Residential, Commercial & Institutional Sectors: 1990 - 2000

The Residential, Commercial & Institutional (RCI) sector of the Canadian Greenhouse Gas Inventory includes emissions from fuel combustion in buildings for space heating and cooling* (excluding electricity use) and water heating.

- *In 2000*, this sector contributed about 11% of Canada's 726 megatonnes of carbon dioxide equivalent** (Mt CO_2 eq) greenhouse gas emissions. Total emissions in 2000 from this sector were 76.9 Mt - 45 Mt from the Residential sub-sector and 31.9 Mt from the Commercial & Institutional sub-sector.

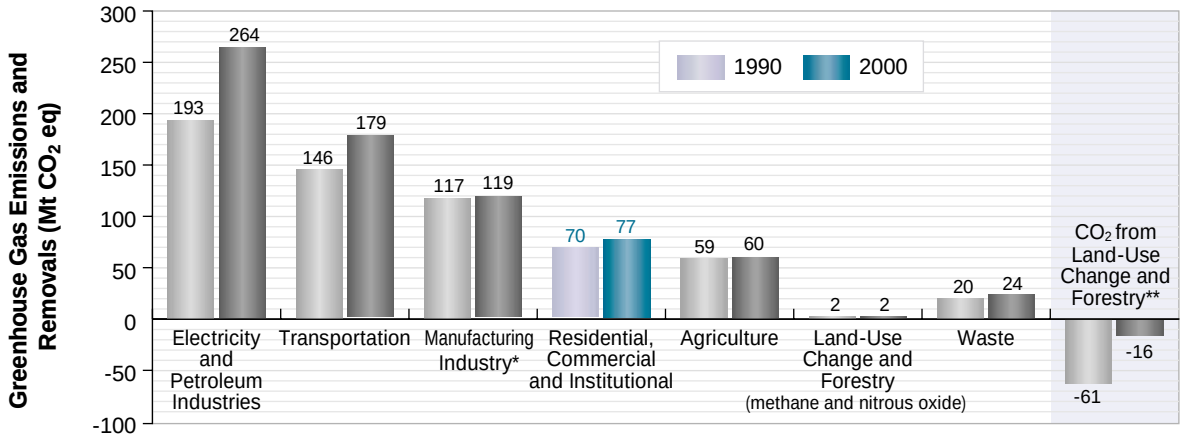
Between 1990 and 2000, overall greenhouse gas emissions grew 10% from a base of 69.8 Mt. Residential sub-sector emissions increased 2.3% while Commercial & Institutional sub-sector emissions grew 23%. Greenhouse gas emission and fuel consumption associated with space conditioning within the RCI sector is greatly influenced by year to year temperature fluctuations. Overall changes in emissions can be attributed to:

- *use of energy.* There has been an increase in energy use because of growth in both sub-sectors. Increased energy use, however, has been offset by mitigating factors that include energy efficiency improvements in building stock and warmer weather; and
- *substitution of fuel oil by natural gas*, a less carbon intensive fuel.

*Gas fired space cooling is a potential small source of greenhouse gas emissions.

**Unless otherwise indicated, all emissions are reported in Mt CO_2 eq. For brevity, this have been shortened to Mt. This concept provides a relative measure of the impacts of different greenhouse gases on global warming, with the effect of carbon dioxide being equal to one.

Figure 1 Canadian Greenhouse Gas Emissions and Removals, 1990 and 2000



*Value illustrated includes emissions due to Solvent and Other Product Use

**Carbon dioxide emissions from the Land-Use Change and Forestry sector are not included in the national inventory totals.

Canada's RCI Sector

The RCI sector accounts for greenhouse gas emissions from all fossil fuel combustion in buildings. Overall the RCI sector is not a major contributor to national emissions: in 2000 its contribution was about 11% of the national total. The Residential sector contributed 6.2% , while the Commercial & Institutional sector contributed 4.4%.

Buildings in this sector encompass a range of uses - from detached single family dwellings and apartment buildings, to retail, office and institutional buildings serving business, industry, government, finance, education, health, warehouse, recreation and social service purposes. Omitted from this sector are buildings used in manufacturing, mining and construction (these are included in Fact Sheet #4 - Manufacturing Industry: 1990-2000).

The heating or cooling of building interiors, known as space conditioning, and water heating are the sources of this sector's emissions. In addition, they are important energy consuming activities in the operation of buildings. In 2000, about 82% and 66% of total energy demand in the residential and commercial sub-sectors, respectively, was for space conditioning and water heating (Natural Resources Canada, 2002).

The Canadian Greenhouse Gas Inventory (CGHGI)

The Canadian Greenhouse Gas Inventory is developed, compiled, and reported annually by the Greenhouse Gas Division of Environment Canada, and utilizes methods and models developed in-house by engineering and scientific staff, as well as published data, data developed by industry, or methods developed by the Intergovernmental Panel on Climate Change (IPCC, 1997).

The greenhouse gases that have been estimated in the national inventory are carbon dioxide (CO_2), methane (CH_4), nitrous oxide (N_2O), sulphur hexafluoride (SF_6), perfluorocarbons (PFCs), and hydrofluorocarbons (HFCs).

The inventory uses an internationally agreed to reporting format that groups emissions and removals into the following six sectors: Energy, Industrial Processes, Solvent and Other Product Use, Agriculture, Land-Use Change and Forestry, and Waste. The 2000 Trends Fact Sheet Series, while presenting the latest information on Canadian greenhouse gas emissions and removals derived from the latest national inventory, uses a modified sector approach to facilitate the use of information by the public.

RCI Emission Trends

Over the 1990 to 2000 period, overall greenhouse gas emission growth in this sector was relatively flat. Emissions from the Residential sub-sector grew by 2.3% while Commercial & Institutional emissions increased by 23%. Figure 2 illustrates the trend in emissions for both the Residential and Commercial & Institutional sub-sectors for the period 1980 to 2000.

In order to understand RCI trends, it is important to examine influencing factors, and hence, emissions. Trends in emissions can be influenced by four important factors:

1. real estate activity within the sector (the growth or decline of heated/cooled building space);
2. changes in efficiency of energy use;
3. changes in weather (which would require more or less fuel for heating or cooling); and
4. substitution of fuels with differing carbon intensities.

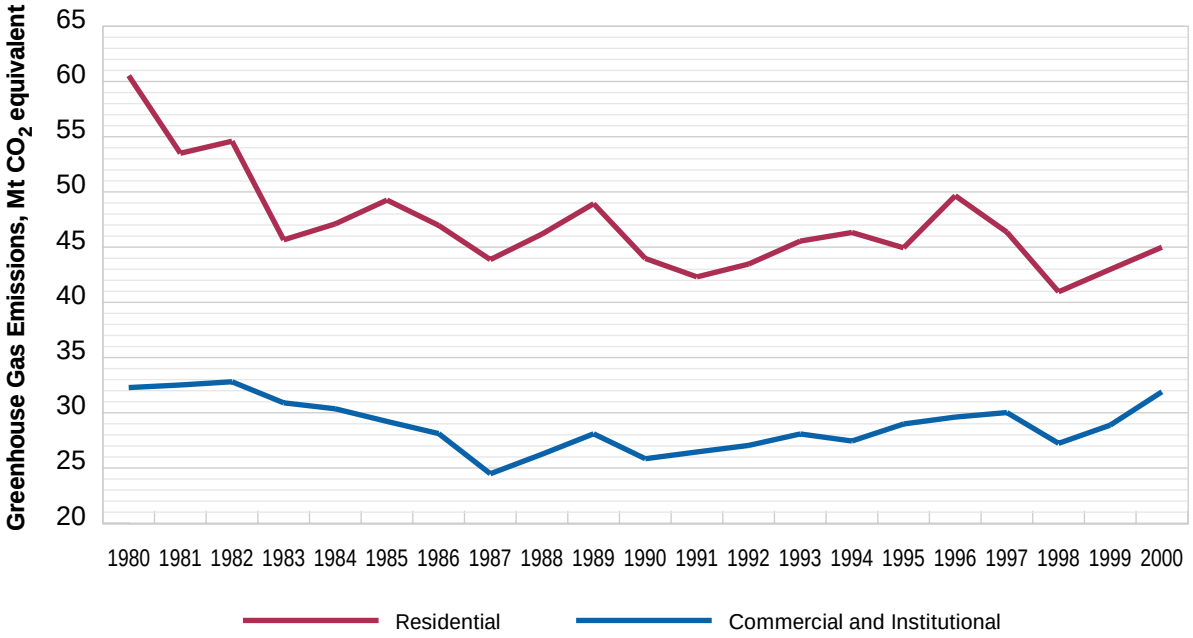
Growth in Residential and Commercial Activity

The Residential, Commercial and Institutional sub-sectors all experienced significant growth in activity between 1990 and 2000. An 18 % growth in residential floor space and a 24% growth in commercial floor space were estimated for 2000 (Natural Resources Canada, 2002). Without other influences, growth in sector activity may have had the greatest impact on energy use, giving rise to a potential increased energy demand of 500 PJ, or 23% over 1990. The impact on greenhouse gas emissions by this potential increase in energy use, however, was ameliorated by other factors described below.

Electricity Emissions

For accounting purposes, Canada's Greenhouse Gas Inventory attributes emissions from electricity only to production at the generation source. Demand for electricity in the RCI sector, whether for space heating, cooling, or other purposes, is included in Fact Sheet #2 - Electricity and Petroleum Industries: 1990-2000.

Figure 2 RCI Sector's Greenhouse Gas Emission Trends, 1980 to 2000



Increases in Energy Efficiency

Energy efficiency increases within buildings (for example, increased insulation and high efficiency furnaces) was the major contributor to dampening overall energy demand over the period. In the Residential sub-sector, increases in efficiency decreased potential growth in space heating energy use by 196.6 PJ (Natural Resources Canada, 2002). In the Commercial & Institutional sub-sector, potential growth in all energy use decreased by 23.2 PJ. Energy efficiency improvements, therefore, are significant contributors to reducing the growth of greenhouse gas emissions.

Changes in Weather

The other factor influencing energy use, and hence emission trends, is weather. Figure 3 tracks greenhouse gas emission trends in the RCI sector against heating degree days (HDD). From the figure, it is evident that there is a general coincidence in the trends. The Commercial & Institutional sub-sector is less likely to show the influence of heating degree days because of its widespread use of gas-fired absorption air conditioning.

In 2000, heating degree days were 1.6% lower than in 1990 (Statistics Canada, #57-003). In warmer years with lower heating degree days, decreased energy use for heating is offset because the requirement for air conditioning likely increases with more cooling degree days (CDD).

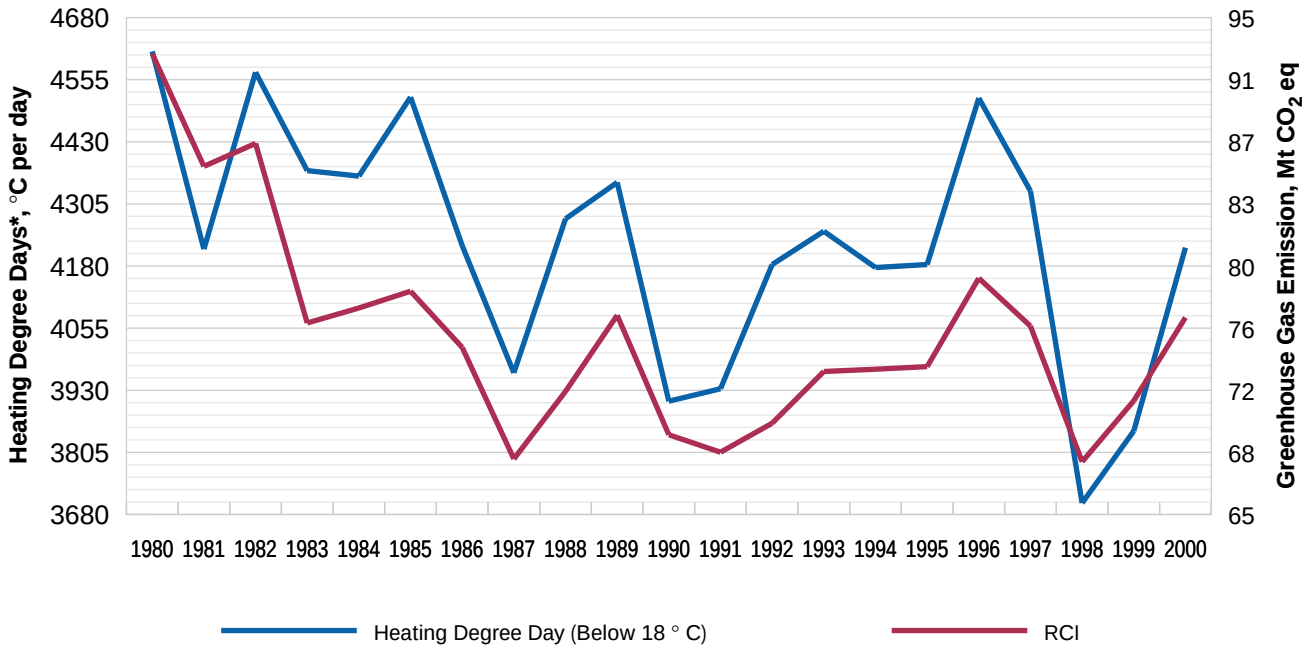
Fuel Substitution

Fuel substitution away from carbon intensive fuels can ameliorate greenhouse gas emissions. This has been the trend in the RCI sector. Table 1 compares the trends in all fuel use for the RCI sector for the years 1990 to 2000.

There has been a clear trend over the last 11 years for the substitution of fuel oil by natural gas in the RCI sector. While electricity, coal and propane have maintained their contributions to energy used, the natural gas contribution has increased 3% and fuel oil has decreased by the same proportion. The carbon intensity of natural gas is 25% less than that of fuel oil, leading to emission reduction trends.

By examining climatic and population influences, as illustrated in Figure 4, the decline in RCI emission intensity demonstrates the effect of fuel switching and energy efficiency improvement.

Figure 3 RCI sector Trends Related to Heating Degree Days (HDD), 1980 to 2000



* Statistics Canada, Quarterly Report on Energy Supply-Demand in Canada, Catalogue 57-003-XPB

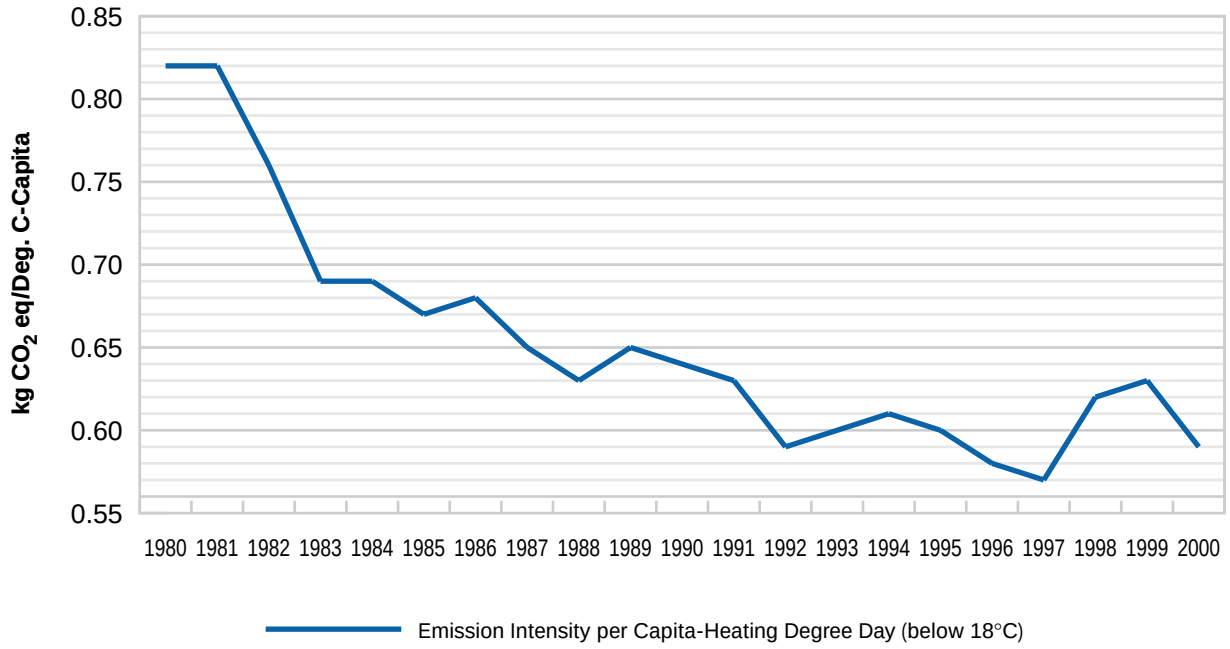
Table 1 RCI Greenhouse Gas Emissions and Energy Consumption: 1990 to 2000

	Greenhouse Gas Emissions	Energy Consumption[1]					
		Energy Total	Primary Electricity*	Coal	Natural Gas	Natural Gas Liquids	Fuel Oil
	Mt CO_2 equivalent	PJ	Percent Contribution (%)				
1990	69.8	2258	38	0.1	41	1.6	20
1991	68.8	2241	39	0.1	42	1.8	18
1992	70.5	2283	38	0.1	42	1.6	18
1993	73.6	2357	38	0.1	44	1.5	17
1994	73.8	2384	37	0.1	44	1.9	17
1995	73.9	2405	37	0.1	44	2.3	16
1996	79.3	2512	36	0.1	46	1.9	16
1997	76.4	2485	37	0.1	44	2.1	16
1998	68.2	2326	39	0.1	43	1.8	17
1999	71.9	2418	38	0.1	44	1.9	17
2000	76.9	2565	37	0.1	44	1.8	17

*For accounting purposes, GHG emissions attributed to RCI electricity consumption are included in Fact Sheet #2, Electricity and Petroleum Industries.

[1]Statistics Canada, Quarterly Report on Energy Supply-Demand in Canada, Catalogue 57-003-XPB

Figure 4 RCI Emission Intensities, 1980 to 2000



References

Environment Canada, *Canada's Greenhouse Gas Inventory 1990 - 2000*, June 2002

Intergovernmental Panel on Climate Change (IPCC), *Greenhouse Gas Inventory Reporting Instructions,* Vol. 1; and *Greenhouse Gas Inventory Manual,* Vol. 3, Revised 1996 IPCC Guidelines for National Greenhouse Gas Inventories, 1997

Natural Resources Canada, *Office of Energy Efficiency Trends in Canada 1990 to 2000 Trends 1990-2000,* June 2002.

Statistics Canada, *Quarterly Report on Energy-Supply Demand in Canada* (QRESD), Catalogue #57-003.

Glossary

Heating Degree Day (HDD): An indicator of winter heating loads. The annual sum of the degrees of average daily temperatures for all days below 18°C.

Cooling Degree Day (CDD): An indicator of summer cooling loads. The annual sum of the degrees of average daily temperatures for all days above 18°C.

Carbon intensity: The proportion of molecular carbon to the energy content of a fuel. Since nearly all carbon is released as a gas on combustion of fuels, high carbon intensity fuels produce more CO_2 per unit of heating than low intensity fuels.

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