CITY OF YELLOWKNIFE

Partners for Climate Protection – 5th Milestone Report

The City of Yellowknife joined the Federation of Canadian Municipalities' Partners for Climate Protection program in 1997 symbolizing the beginning of its journey to reduce emissions and improve the overall sustainability of the community. In 2005, a baseline emissions inventory was conducted which informed the Community Energy Planning Committee's recommendations to Council. The City has progressed through the program's milestone framework and is proud of its efforts and accomplishments. Its success can be attributed in part to the structure and guidance that the PCP program has provided.

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Tracking Municipal Energy Projects

As part of the City's PCP commitment it set a municipal operations emission reduction goal of a 20% decrease over 2004 levels by 2014 and a 6% decrease within the community. To achieve these goals the City set aside $500,000 annually in its budget to be put towards energy efficiency, renewable energy conversions and public awareness. The City has undertaken a number of energy projects within its operations and in 2009 a 38% reduction of 2004[1] emission levels was reached (excluding landfill emissions).

Municipal Energy Projects

- **Biomass boiler district energy system** – A wood pellet boiler was installed in 2008 at the Community Arena providing supplementary heat to the Arena, Curling Rink and Pool facilities through a district heating system. The 750kw containerized European made boiler is connected to the facilities and provides up to 95% of the facilities heating needs. All biomass heat generated displaces oil use. The biomass boiler contributes to the green economy of the community while at the same time remaining economical. The facilities consumed 296,000 litres of oil before the conversion.
    - After: Average annual wood pellet consumption 2149Mwh, displacing 268,600 litres[2]
    - Annual Savings: $138,800[3]

- **Vehicle Plugin Controllers** – The IPLC parking lot plug-in system was installed in a number of City staff parking lots to manage power consumption of plugged in vehicles. The smart plug incorporates a microprocessor and temperature sensor to optimize power consumption. An analysis report was produced at the City Garage location comparing consumption with and without the IPLC controller. All other facility savings are based on estimates.
    - Without controller – 99,679kWh
    - With controller – 70,863kWh
    - Annual Savings – 28,815kWh

- **Hybrid Vehicle** – A Prius Hybrid was purchased for the Fire Hall to replace a Ford F-150 truck. The concept was to demonstrate the technology, saving money and GHG emissions. The vehicle travels on average 7,000 km annually. Energy savings are based on estimates.
    - F-150 fuel rating is 15 L/per 100km – 1050 litres
    - Prius fuel rating is 4 L/per 100km – 280Litres
    - Annual Savings – 770 litres annually

[1] City of Yellowknife, 2009 Energy and Emissions Inventory
[2] Litres of equivalent oil = (MWh / 75% boiler efficiency) x 93.75 L per MWh
[3] Savings = (Displace oil equivalent in Litres x Avg. 2011 oil price) - (Avg. wood pellet price 2011 x 554 tonnes pellet) – Additional Labor Costs ($12,500)

In addition, a Ford Escape Hybrid was purchased in place of a Ford F-150 resulting in an estimated savings of 322 litres of gasoline.

- **Biomass Boilers in Liftstations** - In 2008, the City was an active member of a GNWT/Arctic Energy Alliance committee with the objective of expanding the wood pellet market in the NWT. One of the areas of interest was developing market uptake on residential sized wood pellet boilers. A challenge in achieving market penetration was the limited number of installed residential units.

  As part of the Community Energy Plan the City set an objective of expanding wood pellet use within its operations and promoting its use within the community. It was identified that many of the City's Public Works Liftstations have a similar heating load to a residential home and would offer a demonstration opportunity for the local market to see the technology in use. The City invested in two residential sized biomass boilers as a demonstration project.
    - An average of 9.5 tonnes of pellets (39,000kWh) was consumed in the facilities annually, displacing 4910 litres of heating oil. All biomass consumed displaces heating oil.
    - Through the evaluation of this demonstration project it was determined that the cost to maintain the system City staff wage rates eroded all energy savings of using the lower priced wood pellets.

- **City Garage Roof Insulation upgrade**. In 2009 the roof was being replaced at the main Public Works garage. The initial insulation levels were estimated in the R12 range and were upgraded to an effective R55 rating.
    - Average building oil consumption before retrofit. 67,200 litres
    - Average building oil consumption after retrofit. 44,920 litres
    - Annual Savings - 22,300 litres

- **Hybrid vehicle upgrade**. As part of the normal vehicle procurement process a Ford Escape was upgraded to a hybrid option. The cost to upgrade to a hybrid was an additional $5,000. The average annual distance traveled for the vehicle is 7,000 km. Savings are based on estimates.
    - Non hybrid fuel rating 10.4 L/per 100km – 728 litres
    - Hybrid fuel rating – 5.8 L/per 100km – 406 litres
    - Annual Savings 322 Litres

- **Ice Plant Heat Recovery –** A heat recovery system was installed at the Multiplex Arena to capture and use waste heat generated by the ice plant. Before the retrofit this heat was dumped. With the system in place, the heat is redistributed back into the in-floor heating network, reducing the need to run the oil boiler to heat the facility. The system was expanded in 2011 connecting it to the Fieldhouse, a neighbouring recreational facility. The system is fitted with an energy and flow meter to measure the amount of heat captured. The complete project cost $580,000 and was supported by $286,000 in Federal and Territorial grants.

- 4,222,460 kBTU of thermal energy was redistributed into the facilities. Converted into equivalent litres of oil - 117,291L valued at $123,000[4]. Power consumption increased by an estimated 71,000 kWh valued at $15,000.
- Annual Savings estimate - $108,000

- **Server Room Free Air/Heat Recovery System** – The City's computer server room was previously cooled with mechanical units. A glycol fan cooling system was installed that uses outside cold air to cool the servers. The heat removed from the server room is redistributed into the buildings fresh air intake, further reducing energy use. The project also improved system reliability; the mechanical cooling system consistently malfunctioned in cold weather which is when the new system is most efficient and reliable. The project cost $69,000 to install**.**
  - The system will save 1070 litres of heating oil and 36,829kWh of electricity.
  - Annual savings estimate - $8,650

- **Solid Waste Facility Biomass Boiler –** A 300kw wood pellet boiler was installed at the Solid Waste Facility. The boiler provides supplementary heat to the facility displacing the need to burn heating oil. The boiler also has the capacity to operate on wood chips which in the future could utilize waste wood that is presently landfilled.
  - Before: The facility consumed an average of 73,000 litres of oil
  - After: Average annual wood pellet consumption of 895MWh, displacing 84,000Litres[5]
  - Annual Savings: $34,000[6]

- **Facilities Lighting Upgrades –** A focused effort has been placed on improving the efficiency of facility lighting. Numerous small projects have been undertaken with an estimated reduction in power use of 357,000 kWh.

[4]2012 average heat oil price in Yellowknife $1.05. City of Yellowknife fuel records.
[5]litres of equivalent oil = (MWh / 75% boiler efficiency) x 93.75 L per MWh
[6] Savings = (Displace oil equivalent in Litres x Avg. 2011 oil price) - (Avg. wood pellet price 2011 x 554 tonnes pellet) – Additional Labor Costs (12,500)

Community Energy Plan – In-house Project Inventory

		Petroleum Product			Electricity		Wood Pellet		
Project	**Installed Cost**	**L**	**kWh**	**GHG (t)[7]**	**kWh**	**GHG (t)[8]**	**kWh**	**GHG (t)[9]**	**Total GHG Saved (t)**
Biomass Boiler District Energy System	$529,000	285,000	3,024,167	777.31			- 2,149,000	- 154	624
Vehicle Plugin Controllers	$21,540				28,815	3			2
Hybrid Vehicle	$34,800	770	8,171	2.10					2
Biomass Boilers in Liftstations	$55,000	7,367	78,172	20.09			- 39,000	- 3	17
City Garage Roof Insulation Upgrade	$60,000	22,300	236,628	60.82					61
Hybrid Vehicle Upgrade	$5,000	322	3,417	0.88					1
Ice Plant Heat Recovery	$586,000	117,291	1,244,588	319.90	-71,000	- 4			316
Server Room Free Air	$69,550	1070	11,354	2.92	36,829	2			5
Solid Waste Facility Biomass Boiler	$349,000	84,000	891,333	229.10			-895,000	- 64	165
Facility Lighting Efficiency	$85,700				357,000	18			18
Total	$ 1,795,590	518,120	5,497,829	1,413	351,644	19	- 3,083,000	- 220	1,211

[7] Fuel Oil = 0.26 kg CO2e/kWh kg CO2e/kWh - Conversions taken from the City of Yellowknife, 2009 Energy and Emissions Inventory

[8] Electricity = 0.05 kg CO2e/kWh kg CO2e/kWh - Conversions taken from the City of Yellowknife, 2009 Energy and Emissions Inventory

[9] Wood Pellet = 0.07 kg CO2e/kWh

Community Energy Plan Initiatives

- **Energy Coordinator Position** - It was recognized in the development of the CEP that energy planning is not a traditional mandate of the municipalities and would require a focused effort over a period of time to ensure the plans principles were adopted. A position was created to lead the process. The Energy Coordinator liaised with a CEP committee made up of community stakeholders to ensure the process remained on track.

- **Wood Pellet Market Development** - The wood pellet industry has expanded rapidly in recent years in Yellowknife as a result of its classification as carbon neutral and price competitiveness with heating oil. Ten known large commercial boilers (750kw) have been installed and residential heating systems are now popular as a result of a distribution truck that can deliver bulk wood pellets similar to the way heating oil is delivered. Hundreds of home owners supplement their heating requirements with wood pellet stoves. The City has been an active member of a wood pellet committee with the mandate to develop the industry and has shown leadership by demonstrating both commercial and residential systems within its own operations.

- **Water Intake Study** - The City consumes on average 220,000 litres of oil to heat the municipal water supply during the coldest five months of the year. A water intake study was conducted to determine if drawing water from deep sections of Yellowknife Bay to take advantage of stratified warmer water could be undertaken to reduce water heating requirements. Temperature testing at three different periods over two years was conducted. The results showed that the warmest temperatures were in the 2^0 Celsius range, lower than the anticipated 4^0Celsius and were located 3km from the pumphouse facility.

- **Sewer Heat Recovery Study** - The City examined the concept of extracting heat from the sewer system for use in the four City facilities clustered around the Multiplex. The feasibility study determined it was technically viable and would require a capital investment of $3.7 million, producing a payback in the 14 year range. The concept will be weighed against other alternative heating options for the cluster of City buildings such as wood pellet heating and an ice plant heat recovery system.

- **Greening Procurement Process** - The life cycle costing for new vehicles and machinery was added to the tendering process. Now when a new vehicle is purchased it takes into account not only the upfront price but also its cost of operation which is heavily influence by fuel efficiency. Also, Energy Star labeled office equipment is giving preference in the tendering process which ensures energy efficiency is considered.

- **Fieldhouse** - The City commissioned the $16 million Fieldhouse recreation facility in 2010 which was designed to meet LEED certification. The facility includes an upgraded insulation package, natural lighting, ventilation heat recovery, low volume water consumption equipment (resulting in a 20% reduction in water usage) and an efficient in-slab heating system. In addition to the numerous energy efficiency upgrades the facility is

also heated with waste heat generated from an ice rink located next door. The Fieldhouse contains an indoor running track and two large soccer pitches which are an important addition to the community and encourage healthy living throughout the long cold winter months.

- **Energy Efficiency Building Standards** - Yellowknife is a growing community and recognizes that future development must give strong consideration to the energy performance of its buildings. Yellowknife has adopted one of the most progressive energy efficiency standards in the country for new construction. It is the first municipality to pass minimum level energy efficiency standards for commercial buildings (25% better than the Model National Building Code) and requires new homes achieve an 80 score on the EnerGuide for Homes rating system.

- **LED Street Lighting** – After converting its traffic signaling lights to LEDs in 2005 the City monitored the market performance of LED street lighting. In 2011 the City partnered with its local power provider, Northland Utilities (NUL), to install twenty LED fixtures in four different locations. The majority of the existing 1400 streetlights are 150 watt high pressure sodium fixtures and will be replaced with 70 watt LED lights. The conversion is estimated to reduce kWh use by 490,000 and GHG emissions by 24 tonnes.

Smart Growth Plan

In July of 2010, City Council adopted the Smart Growth Development Plan which commenced in 2007 and consulted more than 2000 Yellowknife citizens. The Plan's 50 year vision consists of seven background reports – Questionnaire Survey, Focus Groups, MetroQuest, Transportation Improvement Plan, Urban Design Initiative, Downtown Façade Improvement Guidelines, Natural Area Study, and a Final Recommendations Report. Together these documents are used to assist daily, mid-term and long-term planning decisions with regard to transportation, land use, environment, housing, budget considerations, and public engagement. The Recommendations Report summarizes 15 implementation strategies and 100 actions. Each Strategy includes an analysis of Sustainability Impact along with timelines, budget, and responsibility designations. Monitoring and measurement is identified as one of the 15 strategies and will be incorporated within the City's strategic decision making framework on an annual basis.

As part of the Smart Growth Development Plan the City's transportation consultant completed over 300 telephone surveys with Yellowknife citizens on transportation patterns. These origin/destination surveys tracked citizen travel patterns at various times of the day including modes of travel (automobile, transit, pedestrian, cycling, or other). It is the City's vision that a compact growth scenario which invests in alternative transportation infrastructure will over the long term increase transit ridership and pedestrian and cycling. The survey baseline information can be used and updated in the future (e.g. every 3-5 years) to track whether the City's smart growth planning objective of increasing alternative transportation usage is being met.

In addition to the EGH-80 requirements in the City's Building By-law the City has adopted the Development Incentive Program to promote revitalization and redevelopment. One of the five initiatives under the program provides for multi-year tax relief for LEED building development. A goal of the Smart Growth Development Plan is to continue to build capacity in LEED through training of staff.

Strategic Planning

In November of 2010, City Council adopted a ten year Community Based Strategic Plan which will assist administration and Council in its decision making process. The four priority goals of the Plan are (1) Affordability, (2) Enhance Our Built Environment, (3) Build Social Capital, and (5) Continuous Improvement. Each of these goals includes objectives and actions which are used as sustainability filters in the decision making process of Council and administration. Council is currently (January 2013) reviewing its Strategic Plan and will be developing priority actions to measure and evaluate the effectiveness of the City in advancing quality of life and sustainability.

- **Active Transportation** - Despite Yellowknife's harsh climate it remains home to a large community of outdoor enthusiasts. As a result a great emphasis is put on the preservation and pedestrian access to urban green space and park areas. Yellowknife maintains 28 hectares of designated park area in addition to a 486 hectare Territorial park within City boundaries. There is an additional 468 hectares of green space preserved within the community.

  The Somba K'e Civic Plaza, completed in the fall of 2009 converted a parking lot into 642 sq meter of class "A" park space located in the heart of the City and services as a trail head for commuters entering and exiting the downtown core. The project demonstrates the City's support of an active transportation system. Central to the design of this plaza is a large civic plaza and amphitheater supports festivals and outdoor activities year round in a beautiful waterfront setting. There are 22.3 km of signed bike routes, 5.4 km of multi-use trails and 9.4 km of hiking trails totaling 37.1 km of municipally developed and maintained active transportation and recreational infrastructure.

- **Eco-housing Demonstration Project** - The City has recently entered a partnership with CanNor, Canada Mortgage and Housing Corporation and NWT Housing Corporation to design a model energy efficient multi-family residential dwelling. Stage one of the project entails the planning, designing, and construction focusing on alternative and innovative strategies including renewable energy techniques. The intent is to illustrate to builders, operators of business related to the components (plumbing, electrical, mechanical, etc.) and training institutions that sustainable building construction and utility provision is smart business.

Updated Community Energy and Emissions Inventory

The initial Yellowknife Energy and Emissions Baseline study, completed in 2005, indicated that the Yellowknife energy supply mix consisted of 90% fossil fuels and 10% electricity. In response to the findings of the 2004 Baseline the City of Yellowknife formed a community energy planning committee and developed a comprehensive Community Energy Plan (CEP) that was adopted in 2006. The CEP Committee is a voluntary body comprised of 12 stakeholders including representation from the Chamber of Commerce, the general public, two electricity utilities, Ecology North (NGO), the Arctic Energy Alliance, the Government of the Northwest Territories and the City of Yellowknife.

After the adoption of the CEP in 2006 the Committee continued to play an important role in the implementation and evolution of the CEP. The Committee meets on quarterly bases to hear updates and plan future initiatives.

In 2011, the City of Yellowknife hired a consultant to update the energy and emissions inventory using 2009 data. See Appendix A

While our 2004 inventory did not include estimated emissions from our municipal landfill an estimation methodology was provided by ECLEI. Current waste production suggests that 25,725 tonnes of CO_2 equivalent will be emitted by our landfill. The City's next emissions reduction plan may take these emissions in consideration and could address them with waste reduction or gas capture projects.

Stakeholder Engagement and Decision Making

In 1997, the City of Yellowknife joined the Partners for Climate Protection (PCP) program. As part of Council's goals and objectives for the 2004-2006 term, the City adopted Action Item 2.4 which stated "Through a community energy planning approach, work closely with community groups to reduce greenhouse gas emissions and energy use …" This approach to community based collaboration and decision making has been a cornerstone of the CEP's evolution.

Conclusion

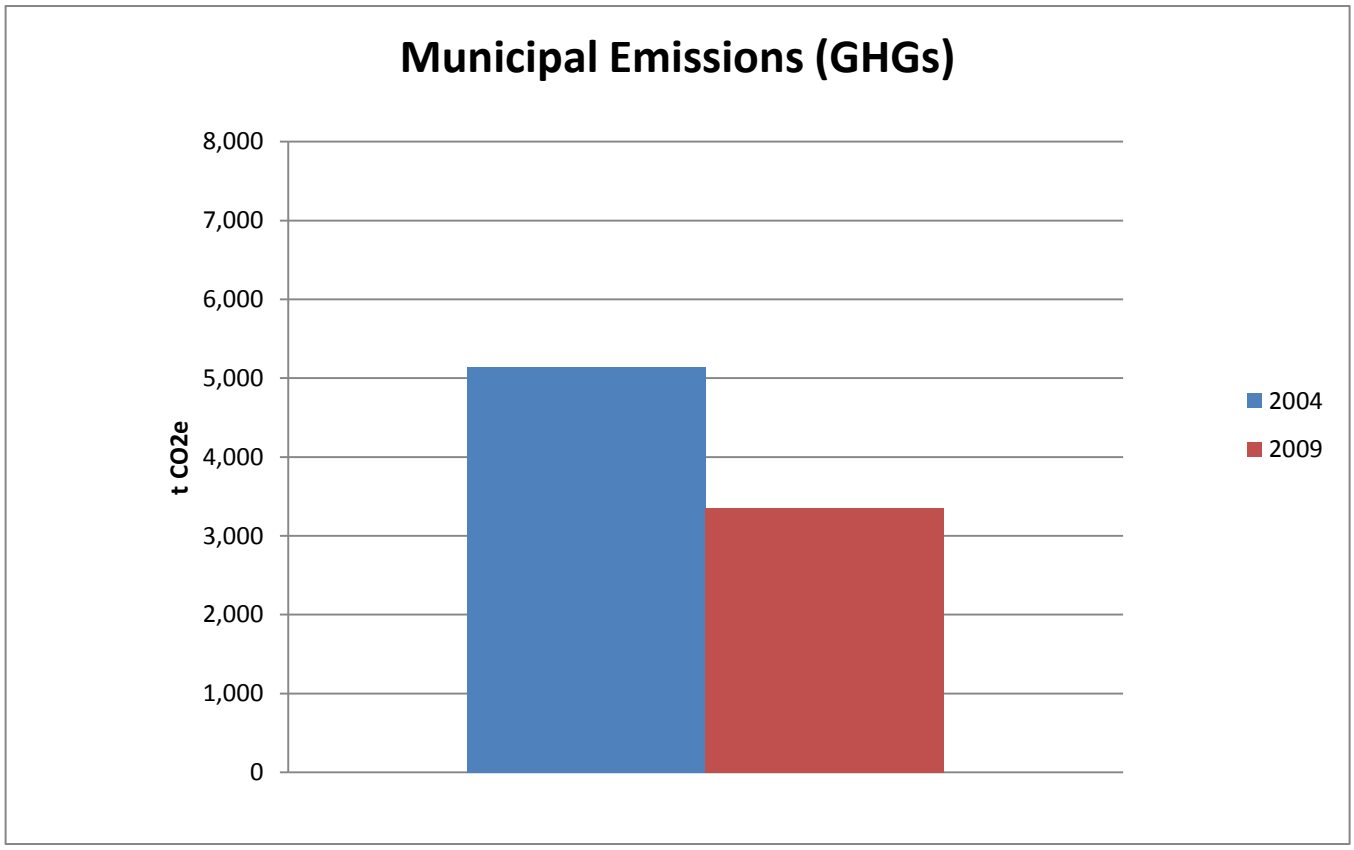
The City of Yellowknife is proud of what it has accomplished through the Community Energy Planning process and looks forward to its continued evolution. As the Energy and Emissions Inventory demonstrates Yellowknife is well on its way to achieving its PCP commitments. Achieving milestone 5 will bolster the community's commitment to the PCP goals and ensure the process continues to progress.

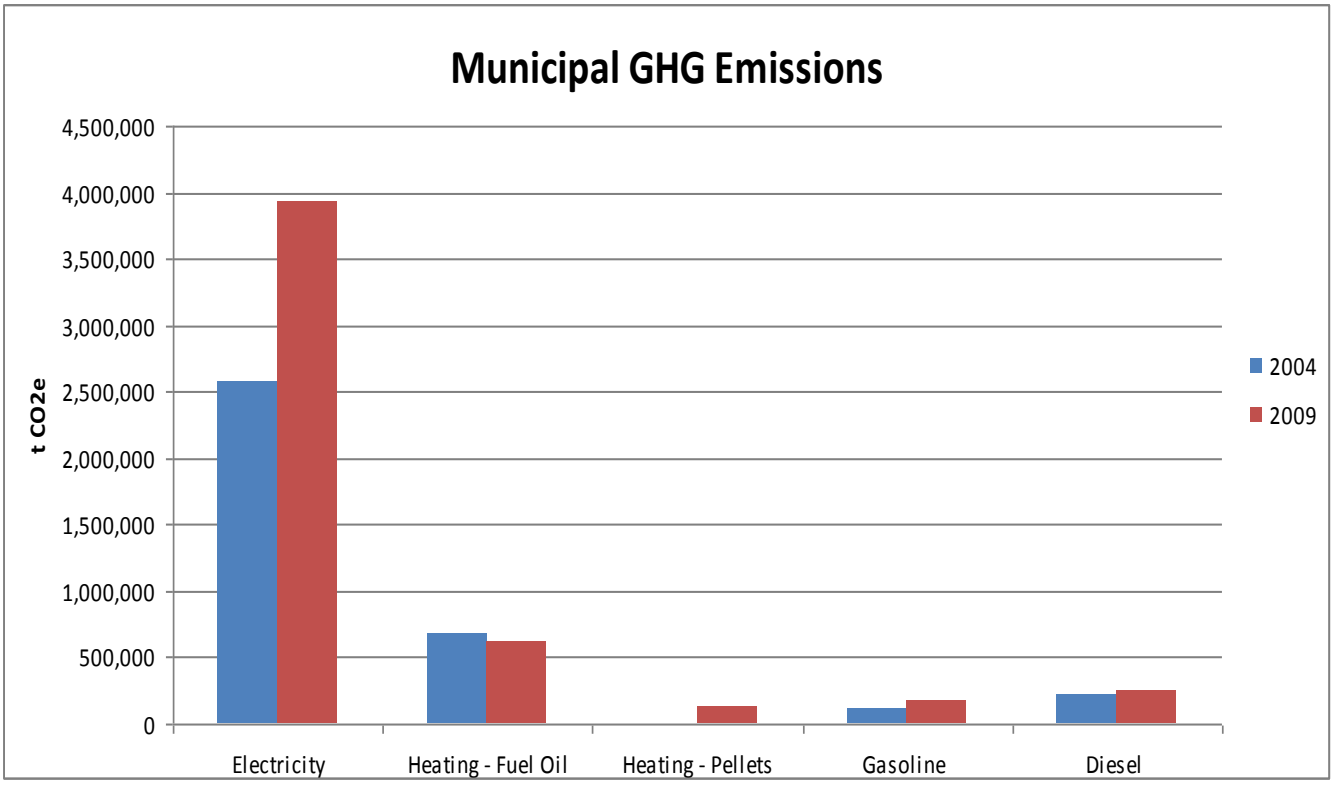
On February 13, 2013, the Federation of Canadian Municipalities (FCM) and ICLEI – Local Governments for Sustainability recognized the City of Yellowknife for taking steps to reduce

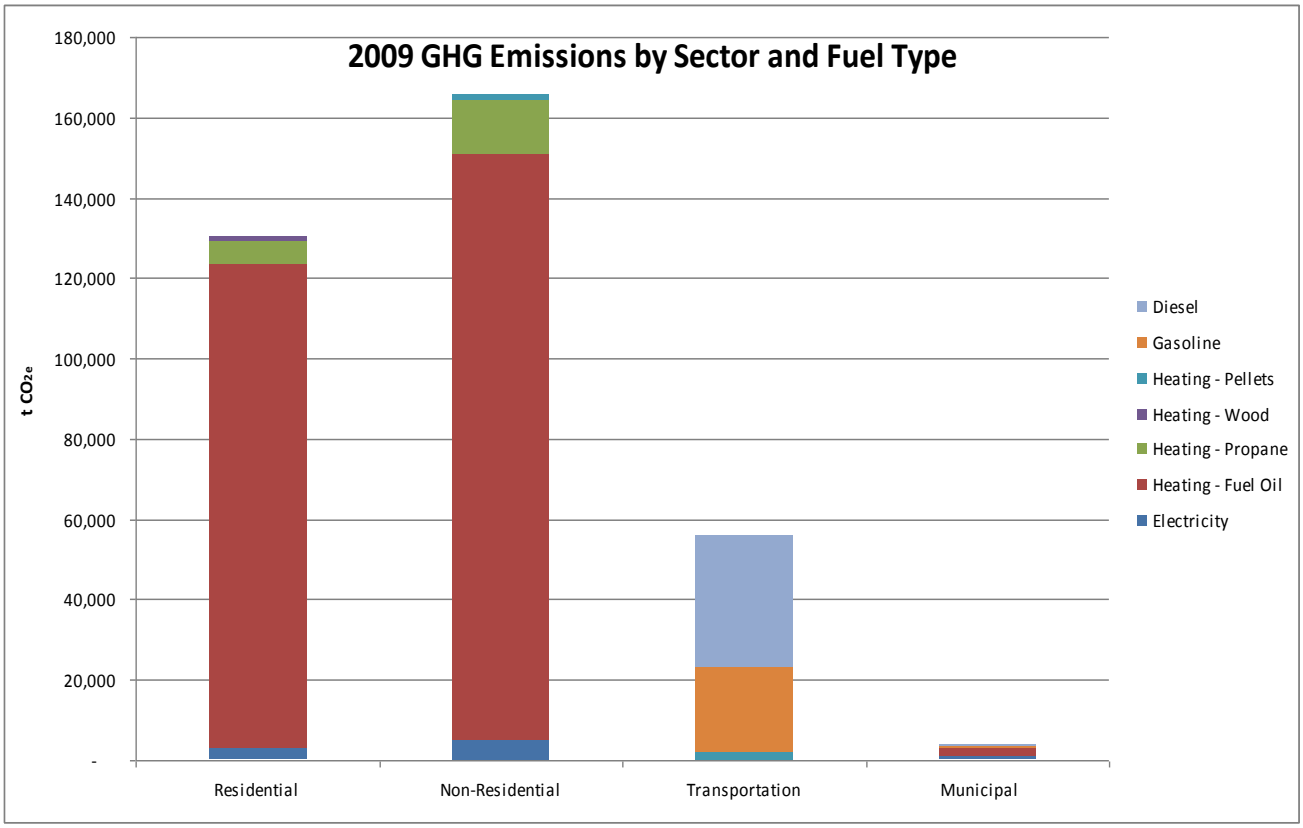
greenhouse gases (GHG) and improve energy efficiency, achieving the fifth milestone of the Partners for Climate Protection (PCP) program.

Since adopting greenhouse gas reduction targets in 2004, the City of Yellowknife has reduced its emissions by 10% and decreased its reliance on non-renewable energy by 20%.

APPENDIX A - GHG EMISSIONS CHARTS






2009 GHG Emissions by Sector and Fuel Type
t CO2e
180,000
160,000
140,000
120,000
100,000
80,000
60,000
40,000
20,000
-
Residential
Non-Residential
Transportation
Municipal
Diesel
Gasoline
Heating - Pellets
Heating - Wood
Heating - Propane
Heating - Fuel Oil
Electricity