

CITY OF YELLOWKNIFE

**PARTNERS FOR CLIMATE PROTECTION PROGRAM
5TH MILESTONE APPLICATION**

MAY 14, 2012



City of Yellowknife Milestone 5 Application

This report and attached Emissions Inventory is the City of Yellowknife application to the Partners for Climate Protection (PCP) program's 5th Milestone. The City joined the Federation of Canadian Municipalities' (FCM) PCP program in 1997 (formally known as the 20% Club) which symbolized 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 recommendation to Council. The City has progress 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 over the years.

1. 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, achieving a 38% emission reduction since 2004¹. Below is a list of some of the larger projects undertaken by the City of Yellowknife since the adoption of the Community Energy Plan.

1.1. 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 requires additional time to operate, adding 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 Litres²
 - Annual Savings: \$138,800³
- **Vehicle Plugin Controllers** – The IPLC⁴ parking lot plug in system was installed in a number of City staff parking lots to manage power consumption of plugged in

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)

⁴ www.iplc.com



vehicles. The smart plug incorporates a micro processor 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 facilities saving 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 – 280
 - Annual Savings – 770 Litres annually
 - **Biomass Boilers in Liftstations** - In 2008, the City was an active member of a GNWT/Arctic Energy Alliance committee that had 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 the market penetration was the limited installed capacity. Although wood pellet boiler technology is well established in other jurisdictions, individuals did not want to be the first into the local market.

As part of the Community Energy Plan the City has the 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 be a good demonstration opportunity for the local market to see the technology in use. The City invested to biomass boilers as a demonstration project.

- An average of 9.525 tonnes of pellets (39,000kWh) were consumed in the facilities annually displacing 4910 litres of heating oil. All biomass consumed displaces heating oil.
 - Through the evaluation of the 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 Savings 322 Litres

- **Ice Plant Heat Recovery** – A heat recovery system was installed at the Multiplex Arena to capture and uses 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 \$123,000⁵. 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 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 utilized waste wood that is presently landfilled.
 - Before: facilities consumed an average of 73,000 Litres of oil

⁵ 2012 average heat oil price in Yellowknife \$1.05. City of Yellowknife fuel records.



- After: Average annual wood pellet consumption 895MWh, displacing 84,000Litres⁶
- Annual Savings: \$34,000⁷
- **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.

Community Energy Plan – In-house Project Inventory

Project	Installed Cost	Oil			Electricity		Wood Pellet		Total GHG Saved (t)
		L	kWh	GHG (t) ⁸	kwh	GHG (t) ⁹	kWh	GHG (t) ¹⁰	
Biomass Boiler District Energy System	\$ 529,000	285,000	3,024,167	777.31			- 2,149,000	- 154	624
Vehicle Plugin Controllers	\$ 21,540				55,629	3			3
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	378,458	19	- 3,083,000	- 220	1,212

⁶ Litres of equivalent oil = (MWh / 75% boiler efficiency) x 93.75 L per MWh

⁷ 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)

⁸ Fuel Oil = 0.26 kg CO₂e/kWh kg CO₂e/kWh - Conversions taken from the City of Yellowknife, 2009 Energy and Emissions Inventory

⁹ Electricity = 0.05 kg CO₂e/kWh kg CO₂e/kWh - Conversions taken from the City of Yellowknife, 2009 Energy and Emissions Inventory

¹⁰ Wood Pellet = 0.07 kg CO₂e/kWh



1.2. 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, reporting to 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. Over ten 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^o Celsius range, lower than the anticipated 4^o Celsius 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 labelled office equipment is giving preference in the tendering process, ensuring 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 and measures to produce a 20% reduction in water usage. an efficient in-slab heating system. In addition to the numerous energy efficiency upgrades it is also be heated with waste heat generated from an ice rink located next door. The facility's heating will be supplemented with waste heat from an arena ice plant located next door. In addition to the energy efficient components, the facility will house an indoor running track and two large soccer pitches, an important addition to the community to encourage healthy living even during 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 the building. Yellowknife has adopted one of the most aggressive 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 EnerGuide for Homes rating system.
- **LED Street lighting** – After converting its traffic signaling lights to LEDs in 2005 the City has been monitoring the market performance of LED street lighting. A parking lot's light were converted to LED to evaluate the technology in 2008 and in 2011 the City partnered with its local power provider, Northland Utilities (NUL), to install twenty LED fixtures in four different locations. The market researched has enabled the City and NUL to selected a preferred vender and proceed with a City wide street lighting conversion to LED fixtures. 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 making daily, mid-term and long-term planning decisions with regards to transportation, land use and density, environment, housing, finance, and public engagement. The Recommendations Report summarizes 15 key implementation strategies and 100 actions, is the summary document most utilized by Administration. Each Strategy includes an analysis of Sustainability Impacts along with timelines, budget, and responsibility. 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.

In November of 2010 the City adopted its Community Based Strategic Plan 2010 which will guide Administration and Council over the next 10 years. The Plan goes beyond Council's Goals and Objectives which were commonly adopted for every three years of Council. 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. These filters will serve to guide, measure, and evaluate the effectiveness of the City in advancing quality of life and sustainability.

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 ENGH-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. The City currently has one LEED Accredited Professional and one of the goals of the Smart Growth Development Plan is to continue to build capacity in LEED through training of staff.

- **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 walk able access to urban green space and park areas. Yellowknife preserves 28 hectares of maintained 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. See Appendix ?? for a map of the parks and how they are integrated with trail networks.

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 importance the City's puts on supporting the



active transportation system. Central to the design of this plaza is a large civic plaza and amphitheater that will support festivals and outdoor activities year round in a beautiful waterfront setting. As well an area on site has been identified for the future development of a new public library and art centre. There are, 22.3 km of signed bike routes and 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. The community puts a strong emphasis on further developing this popular infrastructure and is implementing the recommendations in the Integrated Parks, Trails, Open Spaces Study¹¹. An additional 14 km of bike lanes, multi-use trails and bike routes are proposed to be built.

- **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 of which focuses 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.), training institutions and others that “sustainable” building construction and utility provision is good business and that this is the way which the north needs to progress. The City is working to have an agreement with a developer complete within the year.
- **District Energy System Business Development** - Since 2007, the City has put a considerable amount of effort and funding towards the development of a district heating system that would supply heat to a majority of the large buildings in Yellowknife. The project has completed preliminary design and has developed an investment grade business plan based on a cost of service utility model. The final stage before the project proceeds is securing end customers. If successful the system would be begin development in 2012.
- **Mine Energy Feasibility Work** – The City has been investigating the potential of using a decommissioned gold mine located within and below the community. The mine is 1,900 meters deep and has temperatures in the 28 Celsius range. A preliminary evaluation was completed in 2009 and a detailed feasibility is in the process of being completed. Preliminary finding show that the mine resource is sufficiently sized to heat the towns water supply which would displace 250,000 litres of heating oil annually and reduce emissions by 680 tonnes annually.

2. UPDATED COMMUNITY ENERGY AND EMISSIONS INVENTORY

¹¹ http://www.yellowknife.ca/City_Hall/Departments/Community_Services/IntegratedParksTrailsOpenSpacesStudy.html



The initial Yellowknife Energy and Emissions Baseline study, completed in 2005, showed that the Yellowknife energy supply mix was about 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. In 2011, the City of Yellowknife hired a consultant, to update the energy and emissions inventory using 2009 data. The 2009 Community Energy and Emissions Inventory is an appendix to this report.

3. STAKEHOLDER ENGAGEMENT AND DECISION-MAKING

The creation of Yellowknife's Community Energy Plan and its ongoing evolution has been a collaborative effort between The City of Yellowknife and key community stakeholders. In 1997, the City of Yellowknife joined the Partners for Climate Protection (PCP) program. As part of Council's Goals & 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.

In 2005, the City of Yellowknife created a Community Energy Planning Committee. The CEP Committee is a voluntary body comprised of 12 entities, including representation from the Chamber of Commerce, the general public, the two electricity utilities, Ecology North (NGO), the Arctic Energy Alliance, the Government of the Northwest Territories and the City of Yellowknife. The Committee was instrumental in the development of the CEP and were directly involved in the development of the specific recommendations that were adopted by Council in 2006. Some have described The CEP development process has been described as a grass roots effort initiated by engage stakeholders such as the Arctic Energy Alliance and supportive Councillors such as Mark Heyck who now chairs' the Committee. After the adoption of the CEP in 2006 the Committee continues 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.

4. 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.

ATTACHMENTS

- City of Yellowknife, 2009 Energy and Emissions Inventory Report
- City of Yellowknife, 2009 Energy and Emissions Inventory Model (excel)
- City of Yellowknife – in house projects inventory (excel)

