

# Federal House in Order

Annual Report on Emissions Reductions  
From Federal Operations

October 2002



Government  
of Canada

Gouvernement  
du Canada

Canada 

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Companies in a growing number of sectors of the Canadian economy are working to reduce the greenhouse gas emissions from their operations. As the country's largest single enterprise, the Government of Canada is leading by example and getting its own "house in order."

In late 2002, the Government of Canada released its *Climate Change Plan for Canada* and shortly thereafter announced its ratification of the Kyoto Protocol. Leadership by governments was identified as a key area where reductions can be made. The Federal House in Order (FHIO) initiative will be the cornerstone program to achieve these commitments.

The *Government of Canada Action Plan 2000 on Climate Change* set a target for the Government of Canada to reduce its greenhouse gas emissions from federal facilities by 31 percent below 1990 levels by 2010. In this year's *Emissions Reductions From Federal Operations*, we are pleased to announce that, to the end of the 2000–2001 fiscal year, we have already reduced our emissions by 21 percent below 1990 levels.

Natural Resources Canada and Environment Canada are leading the FHIO initiative in which the 11 departments and agencies that produce 95 percent of federal emissions are participating. These departments have made a commitment to increase energy efficiency, switch to more environmentally friendly fuels and purchase electricity from renewable sources. As well, the Leadership

The Honourable Herb Dhaliwal  
Minister  
Natural Resources Canada



Challenge encourages all other federal departments and agencies to reduce their emissions and report the results. By gaining a better understanding of where and how it produces greenhouse gas emissions, the Government of Canada can improve its existing programs and design new ones to reduce emissions. For example, on November 22, 2002, the Prime Minister announced that all executive vehicles should be factory-equipped for alternative fuels or be among the most energy efficient in their class, such as being fuelled by E-10 gasoline wherever available. Additionally, all departments will purchase vehicles that are among most energy efficient in their class or ensure that new vehicles are equipped to run on natural gas, propane or E-85 gasoline.

*Emissions Reductions From Federal Operations* details the progress that the Government of Canada has made through FHIO and other initiatives such as the Federal Buildings Initiative, FleetWise, the Federal Industrial Boiler Program and the Renewable Energy Deployment Initiative.

The Government of Canada is proud to do its part to help Canada meet its climate change commitments by reducing greenhouse gas emissions while maintaining and improving the services we offer to the people of Canada.

The Honourable David Anderson  
Minister  
Environment Canada

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# Executive Summary

The Government of Canada is taking action to address climate change and is demonstrating leadership by reducing greenhouse gas (GHG) emissions within its own operations. The Federal House in Order (FHIO) initiative formally centralizes the Government of Canada's efforts to monitor, track and reduce its own GHG emissions. Supported by lead departments Natural Resources Canada and Environment Canada, the initiative involves 11 departments and agencies that together account for more than 95 percent of all Government of Canada GHG emissions.

This document, *Annual Report on Emissions Reductions From Federal Operations*, meets the Government of Canada's commitment to report annually under the FHIO initiative on its progress in reducing GHG emissions. It is the seventh progress report submitted by the Government of Canada to Canada's Climate Change Voluntary Challenge and Registry Inc. (VCR Inc.). Under the FHIO initiative, emissions data reported by Government of Canada departments are centralized in a GHG inventory. The resulting information was used in the April 2001 report to revise the Government of Canada's target for reducing GHG emissions. This report goes beyond target setting and updates the Government of Canada's progress toward reducing its own GHG emissions by providing emissions data for 2000.

Highlights in this report include the following:

- As part of its *Action Plan 2000 on Climate Change*, the Government of Canada announced a revised target of a 31 percent reduction in GHG emissions from 1990 levels by the year 2010. This revised target requires an additional 10 percent reduction in addition to the 21 percent reduction achieved to the year 2000.
- In 2000, approximately 82 percent of emissions originated from facilities (i.e., buildings), 15 percent were from vehicle fleets, and 3 percent were from non-energy sources.
- Total GHG emissions from Government of Canada operations declined by approximately 21 percent between 1990 and 2000.

For further information on the Federal House in Order initiative, visit the Web site at [www.fhio.gc.ca](http://www.fhio.gc.ca).

### 1.1 Background

Greenhouse gas (GHG) emissions contribute to global climate change, and emissions from the combustion of fossil fuels such as coal, oil and natural gas account for most of Canada's GHG emissions. In partnership with other levels of government, industry and energy consumers, the Government of Canada is working to limit these emissions.

In 1992, Canada ratified the United Nations Framework Convention on Climate Change (UNFCCC). In 1995, federal, provincial and territorial ministers of energy and the environment approved the National Action Program on Climate Change to demonstrate leadership in reducing GHG emissions by "getting their own houses in order." By reducing emissions related to their own operations, participants sought to encourage other sectors of the economy to do the same.

Accordingly, the Government of Canada registered its action plan with Canada's Climate Change Voluntary Challenge and Registry Inc. (VCR Inc.) in 1995, stating its commitment to reduce GHG emissions from federal operations by at least 20 percent from 1990 levels by the year 2005. This target has since been revised under the FHIO initiative to 31 percent below 1990 levels.

In December 1997, more than 160 nations attending the third UNFCCC Conference of the Parties negotiated the Kyoto Protocol. Under this protocol the Government of Canada agreed to reduce Canada's GHG emissions to 6 percent below 1990 levels between 2008 and 2012.

### 1.2 Federal House in Order Initiative

In 2000, the Government of Canada launched the FHIO initiative with Natural Resources Canada and Environment Canada as the lead departments. This initiative recognizes that the Government of Canada's operations produce GHG emissions and, as a result, must meet their share of the responsibility for honouring the Kyoto commitment. Through the FHIO initiative, the Government of Canada will demonstrate that it is taking a leadership role in getting its own "house in order." Reducing its own emissions may ultimately encourage others to do their part in addressing the issue of climate change.

Through the FHIO initiative, the Government of Canada developed a target for reducing GHG emissions within its own operations. This target, along with a strengthened and formal reporting system to track and monitor Government of Canada emissions, was announced in the *Government of Canada Action Plan 2000 on Climate Change*. Emissions data under the FHIO initiative are based on data quantified and provided by participating departments and agencies and tracked through a central GHG inventory, allowing consistent, reliable and annual reporting.

The objective of the *Annual Report on Emissions Reductions From Federal Operations* is to report on the Government of Canada's progress toward achieving its emissions-reductions goal. This document also meets the Government of Canada's commitment to VCR Inc. to report annually on its progress in reducing emissions.



# Setting Boundaries for Reporting GHG Emissions

## Chapter 2

Setting boundaries for the collection of GHG emissions data for the Government of Canada's GHG inventory ensures consistent and reliable data. These boundaries recognize the challenges and current limitations of collecting data across federal departments and serve to clearly identify the scope of emissions included in the inventory. This scope is expected to increase as data infrastructure improves across Government of Canada departments.

The following identifies the GHG inventory boundaries with respect to sources and types of emissions and GHGs.

### 2.1 Participating Departments

The FHIO initiative identified 11 departments and agencies as being responsible for 95 percent of GHG emissions from Government of Canada operations. These departments and agencies are listed in Table 1.

**TABLE 1. Government of Canada Departments and Agencies Reporting Under the FHIO Initiative**

|   |
|---|
| Agriculture and Agri-Food Canada            |
| Correctional Service Canada                 |
| Fisheries and Oceans Canada                 |
| Department of National Defence              |
| Environment Canada                          |
| National Research Council Canada            |
| Natural Resources Canada                    |
| Parks Canada Agency                         |
| Public Works and Government Services Canada |
| Royal Canadian Mounted Police (RCMP)        |
| Transport Canada                            |

### 2.2 Sources of Emissions

The most significant source of GHG emissions from Government of Canada operations comes from the combustion of fossil fuels. Combustion of fossil fuels, whether direct (consumed at source) or indirect (consumed upstream such as in the generation of electricity), results in emissions that are made up of a variety of gases that contribute to climate change. The FHIO initiative collects data on the three most prevalent GHGs: carbon dioxide (CO<sub>2</sub>), methane (CH<sub>4</sub>) and nitrous oxide (N<sub>2</sub>O).

In addition to emissions from combustion, non-energy sources such as landfills and agricultural operations also emit GHGs. An accounting of these emissions will be included in future FHIO reports. The Government of Canada as an organization emits GHGs primarily from facilities and vehicle fleets. These sources are currently captured in the GHG inventory.

#### 2.2.1 Facilities

"Facilities" largely refers to building infrastructure such as office buildings. The main criterion for including facilities in the GHG inventory is the custodial responsibility of the building. Emissions data are collected for those facilities for which the Government of Canada has custodial responsibility and therefore direct control and influence over curbing future emissions.

## ■ 2.2.2 Fleets

Sources of GHG emissions from fleets include the on- and off-road Government of Canada fleet inventories. The on-road fleet includes cars, vans, trucks and other vehicles that the government owns/leases and operates for on-road travel. The off-road fleet includes a wide variety of vehicles and equipment used in Government of Canada operations. Within the off-road category there is a marine fleet, which includes the boats and ships owned by the Government of Canada. Aircraft are also included in the off-road inventory, as are field equipment such as off-road vehicles, lawn mowers and generators.

## 2.3 Excluded Sources of Emissions

The following sources of emissions are excluded from the GHG inventory.

### Departments With Low GHG Emissions

The FHIO initiative collects data and reports emissions for 11 federal departments and agencies that represent 95 percent of the Government of Canada's GHG emissions (see Table 1). The remaining departments currently excluded from the GHG inventory are actively being recruited through Environment Canada's Leadership Challenge (see Section 6.2).

### Crown Corporations

Crown corporations are also not accounted for in the GHG inventory. However, given the relationship between the Government of Canada and Crown corporations, there is great interest in eventually expanding the GHG inventory's data collection to include these corporations.

### National Safety and Security Sources

National Safety and Security (NSS) GHG emissions from activities such as search-and-rescue operations and military vehicles are excluded because of the important role that these functions have in ensuring the safety and security of Canadians. These emissions are exempt from GHG emissions tracking and target setting so as to not impair the Government of Canada's role in providing these services. In addition, GHG emissions associated with these sources have not yet been addressed through international protocols. Departments that have identified GHG emissions from NSS sources have been asked to track them independently and to undertake best efforts to reduce them.

### "Outside" GHG Emissions

Other GHG emissions that are a consequence of activities of the Government of Canada are not reported in the GHG inventory. These include GHG emissions from employee commuting, business travel and government activities that are outsourced. Some initial work has been done on the impact of these "outside" GHG emissions, and it may be integrated into future FHIO reports if data on this category of emissions can be collected annually.

Nevertheless, activities are underway to reduce these GHG emissions under the Leadership Challenge (see Section 6.2). For example, a pilot test of a public transit pass system has been launched in the National Capital Region. Through payroll deductions, employees of the Government of Canada will be able to purchase a monthly public transit pass at a reduced rate. This reduces GHG emissions by encouraging Government of Canada employees to leave their cars at home and use public transportation.



## 2.4 Divestiture

The intent of the FHIO initiative is to reduce GHG emissions. This will be done by investing in emerging renewable resources (e.g., wind-generated power), switching to cleaner fuels and replacing old technologies with newer, more efficient ones, such as energy-efficient boilers. The Government of Canada will not take credit for reductions in GHG emissions for facilities that are sold and that have had their associated emissions divested to other sectors of the economy. Credit will be given only if a building is decommissioned because of downsizing.

## 2.5 Types of Emissions

The data collected in the GHG inventory encompass direct, indirect and non-energy-related GHG emissions. Direct emissions are obtained from the combustion of fossil fuels by the Government of Canada's fleet and facilities. Indirect emissions result from the purchase and use of electricity, from steam used for heat, primarily for facilities. Non-energy-related emissions from landfills and agricultural operations are currently accounted for in the GHG inventory. However, their quantification is based only on a scoping study, and annual collection of these data is not yet feasible. A process is being developed to collect these data annually.

## 2.6 Greenhouse Gases

In this report, the Government of Canada's GHG footprint is described in terms of total CO<sub>2</sub> equivalent. CO<sub>2</sub> equivalent is an aggregate GHG emissions unit comprising a global warming potential (GWP) weighted value for CO<sub>2</sub>, CH<sub>4</sub> and N<sub>2</sub>O (see Table 2). In subsequent FHIO reports, total CO<sub>2</sub> equivalent will be disaggregated by component GHGs for the direct emissions reported in the GHG inventory.

*TABLE 2. Greenhouse Gases Tracked by the FHIO Initiative and Their Associated Global Warming Potential (GWP)*

| <b>Greenhouse Gas</b>             | <b>GWP</b> |
|-----------------------------------|------------|
| Carbon dioxide (CO <sub>2</sub> ) | 1          |
| Methane (CH <sub>4</sub> )        | 21         |
| Nitrous oxide (N <sub>2</sub> O)  | 310        |

The way in which the Government of Canada estimates its GHG emissions has evolved over the years. The first versions of this report were based on a combination of departmental reports and estimates derived from a modelling exercise. Energy consumption data are the basis for estimating GHG emissions, and establishing the FHIO initiative led to a major shift in how energy consumption data are collected from federal departments.

The FHIO initiative's method for estimating GHG emissions continues to evolve, conforming with VCR Inc. methods and with the World Resources Institute's reporting standard, the Greenhouse Gas Protocol Initiative.

The following steps are used to estimate GHG emissions.

### Step 1 – Data Collection

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Departments are responsible for collecting annual data and reporting them to the FHIO initiative's GHG inventory. Data collection is facilitated by the GHG inventory's data collection tool (see Appendix 1), and departments report energy consumption by fuel type for facilities and fleets. Although non-energy-related emissions data are not currently reported to the inventory, this is being addressed, and a non-energy data collection tool is in development.

### Step 2 – Data Validation

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Personnel that manage and administrate the GHG inventory validate departmental data relative to what has been reported in the past, identifying anomalies in the data and contacting departments for further explanation or correction of reported data. Data are compared with related reporting activities in the Government of Canada by outside experts in the field of federal fleet and building emissions.

### Step 3 – Calculating GHG Emissions

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Estimating the Government of Canada's GHG emissions involves applying GHG coefficients to the fuel consumption reported to the inventory by federal departments. GHG coefficients exist for the various fuel types in the market. Appendix 2 identifies the GHG coefficients used by the FHIO initiative.

The GHG inventory collects fuel usage by fuel type and calculates associated GHG emissions by applying the appropriate coefficients to each fuel type. This process is automated in the inventory's data collection tools; when fuel usage information is reported, the resulting emissions are calculated in the reporting tool for the department.

# Setting a GHG Emissions-Reduction Target for the Government of Canada

## Chapter 4

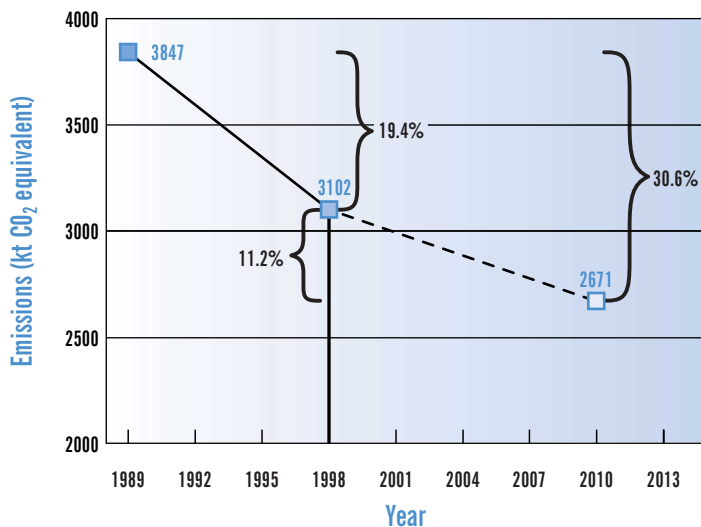
This chapter identifies the Government of Canada's emissions-reduction target and outlines how that target is determined (see Figure 1). This includes detail on the baseline data and the process for building emissions data for the two important reference time frames within the context of the Kyoto Protocol. Essentially, this involved establishing emissions levels for 1990 and 2010, given that the Kyoto Protocol requires emissions to be below 1990 levels between 2008 and 2012.

The following steps were followed to establish a new GHG emissions-reduction target for the Government of Canada.

### Step 1 – Establishing Baseline Data for 1998

Baseline data are the foundation for all Government of Canada GHG emissions figures and target calculations. Any change to the baseline data set will ultimately affect all subsequent data. The first year of data collection reported to the GHG inventory under the FHIO initiative was 1998. In this baseline year, Government of Canada GHG emissions were 3102 kilotonnes (kt) of CO<sub>2</sub> equivalent.

**FIGURE 1**  
Target for Reduction of GHG Emissions From Government of Canada Operations



### Step 2 – Extrapolating GHG Emissions for the 1990 Reference Year

Under the Kyoto Protocol, 1990 is the reference year with which all subsequent emissions levels are compared. Similarly, this is the reference year for the FHIO initiative and for referencing the Government of Canada's GHG emissions target and for reporting progress toward it.

Given that the quantifiable data needed to establish the 1990 reference year are not available from all departments, the 1990 reference was extrapolated from the 1998 baseline year. Information on Government of Canada downsizing, energy intensity improvements and fuel switching between 1990 and 1998 were used to extrapolate the Government of Canada's GHG emissions level in 1990. This was estimated to be 3847 kt of CO<sub>2</sub> equivalent in 1990.

### Step 3 – Forecasting Emissions Levels in 2010

The time frame for attaining the Kyoto Protocol target levels falls between 2008 and 2012. Departments projected their emissions levels to 2010, the midpoint for this target time frame, assuming a business-as-usual scenario in which no new actions would be taken to reduce emissions. Projected emissions estimates are based on planned growth in floor space reported by

departments and agencies in their capital plans. It is assumed that new buildings will be constructed using current building practices and at current performance levels between 1998 and 2010. For the building stock that existed in 1998, it is assumed that its efficiency will remain largely unchanged in the absence of the FHIO initiative's measures. It is also assumed that GHG emissions from Government of Canada vehicle fleets will remain relatively constant in the absence of measures to reduce emissions.

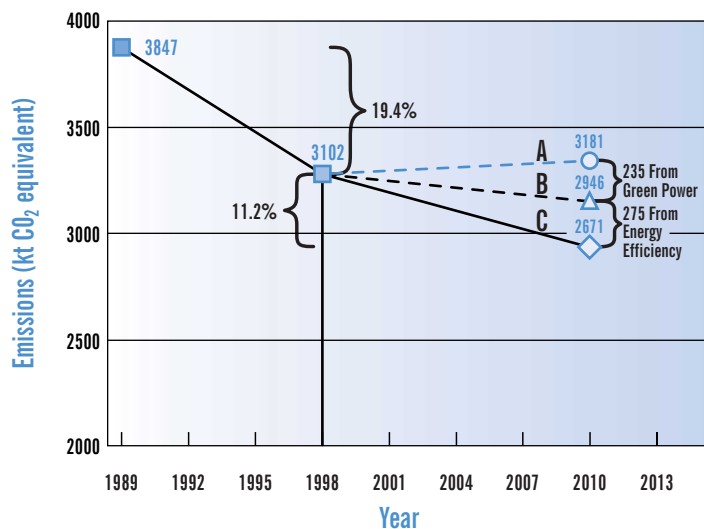
Cumulatively, the Government of Canada's GHG emissions are estimated to increase by 2.5 percent between 1998 and 2010 in a business-as-usual scenario. These emissions would therefore reach 3181 kt of CO<sub>2</sub> equivalent in 2010 if no actions to reduce emissions were taken. The business-as-usual forecast is the basis for calculating an emissions-reduction target.

#### Step 4 – Calculating an Emissions-Reduction Target for 2010

Departments assessed a variety of cost-effective measures to improve energy efficiency and emissions levels in their respective departments between 1998 and 2010. In addition, the Government of Canada is proposing to reduce emissions through proposed renewable energy projects.

Emissions reductions to be achieved through departmental energy efficiency measures and the use of renewable energy were subtracted from the business-as-usual scenario emissions value of 3181 kt CO<sub>2</sub> equivalent (See Figure 2, line A). Emissions are estimated to be reduced by 235 kt by implementing renewable energy projects (Figure 2, line B). The remainder of the estimated emissions reduction will be 275 kt. This will be achieved collectively by Government of Canada departments through their individual energy management plans and emissions-reduction activities (Figure 2, Line C). In total, the Government of Canada estimates that it will reduce its emissions by 510 kt from the 2010 business-as-usual scenario.

**FIGURE 2**  
Projected Government of Canada GHG Emissions, 1990–2010



Government of Canada GHG emissions are projected at 2671 kt in 2010, given the planned reduction of 510 kt from the 2010 business-as-usual scenario (3181 kt). This represents a 30.6 percent reduction from 1990 emissions levels (3847 kt). The Government of Canada target is therefore to reduce GHG emissions by 31 (30.6) percent from 1990 levels.

# Progress Toward Achieving the Government of Canada's Emissions-Reduction Target

## Chapter 5

The main objective of this document is to report on the Government of Canada's progress toward achieving its GHG emissions-reduction target. This section profiles the characteristics of the most recent year's data collection and outlines progress based on emissions data for 2000.

### 5.1 Profile of GHG Inventory in 2000

Overall, Government of Canada GHG emissions declined 21.2 percent from 3847 kt to 3031 kt of CO<sub>2</sub> equivalent between 1990 and 2000 (see Figure 3). As a result, the Government of Canada is required to reduce its GHG emissions an additional 9.4 percent between 2000 and 2010 to achieve the 30.6 percent (31 percent) reduction target.

**FIGURE 3**  
Progress Toward Achieving the Government of Canada's Emissions-Reduction Target

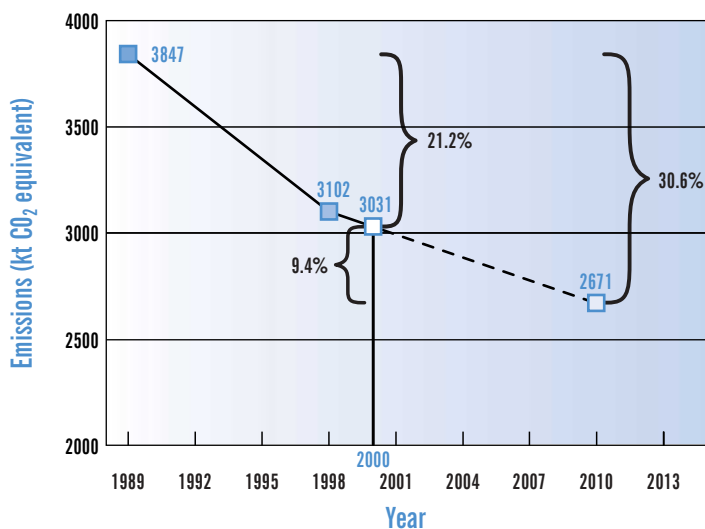
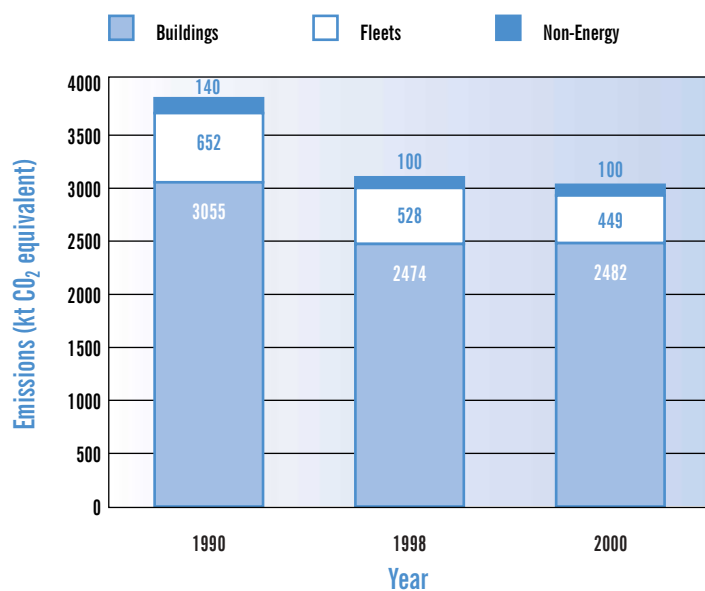


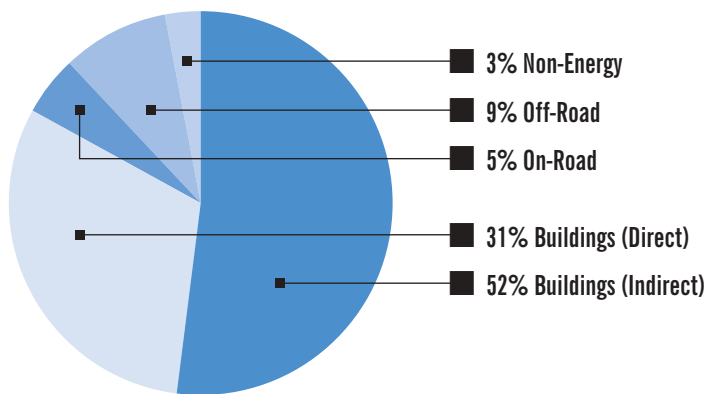
Figure 4 shows the reduction in GHG emissions by source for the 11 federal departments and agencies listed in Table 1 for 1990, 1998 and 2000. Emissions declined 745 kt, or approximately 19.4 percent, from 1990 to 1998. Emissions were further reduced by 71 kt between 1998 and 2000, representing an additional 1.8 percent reduction relative to 1990 emissions levels.

**FIGURE 4**  
Total GHG Emissions From Government of Canada Operations: Buildings, Fleets and Non-Energy Sources



In 2000, emissions from Government of Canada operations were equivalent to approximately 0.4 percent of Canada's overall GHG emissions. Approximately 83 percent (2482 kt) were associated with buildings, 15 percent were from vehicle fleets (162 kt from on-road and 287 from off-road sources), and 3 percent (100 kt) were from non-energy sources. Figure 5 shows the share of GHG emissions from Government of Canada operations by source for the year 2000.

**FIGURE 5**  
Government of Canada GHG Emissions by Source, 2000



## 5.2 Government of Canada Buildings

In 2000, Government of Canada facilities emitted approximately 2482 kt of GHG emissions; of these, about 80 percent were from three federal departments: the Department of National Defence (approximately 47 percent); Public Works and Government Services Canada (approximately 25 percent) and Correctional Service Canada (almost 8 percent).

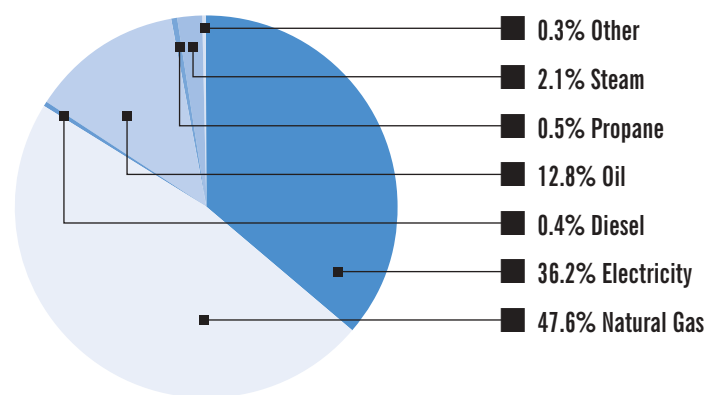
Total emissions for Government of Canada buildings represent less than half a percentage increase in emissions from 1998 levels. Energy intensity improved by approximately 1 percent in the same period. Emissions attributed to federal facilities remained relatively the same due to fuel switching. For example, there was an increase in the use of diesel.<sup>1</sup>

<sup>1</sup> Energy intensity is the amount of energy used per unit of floor space. On its own, an energy intensity value does not give much information. However, when compared across time, patterns in energy demand and use become more clear.

<sup>2</sup> Natural gas is a clean fuel relative to other fossil fuels. However, in order to generate electricity, three times as much natural gas needs to be consumed. This results in a GHG emissions factor three times greater than that of natural gas used for heating.

Just over 36 percent of energy use in Government of Canada facilities was from electricity; nearly 62 percent was from the direct combustion of fossil fuels (see Figure 6). Reducing the use of fossil fuels leads directly to reductions in GHG emissions. Although electricity generated by hydro, wind, solar or nuclear power has no associated emissions, electricity generated by the burning of natural gas or coal does. The Government of Canada is in a unique situation because it has many facilities across the country. It becomes difficult, and therefore beyond the scope of the inventory, to account for emissions based by region. All departments reporting to the FHIO initiative's GHG inventory agreed on a national average for an electricity GHG emissions factor. The assumption is that natural gas is used to generate electricity.<sup>2</sup>

**FIGURE 6**  
Energy Used by Government of Canada Facilities by Fuel Type, 2000

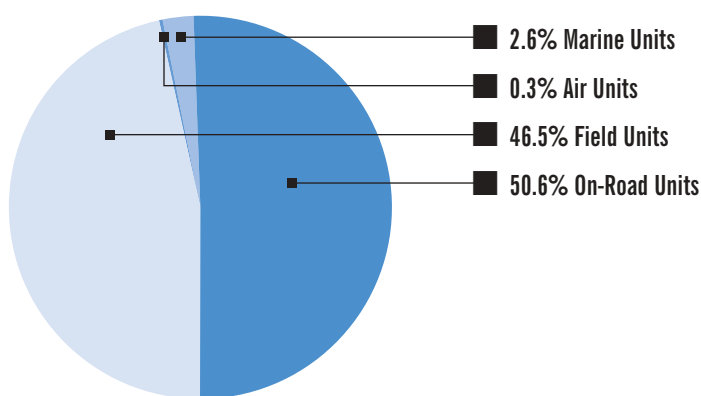




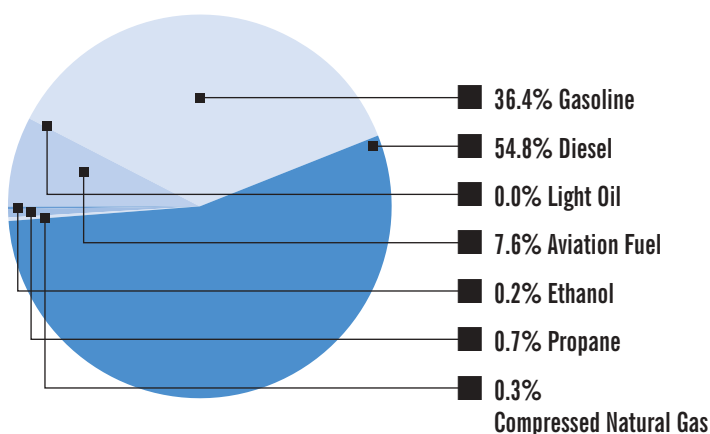
### 5.3 Government of Canada Fleet

In 2000, the Government of Canada's vehicle fleet consisted of just over 39 000 light-duty on-road vehicles, aircraft, marine vessels and field equipment such as snowmobiles, tractors and outboard motors. Figures 7, 8 and 9 and Table 3 provide additional details on the Government of Canada's fleet.

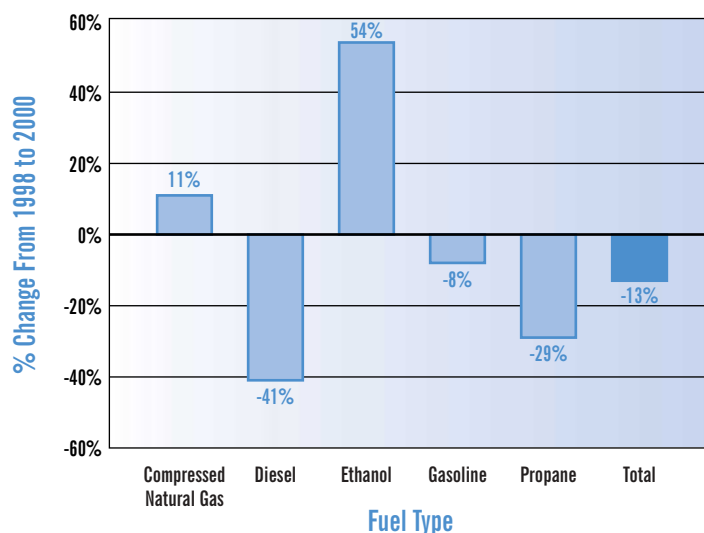
**FIGURE 7**  
Government of Canada's Fleet Units by Type, 2000



**FIGURE 8**  
Energy Use by the Government of Canada's Fleet by Fuel Type, 2000



**FIGURE 9**  
Fuel Switching for the Government of Canada's On-Road Fleet, 1998–2000



For 2000, total GHG emissions from vehicles were estimated at 449 kt; of these, on-road vehicles accounted for 36 percent. Three federal departments (the Department of National Defence, Fisheries and Oceans Canada and the RCMP) accounted for 79 percent of on-road emissions; three Government of Canada departments (Fisheries and Oceans Canada, the RCMP and Transport Canada) accounted for 89 percent of off-road emissions.

The reduction in transportation emissions from 1998 to 2000 is close to 15 percent. This can be attributed to the following:

- reduced energy use for all sectors of transportation (road, air, marine and field);
- reduced on-road fleet size; and
- reduced kilometres driven for the on-road fleet.

## 5.4 Non-Energy Sources of GHG Emissions

GHG emissions from non-energy-related sources were estimated for 1990 and 1998 based on an inventory of known sources from Government of Canada operations. In 1990, estimated GHG emissions from non-energy sources was 140 kt, and this was estimated to have decreased to 100 kt by 1998. For 2000, the estimation is the same (100 kt) as it was for 1998. Because of the difficulties in collecting reliable non-energy emissions data, all 11 departments and agencies reporting under the FHIO initiative have agreed to flat-line this figure until a suitable data collection strategy for non-energy-related emissions has been established. GHG emissions from non-energy sources will therefore remain at 100 kt until the feasibility of collecting these data has been completed. Research is underway to identify an appropriate data collection strategy and develop appropriate data collection tools.

In addition to the factors already mentioned, the on-road fleet experienced some fuel switching from 1998 to 2000. The federal fleet appears to be switching to cleaner fuels such as ethanol and compressed natural gas, which saw a 54 percent and 11 percent increase in demand, respectively.

The energy intensity per unit and per kilometre driven also saw significant reductions when comparing 2000 with 1998. The energy intensity based on the number of on-road units was reduced by 4 percent. However, when using kilometres driven, the reduction was almost 8 percent. The lowered energy intensities show that the fleet is being used more efficiently.

**TABLE 3. Characteristics of the Government of Canada's Fleet, 2000**

|  |   |
|--|---|
| <b>Total federal fleet</b>                   | <b>39 167 units</b>                         |
| <b>Number of light-duty on-road vehicles</b> | <b>19 820 units (50.6 percent of total)</b> |
| Fleets larger than 1000 vehicles*            | 6   |
| Average age                                  | 4.3 years                                   |
| Vehicles using alternative fuels             | 595 <sup>†</sup> (3 percent of on-road)     |
| <b>Off-road fleet</b>                        | <b>19 347 units (49.4 percent of total)</b> |
| Aircraft                                     | 0.6 percent (0.3 percent of total)          |
| Marine vessels                               | 5.2 percent (2.6 percent of total)          |
| Field equipment                              | 94.2 percent (46.5 percent of total)        |

\* Departments and agencies that have on-road fleets larger than 1000 vehicles include Agriculture and Agri-Food Canada, Correctional Service Canada, Fisheries and Oceans Canada, Parks Canada Agency, the RCMP and the Department of National Defence.

<sup>†</sup> Based on 1998–1999 *Report on the Application of the Alternative Fuels Act – Annual Report to Parliament*.

# Highlights of the Government of Canada's GHG Emissions-Reduction Program

## Chapter 6

Between 1990 and 2000, the Government of Canada reduced GHG emissions from its own operations by approximately 22 percent (842 kt). These reductions were realized with the assistance of programs and initiatives offered by Natural Resources Canada, Public Works and Government Services Canada (PWGSC) and Environment Canada. The following chapter outlines specific program contributions to the reduction of GHG emissions since 1990.

### 6.1 Current Programs

Programs such as the Federal Buildings Initiative, the Federal Industrial Boiler Program and renewable energy programs helped reduce GHG emissions by supporting energy retrofits, providing energy managers with information about energy efficiency and GHG issues and encouraging the design of buildings that are more energy efficient.

#### 6.1.1 Federal Buildings Initiative

The Federal Buildings Initiative is a voluntary program developed and administered by Natural Resources Canada's Office of Energy Efficiency to help Government of Canada departments and agencies reduce their GHG emissions, energy use and operating costs by improving the energy efficiency of their facilities. The program's wide range of products and services – which include model documents, employee-awareness products, skills development services and environmental, health and safety advice – give departments and agencies the confidence and flexibility they need to implement a small or large-scale energy management project without necessarily using their capital funds. Through the Federal Buildings Initiative's savings-financing option, a department can engage in a contractual agreement with a pre-qualified energy management firm, allowing the department to pay for the project costs through the savings generated by the energy efficiency improvements.

The Federal Buildings Initiative offers unique opportunities for everyone: it promotes healthy and productive workplaces for employees, increases investment in the growing energy service sector of the economy, helps reduce the cost of government operations, generates thousands of jobs and lowers GHG emissions that contribute to climate change, acid rain and urban smog.

To date, this program has helped foster more than 70 projects that involve 6500 buildings and facilities, has attracted \$190 million in privately financed investments, has generated \$26 million in annual savings and is expected to reduce GHG emissions by 16 kt per year. Examples of this success follow:

- Sixteen Canadian Forces bases have awarded energy performance contracts to energy management firms, which has resulted in more than \$90 million invested by the private sector in energy efficiency improvements and produced more than \$10.5 million in annual savings. A few examples follow:
  - Construction is underway at CFB Borden, 19 Wing Comox, 4 Wing Cold Lake, 17 Wing Greenwood, BFC Montréal and CFB Suffield.

The energy efficiency measures implemented under CFB Suffield's Federal Buildings Initiative energy performance contract have been designed to reduce GHG emissions by more than 6700 tonnes per year once the project is completed in the fall of 2001. Energy efficiency measures include upgrades to equipment and operating procedures (involving 80 of the base's 303 structures), updates to lighting systems and the installation of occupancy and local sensors to improve the efficiency of heating, ventilating and air-conditioning (HVAC) systems. Total annual savings are expected to reach \$500,000.

CFB Petawawa's \$14-million Federal Buildings Initiative energy performance project is expected to generate savings of \$1.4 million per year, with substantial reductions in GHG emissions. Energy efficiency measures include upgrading equipment and operating facilities in 100 buildings, installing a cogeneration unit and upgrading the energy management skills of base personnel to improve operational effectiveness.

- At 17 Wing Winnipeg, CFB Petawawa, CFB Halifax, CFB Shilo, CFB Valcartier, CFB Gagetown, 8 Wing Trenton and 7 CFSD Edmonton, projects are now at the post-construction phase. The energy management firm and base personnel are monitoring the performance of new energy efficiency measures.
- An energy management firm has been awarded a project at WATC Wainwright. The selected firm is detailing the work that needs to be done (i.e., a feasibility study and the schedule for installation).
- The RCMP awarded its first Federal Buildings Initiative energy management project at its D Division Headquarters in Winnipeg, Manitoba. The contract, estimated at more than \$900,000, is expected to generate \$95,000 in annual savings and reduce GHG emissions by 157 tonnes per year. The energy efficiency measures will include comprehensive upgrades to lighting systems, mechanical systems and the building envelope.

The \$3-million energy management project at the Lester B. Pearson complex in Ottawa, Ontario, aims to reduce energy and maintenance costs by implementing a number of energy efficiency measures, including improved controls, water conservation, lighting upgrades and more efficient cooling and ventilation systems. Annual savings of \$375,000 are expected.

- Parks Canada Agency awarded its first Federal Buildings Initiative energy management service contract at Banff National Park, Alberta. Annual savings of \$53,000 and GHG reductions of 157 tonnes per year are expected. The project will provide the following energy efficiency measures: more efficient, higher-quality lighting; new, high-efficiency appliances; building envelope improvements; and HVAC controls upgrades. Parks Canada Agency and the energy management firm will increase visitors' awareness of the importance of energy and water conservation with informative displays mounted at major centres in the park as part of the first Federal Buildings Initiative project to be implemented in a national park in Canada.
- The energy management industry has retrofitted more than 1.2 million m<sup>2</sup> of federal space managed by PWGSC. This department has signed 32 energy management service contracts that represent more than \$41 million in private sector investments in energy efficiency improvements. These projects are expected to generate \$6.3 million in annual energy savings.
- Since its first Federal Buildings Initiative project in 1989, the National Research Council Canada (NRC) has continued to upgrade and retrofit its facilities throughout Canada. To date, NRC is expecting to save more than \$2.5 million a year in energy bills.

Upgrades to lighting in Buildings M-24 and M-12 and the installation of a cogeneration chiller have been completed at NRC's Montreal Road campus. Total estimated project costs are \$605,000, and annual savings are \$103,500. In addition, a new project that involves the installation of a high-efficiency boiler at Building M-6 is underway. Incremental costs for this project are estimated at \$50,000, and energy savings of \$25,000 per year are expected.

NRC has awarded a \$750,000 Federal Buildings Initiative energy management contract for its facility in Boucherville, Quebec. Annual energy savings are expected to reach \$161,000. Located on the south shore of Montréal, this facility houses the Industrial Materials Institute. Its mission is to promote innovation and economic growth in Canadian industry by developing and researching new technologies for material processing.

### ■ 6.1.2 Federal Industrial Boiler Program

Fossil fuel combustion in industrial-sized boilers is a major source of GHGs, including NO<sub>x</sub>, a principal ingredient of smog and acid rain. The Government of Canada operates more than 270 boilers located in 52 heating plants. The Federal Industrial Boiler Program (FIBP) was established in 1991 to ensure that departments and agencies consider environmentally responsible, energy-efficient technologies when they replace or modify their heating plants. Under the FIBP, GHG emissions are reduced by an average of 4.7 kt per year. Examples of initiatives under the FIBP include the following:

- Natural Resources Canada's Bells Corners complex near Ottawa, Ontario, home of the FIBP, converted the entire heating system from hot water to thermal fluid using low-NO<sub>x</sub> burners.
- The FIBP has been working with the Department of National Defence at CFB Bagotville to upgrade the central heating plant's heating equipment. This \$1.5-million project involves installing energy-efficient boilers with low-NO<sub>x</sub> burners and upgrading or replacing controls and ancillary equipment.
- The FIBP studied cogeneration at Dorchester Penitentiary in New Brunswick for Correctional Service Canada. It evaluated a heating plant upgrade for the penitentiary and recommended converting from No. 6 fuel oil to No. 2 oil to significantly reduce NO<sub>x</sub> and sulphur dioxide emissions.
- The FIBP is participating in Correctional Service Canada's sustainable development strategy. It does this by inspecting heating systems in federal penitentiaries across the country to identify problems and recommend options for improving energy efficiency and reducing operating costs and GHG emissions. The central heating plant at the Leclerc Institution in Laval, Quebec, which has been identified as one of the largest contributors to GHG emissions within Correctional Service Canada's facilities, will undergo a complete \$3.8-million refurbishment. This will include the installation of four new boilers, which offer an 8 percent reduction in natural gas consumption and CO<sub>2</sub> emissions, and new low-NO<sub>x</sub> burners to reduce NO<sub>x</sub> emissions.

- The FIBP prepared drawings and specifications for a new replacement boiler, complete with low-NO<sub>x</sub> burners, at the NRC in Ottawa.

### ■ 6.1.3 Emerging Renewable Electricity

In 1997, Natural Resources Canada and Environment Canada made a commitment to purchase 15 to 20 percent of their electrical energy in the form of "green" power by the year 2010. In a pilot project, ENMAX Energy Corporation, an Alberta electric utility company, is providing Natural Resources Canada with 10 000 megawatt hours and Environment Canada with 2200 megawatt hours of electricity every year for 10 years to operate their facilities in Alberta. During 1998 and 1999, ENMAX Energy reported reductions of 10.4 kt of GHG emissions in 1998 and 2000 as a result of the actual displacement of electricity generated by a mix of coal and natural gas.

In its 2000 budget, the Government of Canada committed \$15 million to expand its purchases of green power in Saskatchewan and Prince Edward Island. The first agreement with SaskPower, announced in October 2000, will see federal facilities receiving at least 25 gigawatt hours per year of wind energy, amounting to reductions of at least 20 kt of GHG emissions per year. In Prince Edward Island, an agreement with Maritime Electric, announced in June 2001, will result in an annual delivery of 13 gigawatt hours of wind energy and about 11 kt per year of GHG emissions reductions. Delivery of wind-generated electricity to federal facilities under the SaskPower and Maritime Electric agreements will begin at the end of 2001. Preliminary discussions have taken place with Nova Scotia Power Inc. about eventual purchases of green electricity for federal facilities in Nova Scotia.

In response to a proposal made by the Electricity Table under Canada's climate change consultations, the *Government of Canada Action Plan 2000 on Climate Change* announced that the federal government has committed to purchasing 20 percent of federal electricity requirements from emerging renewable electricity by 2010. This measure is expected to yield two main benefits. First, it will help suppliers of these emerging sources to become more experienced and cost-competitive. Second, the Government of Canada expects to prevent the production of at least 240 kt of GHG emissions by 2010.



#### ■ 6.1.4 Renewable Energy Deployment Initiative for Government of Canada Facilities

Natural Resources Canada's Renewable Energy Deployment Initiative (REDI) was a three-year, \$12-million program launched in April 1998 to encourage the use of renewable energy systems for space and water heating. In the 2000 budget, the Government of Canada announced funding that will allow the program to be extended for an additional three years.

REDI for Federal Facilities is one component of the overall program. It provides support (i.e., marketing, industry and infrastructure support and financial incentives) for four types of renewable energy projects in federal facilities: solar hot water; solar air heating; high-efficiency, low-emission biomass combustion for systems that have a capacity of 75 kilowatts or more; and earth energy systems (no financial incentive is offered for earth energy systems). Examples of initiatives under REDI include the following:

- In 1997, the first air-heating system was installed on an exterior wall of a laboratory building at Natural Resources Canada's Bells Corners CANMET complex near Ottawa, Ontario. This has resulted in a reduction of 44 tonnes of CO<sub>2</sub> per year.
- In 1998, Natural Resources Canada's CANMET Energy Technology Centre (CETC) in Varennes, Quebec, installed a 220-m<sup>2</sup> SOLARWALL<sup>®</sup> that will be capable of supplying 340 m<sup>3</sup> of warmed air per minute, or approximately 400 gigajoules of renewable energy to the building per year, resulting in a reduction of 30 tonnes of CO<sub>2</sub> per year.
- Also in 1998, the Canadian Coast Guard installed a solar air-heating system in a maintenance building in Prescott, Ontario, that has reduced GHG emissions by 11 tonnes per year.

To promote the deployment of renewable energy systems in Government of Canada facilities, REDI has finalized an agreement with the Federal Buildings Initiative and CETC – Varennes under which

- the Federal Buildings Initiative now specifies that renewable energy systems are to be evaluated by energy service companies (ESCOs) as a part of proposals for Federal Buildings Initiative projects for federal facilities; and
- CETC – Varennes is delivering a renewable energy project-assessment course across Canada and is providing post-training technical support for ESCOs, employees and contractors who work on projects for federal facilities.

#### ■ 6.1.5 FleetWise

The FleetWise program was developed by Natural Resources Canada to assist Government of Canada departments and agencies to increase the energy efficiency of their motor vehicle fleets and to promote the *Alternative Fuels Act* within the federal fleet. FleetWise's goal is to reduce the amount of GHG emissions from on-road vehicle fleets by 25 percent from 1999 levels by 2010. This goal can be achieved by reducing the fleet's size and by creating a mix of vehicles that are more appropriate for particular tasks; for example, using a subcompact car instead of a van when only two passengers are in the vehicle. Other methods include introducing alternative fuel vehicles and advanced-technology vehicles. FleetWise initiatives are expected to reduce GHG emissions by 20 kt for 2001. The projected annual rate of reduction from 2001 to 2010 is close to 3 percent.

Table 4 shows the number of vehicles acquired for the fleet of approximately 20 000 on-road vehicles in the

**TABLE 4. Acquisition of Alternative Fuel Vehicles in the Government of Canada's On-Road Fleet**

| Fiscal Year | Total On-Road Vehicles Acquired | Total Alternative Vehicles Acquired* |
|-------------|---------------------------------|--------------------------------------|
| 1997–1998   | 2250                            | 131 (5.8 percent)                    |
| 1998–1999   | 2409                            | 161 (6.7 percent)                    |
| 1999–2000   | 2522                            | 181 (7.2 percent)                    |
| 2000–2001   | 3282                            | 226 (6.9 percent)                    |

\* Includes vehicles that regularly use E-85 fuel and gasoline-electric hybrids.



11 targeted federal departments and agencies, along with the number of alternative fuel vehicles. Approximately 3 percent of the Government of Canada's fleet comprises alternative fuel vehicles.

Examples of FleetWise's initiatives include the following:

- The Department of National Defence has developed its ON-TRACK! system to incorporate FleetWise's Q-Tool SE vehicle acquisition software. The ON-TRACK! system provides a comprehensive package of information for computer-based planning and analysis of vehicle acquisitions, fuel availability and use. Q-Tool SE software is particularly useful in addressing the acquisition of alternative fuel vehicles to meet the requirements of the *Alternative Fuels Act*. The Q-Tool SE database is the only complete Canadian source of information on alternative fuel vehicles. It provides details on the specifications and availability of alternative fuel vehicle platforms, different vehicle configurations, rebate programs and taxation issues in provinces and territories across Canada.
- There has been a significant increase in the number of vehicles that consume E-85 fuel (from 20 to 57), although the amount of E-85 used is highly variable. Use of E-85 fuel has increased by 700 percent since last year and is consumed at an average rate of 4500 litres per month at the Natural Resources Canada site. A new site in the National Capital Region has opened at Agriculture and Agri-Food Canada's Central Experimental Farm facility.
- PWGSC has increased its number of vehicles that are fuelled by compressed natural gas and used in the National Capital Region from eight to 12. It has also increased the number of fuelling devices at its facilities.
- Agriculture and Agri-Food Canada has replaced six gasoline pickup trucks with six electric off-road utility vehicles for field operations.
- The federal fleet acquired 46 Toyota Prius gasoline-electric hybrid vehicles in the last fiscal year.

#### ■ 6.1.6 Awareness, Education and Training

Several federal initiatives are aimed at increasing awareness and encouraging actions by federal employees and industry to address the issue of climate change and reduce GHG emissions. Following are examples:

- Several federal departments, including the Department of National Defence, Environment Canada, Natural Resources Canada, PWGSC and Statistics Canada, have held events that promote the benefits of energy efficiency. A number of departments have offered climate change workshops to employees in order to raise awareness of the issue and to encourage them to take action. The FHIO initiative also ran a pilot project to develop employee awareness.
- In October 2000, the Office of Energy Efficiency of Natural Resources Canada hosted Canada's Energy Efficiency Conference, Awards and Trade Show in Ottawa. This two-day event was attended by more than 500 delegates from academic, industrial, government and non-governmental organizations. It provided a forum for experts to share knowledge and inspire innovation in the field of energy efficiency as a means of helping Canada achieve its climate change goals.
- Natural Resources Canada's Office of Energy Efficiency has also delivered energy management workshops to more than 2000 industrial, institutional, commercial and governmental clients over four years to help them develop action plans to reduce energy consumption in their organizations. These workshops complement the comprehensive energy management training that facility managers and operators undergo as part of energy efficiency retrofit projects.
- The Government of Canada has established a climate change Web site (<http://www.climatechange.gc.ca>). It has links to other key government and non-governmental sites that provide information on policy and scientific, technical and program resources related to climate change.

## 6.2 The Leadership Challenge

The Leadership Challenge, led by Environment Canada, is a component of the FHIO initiative. It is designed to demonstrate leadership by issuing a challenge to all Government of Canada departments, agencies and Crown corporations to design and implement their own GHG emissions-reduction programs and to report on their progress annually. The Leadership Challenge will assist federal entities to develop GHG emissions-reduction programs, develop and promote GHG-reduction best practices, coordinate internal communications, promote training and awareness and deliver an annual awards and recognition program. As part of the Government of Canada's broader commitment to sustainable development and to "greening" government operations, the Leadership Challenge will also promote and support continuous improvement over the FHIO initiative's 10-year commitment period. Moreover, it will ensure that GHG emissions reduction is integrated into the environmental management systems of Government of Canada entities.

The best-practices element of the Leadership Challenge invites all departments, agencies and Crown corporations to undertake specific actions based on a code of best practices that will be developed by Natural Resources Canada and Environment Canada. The code will provide general principles and guidelines in such areas as the design of new buildings, building retrofits and operations, fleet selection and management, green procurement, waste management, renewable energy, staff training and employee awareness. The Leadership Challenge will also work with Transport Canada to promote best practices for reducing GHG emissions that result from employee commuting and business travel.

# Conclusion

The Government of Canada is committed to reducing GHG emissions from its operations and to reaching the federal GHG emissions-reduction target in 2010. Future FHIO reports will continue to monitor and report progress toward reaching the target, will continue to improve the scope of emissions included in the report and will improve the quality of information it presents. This report and related information can be found on the FHIO initiative's Web site at [www.fhio.gc.ca](http://www.fhio.gc.ca).

The following forms illustrate the kind of data that is collected from each of the 11 Government of Canada departments and agencies that report their emissions under the FHIO initiative.

## Data Collection Form for Buildings

Buildings
Version 6

### Federal House in Order Data Report Form - Buildings

---

**Fiscal Year:** \_\_\_\_\_ please enter the appropriate fiscal year

**Department:** \_\_\_\_\_ please select your department from the list

**Contact's Information**

**Name:** \_\_\_\_\_ your name

**Address:** \_\_\_\_\_ your address

**City:** \_\_\_\_\_ your city

**Province / Territory:** \_\_\_\_\_ select your province from the list

**Postal Code:** \_\_\_\_\_ your postal code

**Phone Number:** \_\_\_\_\_ your phone number

**Email Address:** \_\_\_\_\_ your email address

**General Building Information**

*Please enter the total number of buildings in your department, and the estimated floor space.*

Total Number of Buildings \_\_\_\_\_

Total Floor Space (m<sup>2</sup>) \_\_\_\_\_

**Electricity Consumption**

*In kilowatt-hours, please enter your total electricity usage over the fiscal year.*

Amount Used in Natural Units (kWh) \_\_\_\_\_

Amount Used in Energy Units (MJ) \_\_\_\_\_ 0.0

GHG emissions (CO<sub>2</sub> equivalent in tonnes) \_\_\_\_\_ 0.0

**Facility Fuel Consumption**

*For the following table, please enter your department's facility fuel consumption over the fiscal year. Be sure to enter the amount of fuel consumed in the units specified for each particular fuel type.*

|             | Commercial Units | Energy Units (MJ) | GHG (tonnes)    |                 |                  |                        |
|-------------|------------------|-------------------|-----------------|-----------------|------------------|------------------------|
|             |                  |                   | CO <sub>2</sub> | CH <sub>4</sub> | N <sub>2</sub> O | CO <sub>2</sub> equiv. |
| Natural Gas | m <sup>3</sup>   | 0.0               | 0.0             | 0.0             | 0.0              | 0.0                    |
| Light Oil   | L                | 0.0               | 0.0             | 0.0             | 0.0              | 0.0                    |
| Heavy Oil   | L                | 0.0               | 0.0             | 0.0             | 0.0              | 0.0                    |
| Diesel      | L                | 0.0               | 0.0             | 0.0             | 0.0              | 0.0                    |
| Propane     | L                | 0.0               | 0.0             | 0.0             | 0.0              | 0.0                    |
| Steam*      | lbs              | 0.0               |                 |                 |                  | 0.0                    |
| Subtotal    |                  | 0.0               | 0.0             | 0.0             | 0.0              | 0.0                    |

\*Please, only record information for steam that was purchased

**Summary Information**

|  |     |
|--|-----|
| Total Energy (GJ)  | 0.0 |
| Total GHG Emissions (kilotonnes of CO <sub>2</sub> equiv.) | 0.0 |

**Comments and Suggestions**

please type any comments or suggestions here

\_\_\_\_\_

\_\_\_\_\_

## Data Collection Form for Transportation

Vehicles

Version 6

### Federal House in Order Data Report Form - *Transportation*

|                              |       |   |
|------------------------------|-------|---|
| <b>Fiscal Year:</b>          | _____ | please select the appropriate fiscal year   |
| <b>Department:</b>           | _____ | please select your department from the list |
| <b>Contact's Information</b> |       |   |
| Name:                        | _____ | your name                                   |
| Address:                     | _____ | your address                                |
| City:                        | _____ | your city                                   |
| Province / Territory:        | _____ | please select your province                 |
| Postal Code:                 | _____ | your postal code                            |
| Phone Number:                | _____ | your phone number                           |
| Email Address:               | _____ | your email address                          |

#### General Fleet Information

Please enter the number of vehicles in your fleet for each of the following vehicle types. If you do not know the number, or a particular vehicle type is not applicable, then enter 0 (zero) in the corresponding field.

| Number of Vehicles  |         | If you are unable to provide a detailed account of vehicles for marine, air and field, please enter manually, a total for each category in the following fields. |
|---|---------|--|
| <b>On Road:</b>   | _____   |  |
| <b>Marine:</b>  | _____   | Marine total:  |
| Under 10m   | _____   |  |
| 10m to 30m  | _____   |  |
| Over 30m  | _____   |  |
| Total   | _____ 0 |  |
| <b>Air:</b>   | _____   | Air total:   |
| Planes  | _____   |  |
| Helicopters   | _____   |  |
| Total   | _____ 0 |  |
| <b>Field:</b>   | _____   | Field total:   |
| ATV's   | _____   |  |
| Snowmobiles   | _____   |  |
| Other All-terrain Veh.                                      | _____   |  |
| Agricultural Tractors                                       | _____   |  |
| Other Agricultural Equip.                                   | _____   |  |
| Small Equipment<br><small>(e.g. ride-on lawn mower)</small> | _____   |  |
| Generators  | _____   |  |
| Forklift  | _____   |  |
| Backhoe/Loader  | _____   |  |
| Grader  | _____   |  |
| Other Construction Equip.                                   | _____   |  |
| Total   | _____ 0 |  |
| <b>Total:</b>   | _____ 0 |  |

## Data Collection Form for Transportation (continued)

Vehicles

Version 6

### Fuel Consumption

For each of the following fleet categories, please enter the amount of fuel consumed. Be sure to enter the amount of fuel consumed in the units specified for each particular fuel type.

#### On Road Fuel Consumption

|            | Commercial Units | Energy Units (MJ) | GHG (tonnes)    |                 |                  |                        |
|------------|------------------|-------------------|-----------------|-----------------|------------------|------------------------|
|            |                  |                   | CO <sub>2</sub> | CH <sub>4</sub> | N <sub>2</sub> O | CO <sub>2</sub> equiv. |
| Gasoline   | L                | 0.0               | 0.0             | 0.0             | 0.0              | 0.0                    |
| Diesel     | L                | 0.0               | 0.0             | 0.0             | 0.0              | 0.0                    |
| CNG*       | L                | 0.0               | 0.0             | 0.0             | 0.0              | 0.0                    |
| Propane    | L                | 0.0               | 0.0             | 0.0             | 0.0              | 0.0                    |
| Ethanol 10 | L                | 0.0               | 0.0             | 0.0             | 0.0              | 0.0                    |
| Ethanol 85 | L                | 0.0               | 0.0             | 0.0             | 0.0              | 0.0                    |
| Subtotal   |                  | 0.0               | 0.0             | 0.0             | 0.0              | 0.0                    |

\* Compressed Natural Gas

#### Marine Fuel Consumption

|                | Commercial Units | Energy Units (MJ) | GHG (tonnes)    |                 |                  |                        |
|----------------|------------------|-------------------|-----------------|-----------------|------------------|------------------------|
|                |                  |                   | CO <sub>2</sub> | CH <sub>4</sub> | N <sub>2</sub> O | CO <sub>2</sub> equiv. |
| Gasoline       | L                | 0.0               | 0.0             | 0.0             | 0.0              | 0.0                    |
| Diesel         | L                | 0.0               | 0.0             | 0.0             | 0.0              | 0.0                    |
| Light Fuel Oil | L                | 0.0               | 0.0             | 0.0             | 0.0              | 0.0                    |
| Subtotal       |                  | 0.0               | 0.0             | 0.0             | 0.0              | 0.0                    |

#### Aircraft Fuel Consumption

|                     | Commercial Units | Energy Units (MJ) | GHG (tonnes)    |                 |                  |                        |
|---------------------|------------------|-------------------|-----------------|-----------------|------------------|------------------------|
|                     |                  |                   | CO <sub>2</sub> | CH <sub>4</sub> | N <sub>2</sub> O | CO <sub>2</sub> equiv. |
| Aviation Turbo Fuel | L                | 0.0               | 0.0             | 0.0             | 0.0              | 0.0                    |
| Aviation Gasoline   | L                | 0.0               | 0.0             | 0.0             | 0.0              | 0.0                    |
| Subtotal            |                  | 0.0               | 0.0             | 0.0             | 0.0              | 0.0                    |

#### Field Vehicle and Equipment Fuel Consumption

|          | Commercial Units | Energy Units (MJ) | GHG (tonnes)    |                 |                  |                        |
|----------|------------------|-------------------|-----------------|-----------------|------------------|------------------------|
|          |                  |                   | CO <sub>2</sub> | CH <sub>4</sub> | N <sub>2</sub> O | CO <sub>2</sub> equiv. |
| Gasoline | L                | 0.0               | 0.0             | 0.0             | 0.0              | 0.0                    |
| Diesel   | L                | 0.0               | 0.0             | 0.0             | 0.0              | 0.0                    |
| Propane  | L                | 0.0               | 0.0             | 0.0             | 0.0              | 0.0                    |
| Subtotal |                  | 0.0               | 0.0             | 0.0             | 0.0              | 0.0                    |

### Summary Information

Total Energy (GJ)   
 Total GHG Emissions (kilotonnes of CO<sub>2</sub> equiv.)

### Comments and Suggestions



# GHG Conversion Factors

## Appendix 2

### Converting From Natural Units to Energy Units (MJ)

| Fuel                          | Conversion Factor |
|-------------------------------|-------------------|
| Aviation gasoline (L)         | 33.62             |
| Aviation turbo fuel (L)       | 35.93             |
| Diesel (L)                    | 38.68             |
| Electricity (kWh)             | 3.6               |
| Ethanol 10 (L)                | 34.66             |
| Ethanol 85 (L)                | 41.72             |
| Heavy oil – No. 6 (L)         | 41.73             |
| Light oil – No. 2 (L)         | 38.68             |
| Motor gasoline (L)            | 34.66             |
| Natural gas (m <sup>3</sup> ) | 37.23             |
| Natural gas (L)               | 0.03723           |
| Propane (L)                   | 25.53             |
| Steam (lb.)                   | 1.266             |

### Converting From Energy Units into CO<sub>2</sub> Equivalent

| Fuel        | CO <sub>2</sub> Equivalent (t/TJ) |
|-------------|-----------------------------------|
| Electricity | 150.5                             |
| Steam       | 64.23                             |

### Converting from Natural Units into Component Greenhouse Gases

| Fuel                              | GHG (kg/L or m <sup>3</sup> ) |                 |                  |
|-----------------------------------|-------------------------------|-----------------|------------------|
|                                   | CO <sub>2</sub>               | CH <sub>4</sub> | N <sub>2</sub> O |
| <b>Global Warming Potential</b>   | <b>1</b>                      | <b>21</b>       | <b>310</b>       |
| Aviation gasoline                 |                               |                 |                  |
| <i>Air</i>                        | 2.33                          | 0.00219         | 0.00023          |
| Aviation turbo fuel               |                               |                 |                  |
| <i>Air</i>                        | 2.55                          | 0.00008         | 0.00025          |
| Diesel                            |                               |                 |                  |
| <i>Stationary</i>                 | 2.73                          | 0.00026         | 0.0004           |
| <i>On-road</i>                    | 2.73                          | 0.000072        | 0.0001           |
| <i>Marine</i>                     | 2.73                          | 0.00015         | 0.001            |
| <i>Field</i>                      | 2.73                          | 0.00013         | 0.0001           |
| Ethanol 10                        |                               |                 |                  |
| <i>On-road</i>                    | 2.353                         | 0.000333        | 0.000387         |
| Ethanol 85                        |                               |                 |                  |
| <i>On-road</i>                    | 1.655                         | 0.000056        | 0.000065         |
| Natural gas                       |                               |                 |                  |
| <i>Stationary (m<sup>3</sup>)</i> | 1.88                          | 0.000048        | 0.00002          |
| <i>On-road (L)</i>                | 0.0019                        | 0.000022        | 0.00000006       |
| Motor gasoline                    |                               |                 |                  |
| <i>On-road</i>                    | 2.36                          | 0.00038         | 0.00034          |
| <i>Marine</i>                     | 2.36                          | 0.0013          | 0.00006          |
| <i>Field</i>                      | 2.36                          | 0.00032         | 0.00036          |
| Light oil – No. 2                 |                               |                 |                  |
| <i>Stationary</i>                 | 2.83                          | 0.000006        | 0.000013         |
| <i>Marine</i>                     | 2.83                          | 0.0003          | 0.00007          |
| Heavy oil – No. 6                 |                               |                 |                  |
| <i>Stationary</i>                 | 3.09                          | 0.00012         | 0.000013         |
| Propane                           |                               |                 |                  |
| <i>Stationary</i>                 | 1.53                          | 0.00003         | 0.0              |
| <i>On-road and field</i>          | 1.53                          | 0.0007          | 0.00009          |