, the program will deploy a series of market-based initiatives that will encourage consumers to purchase “best in class” efficient products. This will facilitate improvements in minimum energy performance standards.



Some 47 M&M Meat Shops franchise locations across Canada are currently implementing a number of energy-saving initiatives. There are plans to replicate these initiatives in another 116 stores. Visit the Web site at http://buildings.nrcan.gc.ca/home_e.htm.

Energy Efficiency in the Commercial/Institutional Sector

Composition and Trends

The commercial/institutional sector of the economy accounted for 12.5 percent of Canada's secondary energy use and 12.0 percent of the related GHG emissions in 1999.

Improved energy efficiency, combined with weather conditions, helped offset the effect of increased commercial activity between 1990 and 1999. This limited the growth in the sector's energy use to 13.4 percent. The energy efficiency of commercial/institutional buildings, heating and cooling equipment, lighting technology, electric motors and control systems improved. Without these advances, energy use in the sector would have been another 1.6 percent higher in 1999.

GHG emissions from the commercial/institutional sector increased by 13.7 percent during the 1990–1999 period. Fewer GHG emissions would have been released if there had not been a shift toward the use of more GHG-intensive fuels to generate electricity during that period.

Promoting Energy Efficiency

Space heating accounts for about 50 percent of the energy used in this sector and offers significant opportunities for gains in energy efficiency. Auxiliary motors, auxiliary equipment and lighting together account for about 35 percent of commercial/institutional energy use. Energy efficiency improvements are also possible in these areas.

As is the case in the residential sector, it is generally more economical to make energy efficiency improvements during the construction of a commercial/institutional building than after. However, given the slow turnover of the building stock in this sector and the opportunities for energy-efficient retrofits, the energy performance of existing buildings must also be improved.

The OEE's approach to the commercial/institutional sector is to

- use regulations and information programs to gradually exclude the least-efficient equipment from the market and to influence consumers to select, and manufacturers to produce, energy-efficient products that outperform the minimum standards;

- accelerate changes in building design, construction and operation by
 - marketing the benefits of more energy-efficient construction,
 - increasing the awareness and knowledge of building owners, designers and builders,
 - supporting energy codes and
 - providing incentives for designing more energy-efficient buildings; and
- encourage investments in energy-efficient building retrofits to lower costs and reduce GHG emissions by forming partnerships with key associations, emphasizing corporate energy management planning and providing incentives for implementing energy-efficient retrofits.

The OEE and Environment Canada support the Green Municipal Enabling Fund and Green Municipal Investment Fund, which are managed by the Federation of Canadian Municipalities (FCM). These funds support feasibility studies and encourage investments in projects that improve environmental performance or energy efficiency in municipal buildings and facilities, energy services and renewable energy,

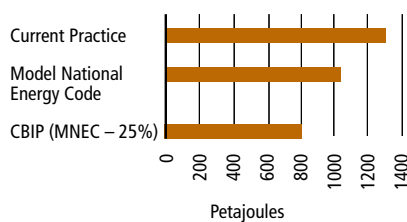
water and wastewater services, waste management and public transportation. The Director General of the OEE sits on the Green Municipal Funds' Council, and OEE staff are involved in assessing projects. Information on the funds can be obtained through the FCM's Web site at <http://www.fcm.ca>.

Selected Progress Indicators

- Through the Commercial Building Incentive Program, 59 projects aimed at improving the energy efficiency of new commercial, institutional and multi-unit residential buildings began in fiscal year 2000–2001. The projects had an estimated value of more than \$2.5 million. Buildings are designed to achieve energy performance that is, on average, 35 percent better than that required by the *Model National Energy Code for Buildings* (the actual range is from 26 to 65 percent).

Figure 9

Comparison of Petajoules Consumed – Commercial Buildings



- The Energy Innovators Initiative (EII) helps commercial businesses and public institutions explore energy efficiency options and strategies. Member organizations can save money and help the environment through the reduction of GHG emissions related to energy consumption. The EII offers access to tools, services and financial assistance – delivered through Energy Innovators Officers who work with members as they pursue energy management planning and retrofits. Since 1992, the EII has recruited over 600 organizations, representing approximately \$2.5 billion, or 26.9 percent, of the energy bills in these sub-sectors.
- The EII Pilot Retrofit Incentive encouraged commercial and institutional organizations to initiate or expand the scope of energy efficiency projects. In its first three years, the program approved 52 projects representing over 8 million square metres of space. These projects will reduce energy costs by \$21 million and energy consumption by 1.5 million gigajoules annually (or 20 percent on average), based on a total investment of \$210 million (of which \$9.2 million came from the incentive). In 2001, the incentive was enhanced and renamed “Energy Retrofit Assistance.” Funding is available for retrofit plans and projects, up to \$250,000.

OEE Buildings Programs

The **Commercial Building Incentive Program** provides financial incentives to eligible building owners who construct new commercial, institutional and multi-unit residential buildings that are at least 25 percent more energy efficient than similar buildings constructed to meet the *Model National Energy Code for Buildings*.

For more information, visit the Web site at <http://oee.nrcan.gc.ca/cbip>.

The **Energy Innovators Initiative** encourages investment in energy efficiency to reduce energy costs and consumption in commercial and institutional buildings. Financial incentives are available for qualifying retrofit plans and projects.

For more information, visit the Web site at <http://oee.nrcan.gc.ca/eii>.

OEE equipment programs, described on page 19, also affect the commercial/institutional sector.

Action Plan 2000 – Commercial/Institutional Sector

The **Energy Innovators Initiative** has been expanded with new elements aimed at offering financial assistance for energy-intensive retrofits and for retrofit planning services.

The **Accelerated Standards Action Program (ASAP)**, described on page 19, may also affect products in the commercial/institutional sector.



BHP Diamonds Inc., Canada's first diamond mine operator, seeks ways to limit the impact of its operations on the environment. Energy efficiency is playing a major role in its search. Visit the Web site at http://buildings.nrcan.gc.ca/home_e.htm.

Energy Efficiency in the Industrial Sector

Composition and Trends

For the purposes of this report, the industrial sector of the economy includes forestry, construction, mining and manufacturing. In 1999, this sector accounted for 39.0 percent of secondary energy use in Canada and 33.3 percent of related GHG emissions.

Industrial energy use increased by 11.4 percent between 1990 and 1999 as a result of growth in economic activity. However, more energy would have been used if energy efficiency had not improved by 9.1 percent. The sector achieved this efficiency by rationalizing operations, installing more efficient equipment and other efforts.

GHG emissions from the industrial sector increased by 6.6 percent between 1990 and 1999. Like the commercial/institutional sector, fewer GHG emissions would have been released if there had not been a shift toward the use of more GHG-intensive fuels to generate electricity during this period.

Promoting Energy Efficiency

In the industrial sector, energy is used primarily to produce heat, to generate steam, or as a source of drive power. Energy efficiency improvements are most easily achieved in equipment and processes that are common to many industries, such as motors and auxiliary

systems. Continued switching from fossil fuels to GHG-neutral energy sources (such as wood and pulp waste) represents another opportunity to reduce emissions from this sector.

The OEE's approach in the industrial sector is to

- implement more stringent minimum efficiency standards for electric motors and for fluorescent and incandescent lamps; and
- encourage and simplify voluntary action, both industry-wide and at the company level, to improve energy efficiency.

Selected Progress Indicators

- Amendments to the *Energy Efficiency Regulations* have raised the efficiency standard for industrial motors by about 5 percent and are expected to result in aggregate annual energy savings of 16.3 petajoules in 2010 (Figure 10). Associated with these savings is a reduction in GHG emissions by more than 2 megatonnes. More than half of the projected energy savings are expected to come from the industrial sector.
- By June 2001, 301 industrial companies had been recruited by the OEE's Industrial Energy Innovators Initiative. More than 200 Industrial Energy Innovators have prepared and submitted action plans describing their efficiency projects.

- The Canadian Industry Program for Energy Conservation (CIPEC) has a network of more than 40 trade associations representing more than 4000 companies from Canada's mining and manufacturing sectors. CIPEC reports on approximately 90 percent of total secondary industrial energy demand through its 23 task forces. The aggregate CIPEC target is a 1-percent overall improvement in industrial energy intensity per year through to 2005.

The number of CIPEC task forces with established energy efficiency improvement targets continues to rise. In general, they call for energy efficiency improvements of about 1 percent per year. The exceptions are breweries (3 percent), textiles (2 percent), cement (0.7 percent) and aluminum (0.3 percent).

Overall, CIPEC exceeded the targets it set for itself: from 1990 to 1999, industrial energy intensity improved, on average, by about 1.9 percent per year,

Figure 10

Energy Savings from Motor Regulations, 2000–2020

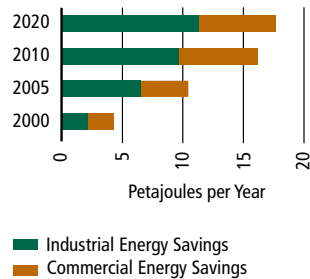
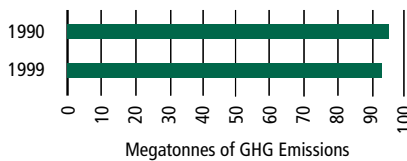


Figure 11

1990 Versus 1999 Emissions Levels for Canadian Industry Program for Energy Conservation (CIPEC) Industries



while emissions for 1999 are confirmed at approximately 2 percent below the 1990 base case level (Figure 11).

OEE Industry Initiatives

The **Canadian Industry Program for Energy Conservation** and the **Industrial Energy Innovators Initiative** are sectoral- and company-level initiatives, respectively. They help Canadian industries identify energy efficiency potential, establish energy efficiency targets and programs, and report on progress.

For more information, visit the Web site at <http://oee.nrcan.gc.ca/cipec>.

OEE equipment programs, described on page 19, also affect the industrial sector.

Action Plan 2000 – Industrial Sector

Following are cross-cutting measures in the industrial sector:

- expand **CIPEC** across all industry sectors and broaden efforts to encourage achievement of even greater energy efficiency;
- improve awareness of the benefits of reducing GHG emissions and the availability of appropriate tools to achieve reductions;
- develop **benchmarking** studies to provide a means for companies to assess their energy efficiency and emissions performance relative to comparable operations;
- provide support for companies to **audit** their facilities in order to identify specific opportunities to improve energy efficiency and reduce GHG emissions within their operations; and
- improve the **tracking and reporting of energy efficiency and emissions trends** to further encourage industry to pursue actions related to climate change and to help identify promising areas of activity for emissions reductions.

The **Industrial Buildings Incentive Program (IBIP)** aims to increase the energy efficiency of newly constructed buildings meant to house manufacturing and other industrial activities. IBIP will offer an incentive to companies building new industrial facilities to offset additional design costs inherent in the initial attempts at energy-efficient design.

The **Energy Rating System** initiative will identify products and platforms for an energy efficiency labelling/rating program for industry; this will ultimately improve the efficiency of the stock of energy-using equipment available for industrial applications.

The **Accelerated Standards Action Program (ASAP)**, described on page 19, may also affect products in the industrial sector.

Energy Efficiency in the Transportation Sector

Composition and Trends

In 1999, the transportation sector accounted for about 28.7 percent of secondary energy use in Canada and 35.7 percent of related GHG emissions.

Energy efficiency improvements in both freight and passenger transportation limited the growth in transportation energy use to 20.3 percent between 1990 and 1999. Without these improvements, transportation energy use would have been another 5 percent higher in 1999. The increase in energy use is due to many factors. Three of the most important are the growth in vehicle activity; Canadians' increasing preference for minivans and sport utility vehicles; and the growth in the amount of freight shipped by truck, which is more energy-intensive than some other forms of transport.

GHG emissions from the transportation sector increased by 19.6 percent from 1990 to 1999, consistent with the increase in energy use.

The transportation sector consists of three sub-sectors – passenger, freight and off-road. The passenger sub-sector comprises three modes – road, rail and air – whereas the freight sub-sector includes road, rail and marine modes. Road transport uses the most energy, accounting for more than 80 percent of

energy use for passenger transportation and more than 75 percent for freight transportation.

Promoting Energy Efficiency

Opportunities to improve the energy efficiency of road transport include manufacturing more fuel-efficient vehicles, encouraging private and commercial owners to purchase more fuel-efficient vehicles, and promoting more fuel-efficient driving and maintenance practices. As well, passenger and freight users can use more energy-efficient modes of transportation.

The OEE's approach in the transportation sector is to

- improve the energy efficiency of the vehicle stock offered to, and purchased by, consumers and fleet owners; and
- influence driver behaviour, vehicle maintenance practices and fleet management.

Selected Progress Indicators

- Company average fuel consumption (CAFC) is an industry-wide, sales-weighted measure used to determine the average fuel consumption of the entire new vehicle fleet. The CAFC is calculated for each model year and expressed in litres per 100 kilometres (L/100 km).



Volvo Cars of Canada Ltd. agreed to sign on to the EnerGuide for Vehicles program in the spring of 2001. All of the major vehicle manufacturers are now on board. Visit the Web site at <http://energuide.nrcan.gc.ca/html/home.html>.

Between 1990 and 1999, the CAFC of new passenger cars sold in Canada improved by 2.4 percent, dropping from 8.2 to 8.0 L/100 km. The light-duty truck segment includes pickup trucks, vans and sport utility vehicles. This segment's CAFC improved by 0.9 percent, dropping from 11.4 to 11.3 L/100 km between 1990 and 1999.

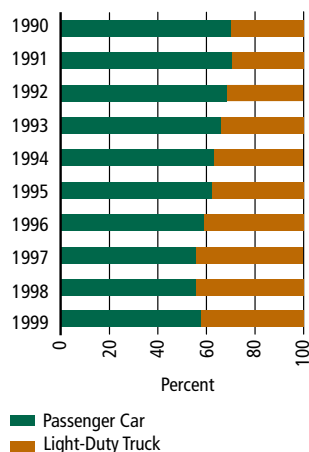
When passenger cars and light-duty trucks are combined, however, the CAFC worsened by 3.3 percent – the average fuel consumption of new vehicles rose from 9.1 L/100 km in 1990 to 9.4 L/100 km in 1999, mainly due to a shift in consumer demand from passenger cars to light-duty trucks (Figure 12).

- In February 2001, eight automobile manufacturers received the annual EnerGuide for Vehicles Awards for manufacturing the most fuel-efficient two-seater, sub-compact, compact, mid-sized and full-sized passenger cars, as well as station wagons, vans, pickup trucks and special-purpose vehicles. Manufacturers affix the EnerGuide Label for Vehicles to new vehicles to provide buyers with information on the fuel consumption of each vehicle. In 1999, 64 percent of new vehicles for sale on dealer lots displayed the EnerGuide Label for Vehicles.

- Auto\$mart aims to improve the energy efficiency practices of private motorists by influencing car purchase decisions, on-road driving practices and vehicle maintenance practices through the use of driver information. In the last year, nearly 250 new-driver educators were using the Auto\$mart driver kits, and the program reached about 60 000 novice drivers.
- The goal of FleetSmart is to improve the fuel efficiency of, and increase the use of alternative fuels in, non-federal vehicle fleets. The program provides information materials, workshops, technical demonstrations and driver training programs to help fleet operators assess and pursue opportunities to increase

Figure 12

New Passenger Car and Light-Duty Truck Market Shares, 1990 to 1999



energy efficiency in their operations. To date, 728 fleets representing 156 520 commercial vehicles have

registered with the program, and close to 99 000 drivers have been trained.

OEE Transportation Programs

The **Motor Vehicle Fuel Efficiency Initiative** encourages manufacturers to produce vehicles that meet voluntary average fuel consumption targets for new cars, vans and light-duty trucks. For more information, visit the Web site at <http://oee.nrcan.gc.ca/english/programs/motorvehicles.cfm>.

Auto\$mart is an information program that encourages motorists to buy, drive and maintain their vehicles in ways that reduce fuel consumption, save money and benefit the environment. For more information, visit the Web site at <http://oee.nrcan.gc.ca/vehicles>.

Under **EnerGuide for Vehicles**, manufacturers voluntarily affix an EnerGuide label to each new car, van and light-duty truck sold in Canada. The label indicates the vehicle's fuel consumption rating and estimated annual fuel costs to help consumers select the most fuel-efficient vehicle that meets their needs. For more information, visit the Web site at <http://oee.nrcan.gc.ca/vehicles>.

FleetSmart provides private-sector fleet managers with information, workshops, technical demonstrations and training programs on fuel-efficient practices for fleet vehicles. For more information, visit the Web site at <http://oee.nrcan.gc.ca/fleetsmart>.

Action Plan 2000 – Transportation Sector

The **Motor Vehicle Fuel Efficiency Initiative** seeks to significantly raise the target for voluntary light-duty vehicle fuel efficiency for the 2010 model year and to phase in a large improvement in fuel efficiency – starting as early as 2004.

The goal of the **Freight Efficiency and Technologies** initiative is to increase the freight transportation industry's participation in voluntary climate change initiatives. It will increase operating efficiency, as well as environmental training and awareness among freight operators and shippers. It will also demonstrate and encourage stakeholders to take up innovative environmental technologies and best practices within the freight transportation sector.

Other Office of Energy Efficiency Initiatives

In addition to delivering sector-specific initiatives, the OEE manages two programs that cut across all energy-using sectors of the economy:

- The **Public Information Program** produces and markets numerous publications and provides promotional products and marketing support, including exhibits, for all OEE initiatives.
- The **National Energy Use Database (NEUD)** initiative is a reliable and comprehensive source of information on end-use energy consumption in all sectors of the Canadian economy (residential, commercial/institutional, industrial, agriculture and transportation sectors).

Selected Progress Indicators

- In 2000, the OEE's corporate energy efficiency exhibit participated in seven home shows across Canada and received almost 100 000 visitors. Each year, the OEE distributes about 2 million copies of more than 300 energy efficiency and alternative energy publications to individuals and program partners. More than 75 percent of these publications are available on-line.
- The NEUD works in conjunction with partners such as Statistics Canada and Canadian organizations to regularly develop and implement several energy-use data collection exercises. For the first time in Canada, the NEUD implemented a Commercial and Institutional Building Energy Use Survey to collect energy consumption and intensity information from the different buildings that make up the commercial/institutional sector.

Other OEE Programs

The **Public Information Program** increases awareness of the environmental impact of energy use. It also encourages consumers to adopt energy-efficient practices and switch to alternative forms of energy. Numerous publications are available on-line at <http://oee.nrcan.gc.ca/>.

The **National Energy Use Database** initiative supports the development of Canadian energy end-use data, knowledge and analytical capabilities. Through the NEUD, data are collected on energy consumption at the end-use level, as well as on the characteristics of energy-using equipment and buildings, the behaviour of Canadian consumers toward energy use and the adoption of energy-efficient technologies. For more information, visit the Web site at <http://oee.nrcan.gc.ca/dpa/>.

Government of Canada Leadership

In 1995, the Government of Canada committed to “getting its own house in order” by reducing GHG emissions from its operations by at least 20 percent from 1990 levels by the year 2005. This commitment and an action plan were registered with what is now known as Canada’s Climate Change Voluntary Challenge and Registry Inc. (VCR Inc.).

To date, the Government of Canada already has reduced its GHG emissions by over 19 percent. The OEE has played an important role in helping to achieve this reduction through two of its programs – the Federal Buildings Initiative and FleetWise – and through its contribution to developing and implementing the Federal House in Order Initiative. This initiative formally centralizes government efforts to monitor, track and reduce its own emissions.

Action Plan 2000 strengthened the Government of Canada’s leadership role by updating the government target to 31 percent below 1990 levels by 2010. This goal will be achieved primarily by making energy efficiency improvements in buildings, putting the “federal garage in order,” switching to cleaner fuels and buying more renewable energy.

The Federal Buildings Initiative is a voluntary program that helps federal departments and agencies improve the energy efficiency of their facilities. It

provides them with a model framework for updating government buildings with energy-saving technologies and practices. To date, Federal Buildings Initiative contracts with private-sector energy service companies have financed retrofits in more than 6500 Government of Canada buildings. This has resulted in annual energy savings of about \$26 million, significant reductions in GHG emissions and a healthier, more comfortable work environment. The initiative’s approach is being replicated by some provinces and municipalities in Canada. For more information, visit the Web site at <http://oee.nrcan.gc.ca/fbi>.

The FleetWise program helps federal departments reduce their operating costs by increasing the energy efficiency of their motor vehicle fleets and promoting the use of alternative transportation fuels within the federal fleet. The program provides federal fleet managers with information and tools to improve the operational (including energy) efficiency of their fleets, reduce emissions from federal operations and accelerate the use of alternative fuels. Between 1995 and 2000, the size of the fleet decreased by 9 percent. At the same time, the number of kilometres travelled per vehicle decreased by 11 percent. However, GHG emissions from the fleet increased by 13 percent over the same period. This reflected the



increased proportion of trucks and vans compared with passenger vehicles, as well as improved data collection for fuels.

Under FleetWise, the Toyota Prius sedan – a hybrid electric vehicle (HEV) – has been promoted to fleet managers in federal departments and agencies as an alternative fuel vehicle.

HEVs are preferable to conventional vehicles because they are more energy efficient and emit fewer pollutants. The Government of Canada purchased 52 Prius vehicles in the 2000–2001 fiscal year. For more information, visit the Web site at <http://oee.nrcan.gc.ca/fleetwise>.

Action Plan 2000 – Government of Canada Leadership

New and expanded initiatives – announced under *Action Plan 2000's Federal House in Order Initiative* – call for the OEE, in conjunction with Environment Canada, to continue to play an important role in helping departments meet the government's new emissions-reduction target.

- Key departments are responsible for 95 percent of GHG emissions by the Government of Canada. They will commit to individual energy reduction targets, thus sharing the responsibility for achieving the overall federal emissions target of 31 percent below 1990 emissions levels.
- The **Federal Buildings Initiative** will provide additional project facilitation, planning advice and contracting help to secure energy management services for projects.
- The **Fleet Strategies and Ethanol Fuel Initiative** will promote life-cycle costing, "best in class" vehicle identification and continued use of alternative fuels through the **FleetWise program**. Support will also be given to increasing the penetration of ethanol-blended fuels in federal fleets.
- The **Leadership Challenge** will encourage all federal departments and agencies to participate in efforts to reduce emissions. The challenge will provide best-practices information on employee awareness, staff training, solid-waste management and GHG-responsible procurement. It will also support public transit and "green" commuting.
- **Canada's Greenhouse Gas Inventory** will be used to track progress through a central GHG inventory and for annual reporting through VCR Inc.