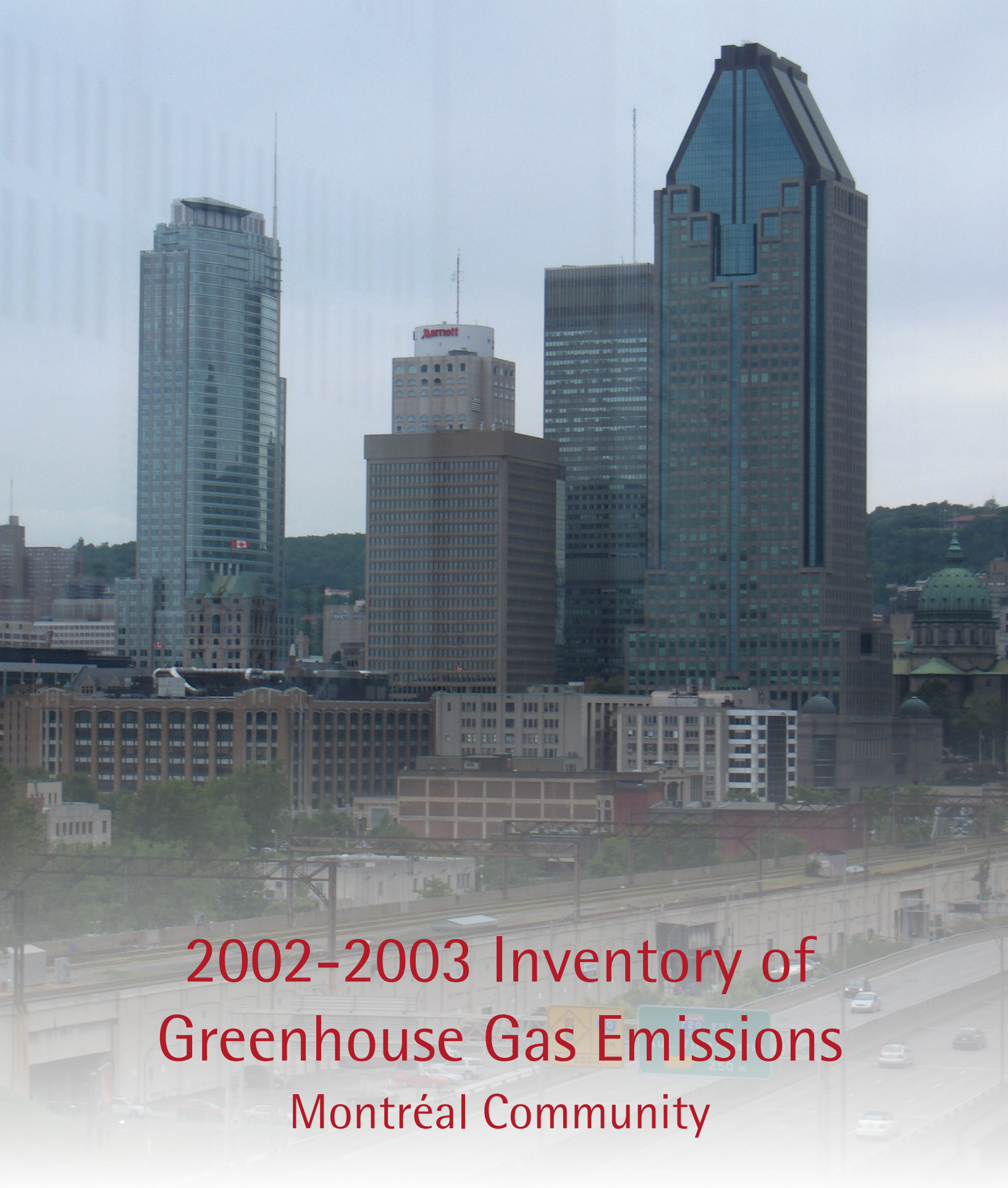

2002-2003 Inventory of Greenhouse Gas Emissions

Montréal Community

Montréal

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Foreword

Emissions of greenhouse gases (GHG) are synonymous with energy consumption, the driving force of development throughout human history. This underscores the challenge of sustainable development, which seeks to use renewable energies so as to leave future generations a world in which they too can develop.

Humanity is currently producing twice as many GHGs as the Earth is able to absorb. In an equitable world, where each individual would have access to the same standard of living, the viable amount of emissions today would be about a half-tonne of carbon dioxide (CO_2) per person.

Summary

The primary source of greenhouse gas (GHG) emissions on the island of Montréal is transportation (50%), followed by industry (28%) and buildings (20%).

Emissions from the transportation sector come primarily from cars (nearly 25% of the island's emissions). However, heavy-duty trucks and light-duty trucks such as sport utility vehicles (SUVs), both heavy energy consumers, were the main sources of the increase in GHGs in this sector over the last few years. Industrial emissions come mostly from the island's two oil refineries, and emit close to 20% of the Montréal agglomeration's emissions. In the buildings category, homes and commercial and institutional buildings share GHG emissions about equally.

With an average of 7.2 tCO_2e/person, the agglomeration ranks among the top cities in North America in terms of climate protection. This positive result is primarily due to its use of hydro-electricity, which is low in GHGs. For every $1,000 of products on the island (GDP), 0.16 tCO_2e are emitted. That's four times better than the Canadian average (although this average is one of the highest in the world). Nonetheless, in relation to other Canadian cities, the Montréal community can still improve the environemental efficiency of its economy.

The island of Montréal has chosen sustainable development. The ultimate objective of a viable community, with respect to GHGs, is to aim below a half-tonne of CO_2e/year per citizen, as this is what the Earth is able to absorb. GHG emissions are almost always generated by combustion; they are therefore closely linked to the emission of classic pollutants that can affect citizens' health (CO, NO_x, SO_x, particulate matter, etc.). Reducing GHGs is therefore also a way for the island's cities to improve air quality and the quality of life of their citizens.

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Chapter 1

Context and key issues

1.1 Greenhouse gases, air quality and health

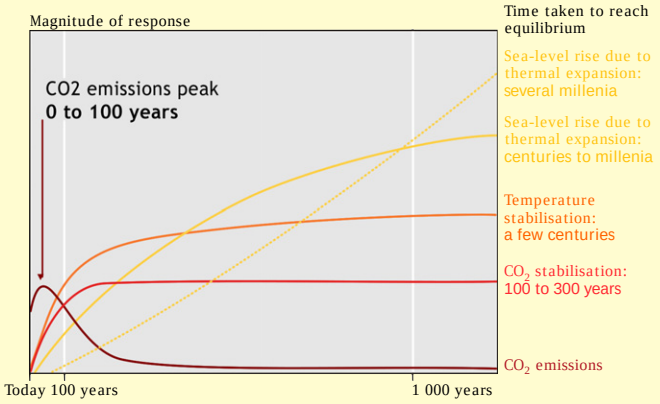
In Montréal, greenhouse gases are emitted primarily through the consumption of fossil fuels. In addition, it is estimated that, in the agglomeration, more than 80% of carbon monoxide (CO) emissions, nearly 60% of sulphur oxide (SO_x) emissions, 90% of nitrogen oxide (NO_x) emissions and more than 60% of volatile organic compound (VOC) emissions come from combustion sources.

Combustion pollutants have significant health impacts, in particular on children and people with sensitive conditions: reduced pulmonary capacity in children, asthma, increased risk of heart attacks, cerebrovascular accidents and cancer, immune deficiency and low birth weights are just some of the potential effects of atmospheric pollution. In a press release dated May 23, 2005, the Direction de la santé publique de Montréal stated that, “pollution from fossil fuel-burning vehicles is linked to serious heart and respiratory illnesses, contributing to more than 1,500 premature deaths in the region each year. Moreover, greenhouse gases are causing climate changes that are leading to heat waves and amplifying air pollution, with significant consequences for major cities.”

Photo: Car-free Day

1.2 Protecting our climate: reducing climate risks

Figure 1
Effects of CO_2 concentrations after reduction of GHG emissions



Source: UNFCCC, 2005

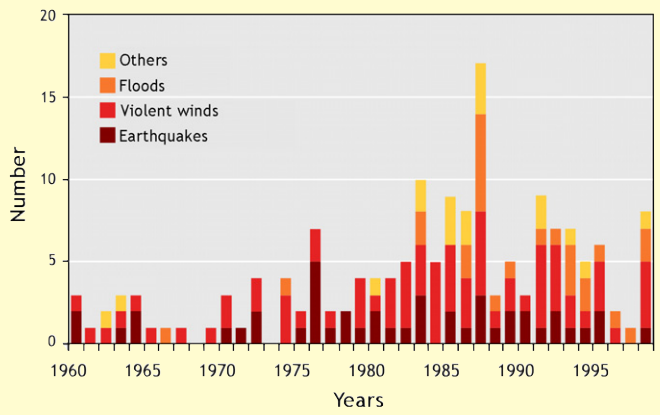
The graph opposite comes from the Intergovernmental Panel on Climate Change (IPCC), a United Nations scientific body that focuses on climate change. Work carried out by some of the world's leading scientists shows that even if CO_2 emissions are dramatically reduced in the coming century, following an emissions peak, climate change is inevitable, with major consequences for human societies. The goal is therefore to lessen this peak and limit climate damage. The costs of adapting to a new climatic environment will be much greater than the costs of initiatives that seek to reduce emissions.

1.3 Sharing access to development

Montréal has demonstrated its commitment to the UN Millennium Development Goals on several occasions. In particular, Goal 7 of this program is to "Ensure Environmental Sustainability," which takes shape through Target 9: "Integrate the principles of sustainable development into country policies and programs and reverse the loss of environmental resources." To reach this target, the UN has defined a number of indicators, including:

- Energy use (kg oil equivalent) per $1,000 gross domestic product
- Carbon dioxide emissions per capita

Figure 2
Losses due to natural catastrophes (insured property)



Source : MunichRe, 1999

Thanks to its clean electricity, the Montréal community is among the good students of the industrialized world in terms of carbon emission per capita, with roughly 7 $tCO_2e/(yr/pers.)$, an emission level comparable to that of countries such as Sweden, Switzerland or Austria. However, this rate is still higher than what a viable community should be emitting in order for all human beings on the planet to be able to develop equally. The Earth's capacity to absorb the atmosphere's carbon, for 6 billion inhabitants, is about a half-tonne of carbon (CO_2e) per person per year. Insofar as carbon emissions are equivalent to energy consumption, this means that we are signing away the share that other communities, current or future, would need to consume energy and develop.

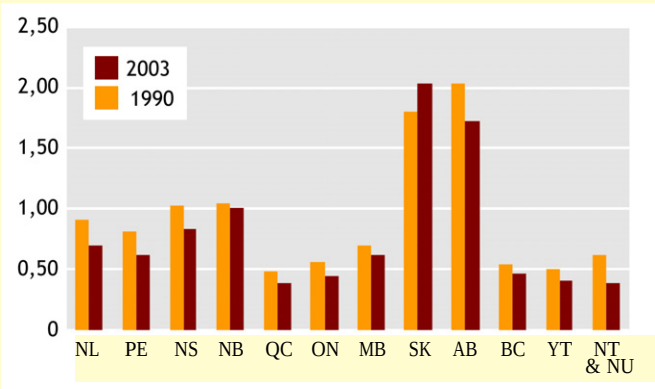
Table 1
Rates of $tCO_2e/(yr/pers.)$ emissions by territory

Territory	Rate of $CO_2e/(yr/pers.)$ emissions – 2003
Germany	13
Canada	24
United States	25
Sweden	8
Quebec	12
Finland	16,5

Despite its use of clean energy, Quebec's GHG emission rate per $1,000 of products is comparable to that of Ontario. This means that Quebec still has substantial room to improve the environmental efficiency of its economy. Similarly, the Vancouver community (which also uses hydroelectricity) seems to generate fewer GHGs to produce the same unit of wealth as the Montréal community.

The citizens of the island of Montréal, therefore, should and can better manage their energy consumption to set their community onto the path of sustainable development.

Figure 3
Economic intensity of emissions (tCO_2e/$K GDP)



Montreal: 0.16 tCO_2e/$K GDP

Chapter 2

Methodologies and sources

The inventory of the Montréal community's GHG emissions was carried out by the Ministère du Développement Durable, de l'Environnement et des Parcs du Québec (MDDEP) for the years 2002 and 2003. In essence, the inventory is calculated using emission factors established by Environment Canada and statistical data provided by Statistics Canada. The inventory can therefore only be published with a two- to three-year delay, once the necessary data has been made available by Statistics Canada. Thus, the 2004 inventory could not be carried out at the time of this report. The calculation methodology was adapted from the work of the Intergovernmental Panel on Climate Change (IPCC), which established standards for the international inventories submitted under the Kyoto Protocol and the United Nations Framework Convention on Climate Change (UNFCCC).

A methodology that mitigates the specific characteristics of cities

Using this methodology, a general balance sheet can be generated without undertaking the colossal efforts of obtaining countless microscopic data. On the other hand, it does obscure certain local characteristics. The inventory provided by the MDDEP was therefore modified by giving preference to field data whenever available.

Broadly speaking, the methodologies used can be summarized as follows:

- Road vehicles: estimate based on the number of vehicles registered with the Société de l'assurance automobile du Québec (SAAQ) per vehicle category, Environment Canada emission factors per vehicle category, and the average number of kilometres travelled per vehicle.

- Buildings: emissions balance sheet based on natural gas and electricity consumption data provided by Hydro-Québec and Gaz Métro.

- Fuelwood: estimate based on the percentage of fuelwood sold on the territory and Environment Canada emission factors.

- Industries and burial of waste: use of atmospheric emission inventory data provided by the city of Montréal's Direction de l'environnement and compiled by the MDDEP.

- Wastewater treatment: use of data from the corporate inventory

- Drinking water production: use of data from the corporate inventory

2.1 Needs

The inventory was designed to meet three key needs:

1. Draw an overall portrait that can be used to identify and quantify the main sources of greenhouse gas emissions on the territory of the agglomeration.

2. Guide and direct the actions of the agglomeration's cities to reduce GHG emissions, which implies a sufficiently detailed inventory (for example, for the various transportation sources).

3. Allow for the monitoring of progress in climate protection, which implies an acceptable margin of error.

Photo: Mount Royal Park

2.2 Distortions due to methodology

The impact of the methodology on the results, and more specifically on the monitoring of GHG emission reductions, is significant.

While the use of national emissions factors is often inevitable in the absence of accessible field data, it nonetheless masks certain local characteristics, especially if specific efforts are being made.

For example, the average number of kilometres travelled by a vehicle on the island of Montréal is lower than the Canadian average. On the other hand, this methodology does not take into account the emissions of vehicles registered outside the island that circulate on the island. Emissions are assigned to the place of residence.

2.3 Recommendations

A first balance sheet for guiding actions to fight GHGs

The inventory carried out by the MDDEP is an excellent working foundation and represents a substantial savings in time and work for regions that want to know the GHG emissions of their community. However, insofar as field data are available, in order to follow local progress independently of Canadian trends, it is important to substitute these estimates with actual values, whenever possible.

Most of the corrections have only a minor impact on the community's total emissions (emissions resulting from wastewater treatment and drinking water production). However, the use of real quantities of gasoline and diesel fuel sold on the island of Montréal rather than estimates based on vehicle registrations and average kilometres travelled could become necessary should the island of Montréal significantly reduce its road traffic in the coming years.

In the same way, given the impact of waste management in the inventory of GHG emissions, if waste is once again disposed of on the island of Montréal through the use of new technologies, it will be important to use field data instead of emission factors.

At the moment, the main purpose of this first inventory of the Montréal community's GHG emissions is to identify the sectors with the highest emissions so as to determine what actions the agglomeration's cities should take.

Consider orders of magnitude rather than absolute numbers

2.4 Cautionary note

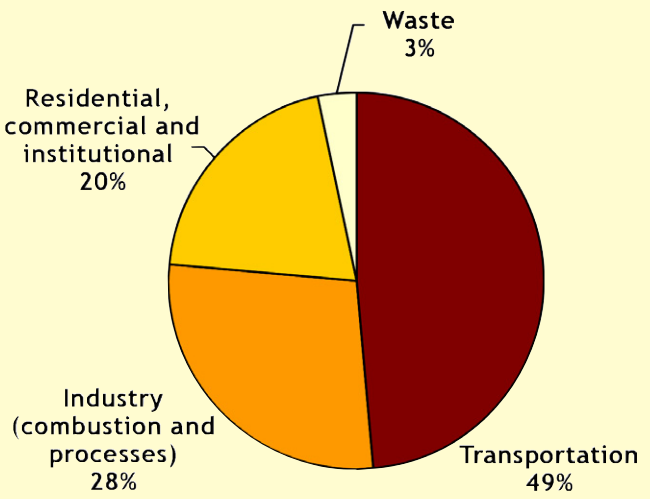
Although the MDDEP did not specify the inventory's margin of error, it is probably higher than 5%. This makes it difficult to follow progress from one year to the next using this tool. Above all, the inventory is useful for identifying the key issues at stake, weighing the sources and guiding actions. The chief purpose of this first inventory is therefore to estimate the relative weight of each emissions source within the Montréal community.

Photo: Honourable-George-O'Reilly Park

Chapter 3

Results

Figure 4
Montréal community emissions – 2003



The most important source of GHGs on the island of Montréal is transportation. This sector alone is responsible for nearly half of the community's GHG emissions. The industrial sector (mostly the island's refineries) ranks second, accounting for close to 30% of emissions. Consumption of natural gas, heating oil and electricity puts the heating and cooling of buildings (residential and institutional) third in GHG emission sources on the territory (20%).

Between 2002 and 2003, GHG emissions on the island of Montréal increased 4.4%, from 13.1 to 13.7 Mt CO_2e/year. However, this variation is not significant given the inventory's margin of error. We should therefore consider this overall increase with caution and concentrate on taking action within the main emission sectors.

3.1 Transportation

Transportation is the main sector responsible for GHG emissions on the island, accounting for close to 50%. It is also a major source of pollutants resulting from combustion, and one of the principal culprits in the deterioration of air quality.

49% of the community's emissions come from transportation

The transportation sector is made up of two sub-categories: road transportation and off-road transportation (trains, airplanes, snowmobiles, boats, bulldozers, etc.). Road transportation accounts for 86% of GHG emissions from transportation. Municipalities have relatively little power over off-road modes of transportation such as trains and airplanes, but they can take significant action with respect to the use of cars and trucks.

Gasoline-powered cars alone generate slightly less than half (43%) of transportation emissions. Close to one quarter of transportation emissions come from heavy-duty diesel trucks (including buses), and 17% of light-duty trucks that run on gasoline (SUVs, minivans, etc.). These three categories of vehicles are therefore key to protecting both the climate and air quality.

From an energy standpoint, 70% of road transportation emissions come from gasoline-powered motors, compared with 30% for diesel. In particular, the trend of SUVs and minivans has had an impact on transportation emissions. According to vehicle registration records, the number of light-duty trucks has gone up twice as fast as the number of cars.

If half the drivers of light-duty trucks (especially SUVs) on the island of Montréal were to convert to classical, more energy-efficient cars (10 litres/100 km instead of 14 litres/100 km), GHG emissions from the road transportation sector would drop nearly 3%. This indicates a clear contradiction between the marked trend in the automobile market, these last few years, toward energy-hungry vehicles and the hope to reduce GHG emissions through the development of fuel-efficient vehicles alone. It is not enough to offer these fuel-efficient cars on the market: the use of more heavily polluting vehicles must be discouraged. In other words, the costs of using polluting vehicles must be internalized.

Finally, it is likely that the energy gains realized by gasoline-powered or diesel vehicles would be cancelled out by the increase in the number of vehicles on the road. It is therefore vital for the city to make changes to promote the use of cleaner modes of transportation.

Figure 5

Road transportation emissions on the island of Montréal – 2003

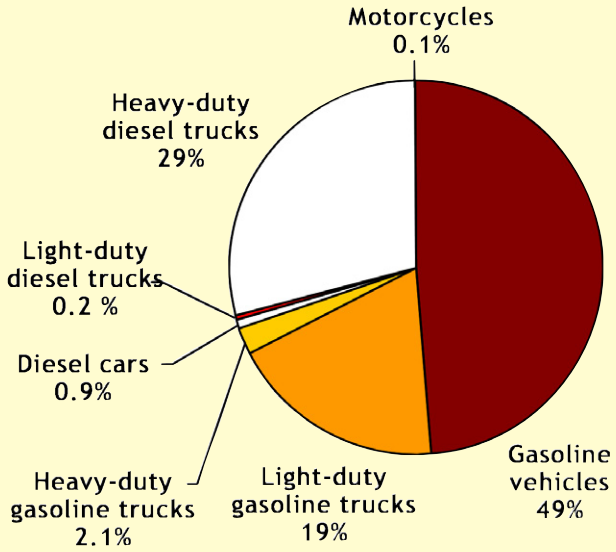
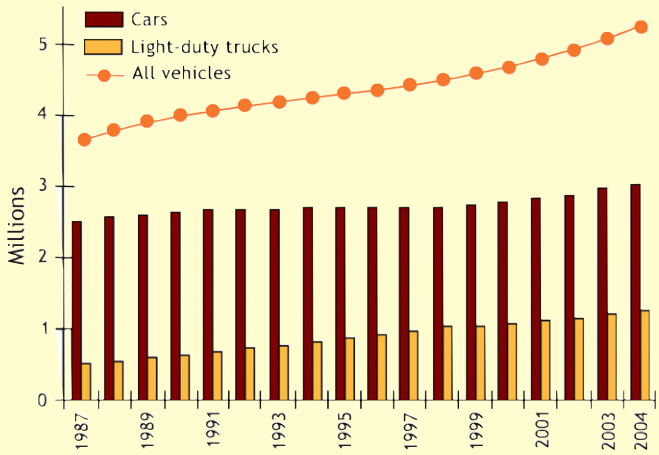


Figure 6

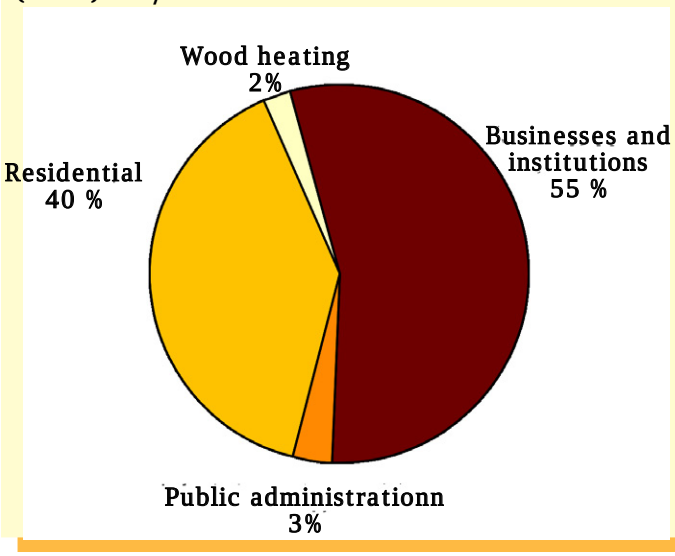
Increase in the number of vehicles on the road in Quebec



Source: MDDEP data in « Les impacts du transport sur la santé publique », Rapport de synthèse, vol. 8 oct. 2005, DSP – Montréal

Figure 7

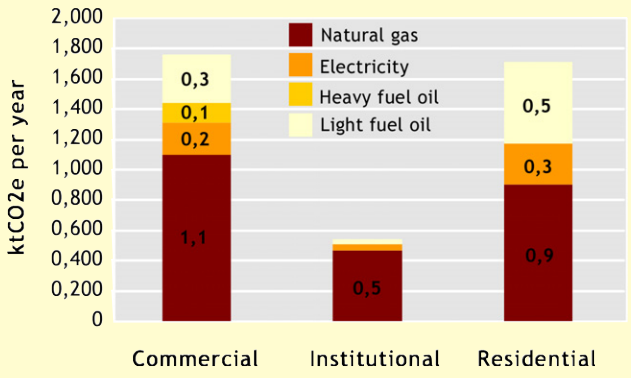
Building emissions on the island of Montréal (2003) – by sector



20% of the community's emissions

Figure 8

Building emissions on the island of Montréal (2003) – by form of energy



3.2 Buildings

Energy consumption in buildings and houses accounts for 20% of GHG emissions on the island of Montréal. It can be divided into four types of energy:

- electricity
- natural gas
- heating oil
- wood

Although wood heating can be a source of local pollution, in terms of GHGs, it is a renewable biomass. For this reason, only combustion gases other than CO_2 are calculated in the environmental balance sheet. This balance sheet reveals the importance of businesses and institutions (hospitals, schools, universities, etc.), which account for more than half the emissions of this sector. However, with 42% of emissions, the residential sector cannot be neglected in the fight to protect the climate's equilibrium.

The inventory provided by the MDDEP using statistical data was compared with the data provided by Hydro-Québec and Gaz Métro for the island of Montréal. If we look at natural gas and electricity alone, the two methods lead to exactly the same results. However, if we add emissions resulting from use of heating oil (provincial data applied on a pro rata basis to the island's population with a correction factor), the estimates differ by about 25%.

3.3 Industry

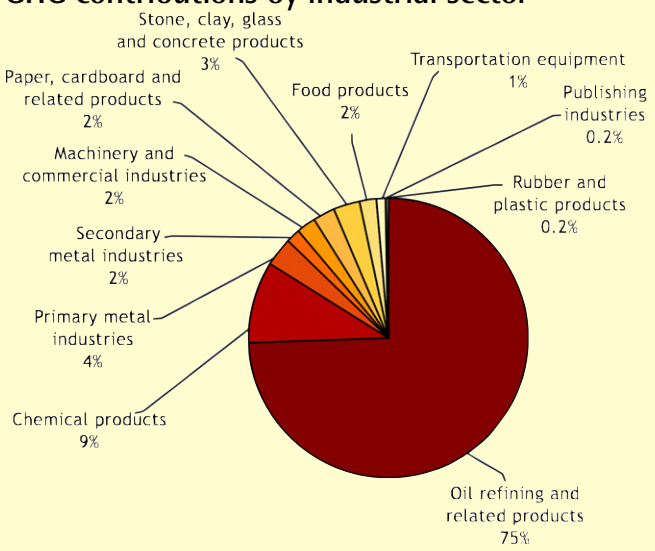
Ninety industries on the island were taken into account to establish the inventory. The data were obtained from businesses by the Division du contrôle des rejets industriels of the Direction de l'environnement et du développement durable de Montréal. Most of the emissions are related to industry processes.

Refineries produce 71% of GHG emissions in the industrial sector. Emissions from the oil sector were relatively stable between 2002 and 2003.

28% of the community's emissions

Figure 9

GHG contributions by industrial sector



Conclusion

GHG emissions on the island of Montréal have three principal sources:

- transportation (49%)
- industry (28%)
- buildings (20%)

Within the transportation sector, road transportation makes up the lion's share (86%). Gasoline-powered cars are the chief source of emissions. However, heavy- and light-duty trucks are responsible for the rise in GHGs in the transportation sector over the last few years, through the rapid increase in the number of such vehicles registered and their high level of energy consumption.

Photo: Rivière-des-Prairies sector

GHG emissions from the industrial sector come primarily (71%) from the island's two refineries.

Homes and commercial and institutional buildings share the amount of GHG emissions from the island's buildings (42% and 58% respectively).

With an average of 7.2 tCO_2e per capita, the agglomeration ranks among the top cities in North America. This positive result is due in particular to its high use of hydro-electricity, which is low in GHG emissions. This asset gives our economy a certain environmental efficiency in terms of greenhouse gases: for every $1,000 of products on the island (GDP), 0.16 tCO2e are emitted. That's four times better than the Canadian average (although this average is one of the highest in the world). Nonetheless, compared to other Canadian cities, the Montréal community can still improve the environnemental efficiency of its economy.

The Montréal community has made the choice of sustainable development. The ultimate objective of a viable community, with respect to GHGs, is to aim below a half-tonne of CO_2e/year per citizen, the amount the Earth is able to absorb.

GHG emissions are almost always generated by combustion; they are therefore closely linked to the emission of classic pollutants that can affect citizens' health (CO, NO_X, SO_X, particulate matter, etc). Reducing GHGs is therefore also a way to improve the air quality and quality of life of citizens.

Abbreviations

CO_2: Carbon dioxide

CO_2e: Carbon dioxide equivalent

FCM: Federation of Canadian Municipalities

GHG: Greenhouse gas

IPP: Investment payback period

IRR: Internal rate of return

kt: Kilotonne (metric)

t: Tonne (metric)

MFSPSD: Montréal's First Strategic Plan for Sustainable Development

SMEC: Saint-Michel Environmental Complex

SUV: Sport utility vehicle

Photographs

Cover page

Old Port of Montréal
Photograph: RSMA

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Metcalfe and De Maisonneuve Streets
Photograph: RSQA

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Photograph: RSQA

Conclusion

Car-free Day
Photograph: RSQA

Appendix

World Mayors and Municipal Leaders Declaration on Climate Change

Fourth Municipal Leaders Summit on Climate Change
On the Occasion of the United NationsClimate Change Conference
(COP 11 and COP/MOP 1)

7 December, 2005, Montréal, Canada

1.0 We, mayors and municipal leaders from around the world meeting at the Fourth Municipal Leaders Summit on Climate Change submit a statement of solidarity as stewards of the Earth and agree that:

- Climate change is a major global challenge requiring urgent and concerted action and collaboration by all orders of government; and that,

- Climate change discussions, negotiations and actions are best informed by scientific evidence such as that provided by the Intergovernmental Panel on Climate Change (IPCC) with a particular focus on vulnerable continents and populations; and that,

- Municipal leaders have the extraordinary ability to change the current trend of global warming; and that,

- If substantial cooperation is exercised among all orders of government the resulting actions can be leveraged to realize the deep reductions needed to move toward climate stabilization.

2.0 We, mayors and municipal leaders, recognize that:

2.1 Local governments play a critical role to effectively reduce human induced greenhouse gas emissions knowing that the sustainable CO_2 emission rate for human-kind is 0.5 tonnes eCO_2 per capita annually based on six billion inhabitants (IPCC).

2.2 Sustainable development and climate change are interdependent as articulated in the UN Millennium Development Goals.

2.3 Local policies and actions will meet or exceed targets set by sub national and national governments to effect deep reductions and lead other sectors to execute the same.

2.4 Climate change impacts like floods, drought, water availability and quality, extreme heat, air pollution and infectious disease pose grave danger to public health and many local governments are already experiencing these effects.

2.5 The linkage between urban and rural communities driven by current development patterns offers opportunities to pursue poverty alleviation and mitigate inequitable impacts affected by climate change.

2.6 The buying power of local governments can accelerate the application and accessibility of clean technologies in the marketplace including renewable energy options.

2.7 The planet is warming. More severe and extreme weather events necessitate urgent action to ensure adequate mitigation and adaptation measures be taken to protect public health, strengthen infrastructure, apply appropriate urban and regional development plans, and advance economic development.

3.0 We, mayors and municipal leaders, commit to the following actions:

3.1 Implementation of policies and operational changes that, acknowledging the differential access to resources between cities in developed and developing countries, will achieve the emission reduction targets set forth in the International Youth Declaration of 30% by 2020 and 80% by 2050 based on 1990 levels, building upon the actions already taken by local governments that committed to a 20% reduction by 2010.

3.2 Establishing a system of accountability on these actions by reporting to the Conference of the Parties and Meeting of the Parties annually through 2012 detailing progress towards the targets.

3.3 Using uniform mechanisms to measure reductions for comparative analysis and verification.

3.4 Improving and advancing the exchange of data monitoring, skills, technologies, methods, tools, public education and experiences to achieve emissions reductions, with specific reference to developing countries.

3.5 Minimization of the dependence on fossil fuel energy through shifting to sustainable land use that:

- encourages public transit.
- diminishes the reliance on vehicular transport and single occupancy vehicles.
- improves energy efficiency.

3.6 Advancing partnerships and collaboration with national and sub national governments, non-governmental organizations, corporate and industrial sectors, as well as non-governmental organizations and community groups, in order to multiply reduction potential.

4.0 We, mayors and municipal leaders, request that:

4.1 Local governments be recognized by the Conference of the Parties for the actions they have implemented and are continuing, tangibly to reduce greenhouse gas emissions. To this end, we request from the UNFCCC an allocation be granted to all Major Groups to strengthen and enhance an annual input process specific to local governments prior to future COP/MOP meetings.

4.2 National and sub-national governments: recognize the fundamental role of local governments in mitigating and adapting to climate change; partner with them to enhance their technical, human and financial capacity and legislative authority; and fully engage them when making strategic decisions on climate change policies.

4.3 Global trade regimes, credits and banking reserve rules be reformed to advance debt relief and incentives to implement polices and practices that reduce and mitigate climate change.

4.4 All national and sub-national governments commit to a process to negotiate an international climate change regime with deep reductions in greenhouse gas emissions enacted by 2012.

4.5 National and sub-national governments ensure that local governments have the opportunity to participate in emissions trading in accordance with evolving domestic and international trading systems.