CITY OF THUNDER BAY

GREEN FLEET

Implementation Plan

FLEET SERVICES DIVISION
FACILITIES AND FLEET DEPARTMENT
FEBRUARY 2009

CITY OF Thunder Bay
Superior by Nature

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3.0 Strategies for Greenhouse Gas Reductions

Tables and Attachments

Acknowledgements

This document has drawn material from public documents and discussions.

1. City of Thunder Bay, Community Environmental Action Plan (CEAP) – 2008

2. Local Governments for Sustainability - ICLEI
   Greenhouse Gas Emissions Inventory. 2008,

3. Fleet Challenge Ontario, E3 Fleet Review

Glossary

Biodiesel - A naturally-sourced product refined to meet a recognized standard that is blended with conventional diesel fuel to reduce engine exhaust emissions, especially particulate matter and soot.

CO - Carbon monoxide: a toxic air pollutant

CO_2 - Carbon dioxide: a non-toxic greenhouse gas

eCO_2 - Carbon dioxide equivalents are the measure of warming potential of a greenhouse gas in terms of carbon dioxide for comparative purposes. For example, methane is 22 times stronger than $C0_2$, so one tonne of methane is equal to 22 tonnes $eC0_2$.

DEV - Diesel-electric hybrid vehicle, which combines a diesel engine and an electric motor to move the vehicle.

Ethanol - An alcohol fuel that can be made from any feedstock containing sugar, and is mixed with gasoline. It has not been practical to mix ethanol with diesel fuel.

GHG - Greenhouse Gas: Natural or anthropogenic gas whose presence in the atmosphere causes the greenhouse effect. The burning of fossil fuels, and changes in land use are the two most significant anthropogenic sources of greenhouse gases (GHG), resulting in an enhanced greenhouse effect. GHGs include CO_2, CH4, NOx, HFCs, PFCs, and SF6.

GFIP – Green Fleet Implementation Plan also known as the “Plan”

HC - Hydrocarbons, an air pollutant and precursor of smog.

HEV - Hybrid-electric vehicle: any vehicle that uses a combination of an internal combustion engine and an electric motor.

HLA - Hydraulic launch assist: a hybrid system combining a diesel engine and a mechanical acceleration booster.

NGV - Natural gas vehicle: any vehicle that uses natural gas in place of

gasoline. May be either “dedicated”, using natural gas only, or bi-fuel, able to use either natural gas or gasoline.

NOx - Nitrogen oxides in general which are precursors of smog.

NO_2 - Nitrogen dioxide: a gaseous air pollutant and also a greenhouse gas.

Off Road Diesel - In Ontario, off road diesel is exempt from the provincial road tax and is dyed red to distinguish it from clear diesel that is subject to tax.

PM - Fine particulate matter: small particles suspended in the air that can be inhaled.

Smog - Ground level ozone together with a number of pollutants emitted into the air as a result of the combustion of fossil fuels which react with sunlight to produce a haze that impacts human health.

SO_2 - Sulphur dioxide: a gaseous air pollutant and precursor of smog and acid rain.

SO_4 - Sulphate: a particulate air pollutant.

ULSD – Ultra low sulphur diesel produced following a new regulation introduced in 2006. Sulphur content is reduced to 15ppm from 500.

VOCs - Volatile organic compounds, including benzene and formaldehyde, which are precursors of smog.

1.0 INTRODUCTION

1.1 Executive Summary and New Green Fleet Initiatives

In 2005 City of Thunder Bay City Council adopted policy 04-02-02- Environment and Sustainability, committing the City to demonstrate leadership and continual improvement in the practice of environmental management and performance. In order to meet the environmental policy objectives, a community vision for sustainable environmental management was developed and included within the City of Thunder Bay 2007-2010 Strategic Plan.

The City Strategic Plan, Initiative 17 required the development of a Green Fleet Implementation Plan having the objective of a long term plan to reduce greenhouse gas emissions.

A community wide Greenhouse Gas Emissions Inventory, including emissions from municipal operations was organized and managed by Earthwise Thunder Bay. This resulted in a Community Environmental Action Plan (CEAP) 2008 adopted by City Council in October 2008.

Ten principles guide the municipal environmental decision making process and include;

1. Energy Conservation;
2. Environmental Legislation;
3. Innovation and technology;
4. Resource Conservation;
5. Communication and Consultation;
6. Environmental Education;
7. Community Involvement;
8. Environmental Action Plan;
9. Precautionary Principle;
10. Green Procurement.

The City of Thunder Bay currently operates over 600 licensed and off road motorized units (small motors not included). Fuel represents over 30% of the overall expense for the City's fleet, with actual costs exceeding $4 million in 2008. As a large consumer of energy, the City has an influential role in utilizing more efficient vehicle technology that reduces both energy consumption and its environmental impact.

Fleets are responsible for a large portion of the air pollutants produced in the course of daily municipal operations. Vehicle engines produce many times the mass of carbon dioxide compared to the fuel consumed. These emissions contribute to poor air quality adversely affecting health and climate change that may have serious long term consequences.

This Green Fleet Implementation Plan (GFIP) does not currently include recommendations for vehicle purchases within Police, Fire, and EMS departments, noting the specialized vehicles being used and the limited options that exist for these service areas. These departments do utilize city fueling sites and fleet training services and this Green Fleet Plan includes emissions reduction options for these areas using strategies for alternate fuels and driver training and education.

Emissions reduction strategies focus on consumption reductions, use of alternate fuels, new and emerging emission reduction technologies where available and cost beneficial, and operator training and development programs.

Proven emissions reduction options are available in limited number today and are included in this plan where applicable. Participation in anti-idling campaigns has shown to be successful and this plan includes the new idling reduction procedure for City vehicles.

New and emerging technologies, such as low emission vehicles will continue to be monitored and introduced into City operations where practical and fiscally possible. Bio-diesel and ethanol fuel options have been tested since 2006.

This strategic plan will establish the framework to reduce by 2016 the annual Corporate fleet emissions (Table 4) by up to 2100 tonnes or 21.5% from 2005 baseline levels (table 1) and contribute towards the Community Environmental Action Plan (CEAP) and its goal of reducing GHG emissions. From 2009 to 2016 inclusive, the plan is expected to reduce emissions from internal combustion engines by 9774 tonnes overall combined.

Summary of New Green Fleet Initiatives

- A phased implementation of Biodiesel fuel is recommended in all fleet areas. Starting with B5 Blend biodiesel in 2009 and 2010 and increasing the blend by 5 % every two years there after to 2016 reaching a blend rate of B20.

- Biodiesel blend fuel has the ability of reducing fleet $eC0_2$ emissions by 5770 tonnes from 2009 to 2016. Biodiesel blend fuel testing shows an increase over current consumption by 3 to 5 % and is projected to increase diesel fuel costs by $927,200 from 2009 to 2016. (table 5)

- Continuation of the new anti Idling procedure with the goal of reducing $eC0_2$ emissions by 95 tonnes annually. No additional costs are necessary to maintain or enhance the existing idling procedures.

- In 2009 introduce NRCan Smart Driver program with the goal of reducing $eC0_2$ emissions by 95 tonnes annually. A one time train the trainer cost of up to $2000 is proposed for this initiative.
- Continuation of efficiency programs related to utilization of vehicles with the goal of reducing $eC0_2$ emissions by 95 tonnes annually. This program has commenced and will continue in 2009 with the Fleet Services Division consulting with operating Divisions to ensure maximum efficiencies while maintaining approved public service levels. Eg- route optimization, passenger pooling.

- Participate in a hybrid technology study offered by Canadian Urban Transit Association (CUTA) to seek efficient and effective fleet products with the goal of reducing fleet fuel consumption, engine emissions and operating costs. The report will be available in the summer of 2009 and will outline current and future hybrid transit technologies along their respective operating details. This report will also include comprehensive decision tools for administration to use in future transit bus purchases.

- Continue to investigate pilot projects utilizing electric vehicle and other heavy truck hybrid technologies as they become available in Thunder Bay and recommend unique opportunities which result in cost effective and reduced fuel consumption and emissions. Currently low speed electric vehicles are not yet approved for use in Ontario. Fleet Services continues to request options for hybrid and new technologies in all Tenders and Proposals for equipment acquisition.

- Continue right sizing of fleet units. Annual fuel savings from each smaller light duty vehicle is expected to reduce consumption up to 600 litres each annually. Fuel reductions from heavy fleet vehicles are contingent on operational service levels and weather related events. It is estimated that the 400 units scheduled to be replaced in the next eight years will have more efficient engines along with improved performance. In addition new vehicle engines will be required to improve fuel economy overall to assist with our goal of reducing $eC0_2$ emissions by 95 tonnes annually. No additional costs are necessary to right size fleet units.

- Completion of the Fleet Challenge Ontario E3 Fleet Rating program to achieve a minimum Silver Rating Status. Major components within the E3 Fleet Rating program are;

    1. Completion of the E3 Fleet Review (completed in 2008)
    2. Completion of a Green Fleet Plan (now)
    3. Effective idling reduction program (in place 2008)
    4. Effective fuel and maintenance data management (in place)
    5. Route optimization strategies for fleet operators (discussions in 2009)
    6. Effective fleet procurement program and standards for emissions reductions.
    7. Alternate fuels and technologies program. (now)

1.2 Purpose

The purpose of this plan is to present a sustainable strategy for the City's fleet of vehicles and equipment that will continually reduce harmful pollutants and emissions.

1.3 Objectives

The objective of this plan is to guide the reductions of greenhouse gas emissions ($eC0_2$) from the 2005 baseline emissions (table 1) by the year 2016 as noted in the Community Environmental Action Plan.

Emissions reductions are recommended through changes in fuels, vehicles, and use efficiencies. Benefits can be measured in terms of social, economic and environmental benefits, such as improved energy efficiency, reduced traffic on city roads, cleaner air and reduced GHG emissions contributing to a better quality of life, and reducing health care costs in the long term.
This Green Fleet Implementation Plan makes a contribution to the Governments of Ontario and Canada's commitment to the reduction of harmful vehicle emissions.

1.4 Emissions Sources

This Plan uses carbon dioxide equivalent (eCO_2) emission reduction at the vehicle tailpipe as the indicator of environmental improvement. The term is used as a consistent measure in the Kyoto Protocol to identify the six greenhouse gases that contribute to climate change and are targeted for reduction. Reducing fuel consumption, using cleaner fuels and improved emissions technology assists in lowering the five key air pollutants that have been consistently linked to health problems. These include ground-level ozone, fine particulate matter ($PM_{2.5}$), carbon monoxide (CO), nitrogen dioxide (NO_2) and sulphur dioxide (SO_2).
Smog is eventually formed in the air by a reaction between nitrogen oxides (NOx) and volatile organic compounds (VOCs) in the presence of sunlight.

Fine particulate matter is the solid or liquid particles in the air that are small enough to be inhaled. These include acid aerosols, sulphates, metal fumes, organic chemicals and smoke. Vehicle exhaust is a significant source of fine particulates.

2.0 INITIATIVES

2.1 Studies and Analysis

The following studies and analysis' were utilized in the preparation of this Green Fleet Implementation Plan.

- City of Thunder Bay 2007-2010 Strategic Plan
  Greening of the Fleet Implementation Plan Initiative #17 having the objective of a multi year plan to reduce GHG emissions.

- Earthwise Thunder Bay - Community Environmental Action Plan (CEAP)-2008

- Local Governments for Sustainability (ICLEI)
  Greenhouse Gas Emissions Inventory and Local Action Plan for Emission Reductions -- January 2008.

- Canadian Energy Efficiency Alliance and Fleet Challenge Ontario E3 Fleet Review Analysis, report and recommendations on the City of Thunder Bay fleet performance. (completed in 2008 using 2007 fleet data)

This document is a strategic action plan that will assist in achieving the goal of reducing harmful combustion engine emissions while improving local air quality. The action plan also focuses on reducing the consumption of non-renewable energy and the wasteful use of energy.

2.2 Fuels

Alternate fuels options are increasing and in order to recommend any fuel options, Fleet Services initiated pilot programs to test wheat based Ethanol blend gasoline (E10) and soy based biodiesel blend diesel fuels (B5 and B10). Testing of these alternate fuels has been in progress since 2006. The 2008/09 Tender for supply and delivery of fuel for City operations has also included options to supply and deliver blended fuel varieties, in the event the City wished to proceed in full or part of the volume required.
Cost per litre in 2009 for these alternate fuel blends was slightly higher than conventional fuel.

2.3 Fleet Vehicles and Climate Change

Vehicle engines today consume large volumes of air to burn fuel to produce energy. Oxygen is consumed in the internal combustion process and the exhaust emissions contain large amounts of carbon dioxide ($C0_2$) as a result. Approximately 2.4 kilograms of eCO_2 at tailpipe are produced for each litre of gasoline burned and 2.7 kilograms of eCO_2 at tailpipe are produced for each litre of diesel fuel burned. (See also Table 3 for fuel type GHG coefficients)

2.4 Vehicle Replacement Requirements 2009 – 2016

The Fleet Services Division Asset Management Plan includes the replacement of approximately 50 fleet units annually to 2016 with the latest engine technology and emission standards. Emission standards for 2007 engines and beyond have emissions technology resulting in up to 90% less smog forming pollutants than those of the vehicles being replaced. The annual capital replacement cost forecast to 2016 requires approx $4.5 million annually to maintain a current, safe, reliable, and efficient fleet.
(NOTE: vehicles for Police, EMS and Fire vehicles are in addition to the above planned cost).

Prior to being selected for replacement, fleet units must satisfy a comprehensive qualitative and quantitative review and assessment. Only those units not meeting lifecycle, safety, physical, or operational standards are recommended for replacement. All units deemed surplus by replacement are sold at auction or sealed bid process.

The Fleet Services Division provides vehicles and support services to meet needs of the many operating divisions in maintaining an appropriate service level to the public. It is expected that the number of fleet units in service from now to 2016 will remain constant unless service levels currently provided are increased or decreased by individual operating divisions.

2.5 Best Practices Approach

To prepare this plan, similar programs currently in place in Canada have been reviewed. Fleet Services is also a member of the Canadian Association of Municipal Fleet Managers (CAMFM) who regularly review best practices and strategies for GHG reductions and operating costs. Natural Resources Canada (NrCan) has useful data and tools to assist with GHG calculations and reductions opportunities in addition to the Fleet Smart driver training program.

Fleet Services along with Fleet Challenge Ontario and E3 Fleet has completed a comprehensive fleet review based on many factors such as utilization, fuel usage, asset age, and sample benchmarks to allow fleets to compare performance within their respective fleet sections and eventually with other E3 Fleet participants in Canada. The OMBI benchmarking initiative has been completed annually for municipal fleets since 2005 and provides a means of comparing fleet operating costs.

2.6 Idling Reductions

A component of this plan includes reductions of unnecessary idling of combustion engines through driver training, education programs and the use of effective idling reduction technologies available. The Facilities and Fleet Department, is responsible for the overall administration of the Driver Development Policy No.13-01-03 through its' Fleet Training Section. The Driver Development Policy provides for the continuous training, monitoring and licensing controls for the purposes of reducing collisions, fleet operating costs and or personal injuries.

In 2008 Fleet Services has added a new procedure AH-100-07 'Engine Idling Procedures' (Attachment A) and includes restrictions and permissions for idling of combustion engines. Fleet Services Division has also installed "Idle Free Zones" at seven City yards. Signage (Attachment B) posted at the entrances to the seven of the main city operation yards and noting them as "Idle Free Zones" promotes awareness and education with the goal of reducing unnecessary idling, consumption of fuel, emissions reductions and engine wear.

3.0 STRATEGIES FOR VEHICLE EMISSIONS REDUCTION

Strategy - 1 Fuels used in combustion engines
Strategy - 2 Procurement of fleet assets
Strategy - 3 Operator education and training
Strategy - 4 New and Emerging technologies
Strategy - 5 Fleet efficiencies

3.1 Strategy - 1 Fuels Used in Combustion Engines

The City of Thunder Bay fleet corporately consumes approximately 2.7 million litres of diesel fuel and 1 million litres of gasoline annually (see table 1). Thunder Bay Transit buses alone consume up to 1.7 million litres of diesel fuel annually which accounts for almost 50% of the GHG produced by vehicle fuels.

An important aspect of biodiesel is the reduction in GHG compared to using regular petroleum fuels. Other benefits of biodiesel include lower sulphur content, the resulting reduction of contaminants that contribute to smog formation, and lower toxicity which reduces the potential harm caused by fuel spills.

Some manufacturers of on road vehicle engines in use by the City's fleet have approved biodiesel blend fuels of up to 20% for engines produced after 2002.
Most engine manufacturers only recommend blend rates of up to 5% at this time.

The City of Thunder Bay currently purchases bulk volumes of unleaded gasoline and diesel fuel through a public tender process. The most recent tender for the Corporate bulk fuel purchase in 2008/09 requested option pricing for alternated fuels. The resulting pricing was 1 cent per litre higher in cost for B10 blend Biodiesel than conventional diesel fuel and up to 4.5 cents per litre higher for Ethanol E10 Blend than conventional unleaded gasoline. The Government of Canada also adopted legislation in 2006 requiring all diesel fuel sold in Canada for use by on road vehicles to be Ultra Low Sulphur Diesel having maximum sulphur particulates of 15 parts per million (PPM) down from 500 produced by Low Sulphur Diesel used prior to 2006.

Sulphur in motor fuel has a direct impact on air quality. When $S0_2$ levels in exhaust emissions are lowered, it enables the use of after-treatment devices that can reduce emissions of other air pollutants such as particulate matter and toxic gases, including HC, VOCs and NOx, which combine with ozone to create smog.

As a result of the alternate fuels pilot projects, biodiesel blend fuel is being recommended in this plan. The recommendation is to phase in the use of biodiesel blend fuels in increments of 5% over an eight year period to allow manufacturers and our fleet replacements to permit higher blend fuels. (Table 4).

Biodiesel is well suited to the fleet needs and represents an affordable, renewable and sustainable solution for reducing eCO_2 from the corporate fleet.

Emission reductions for various fleet emissions strategies are noted in Table 4.

It is estimated that Buses using biodiesel blend fuel will have an increase in fuel consumption between three (3%) to five (5%) percent, when compared to previous

consumption using regular diesel fuels. Heavy trucks using biodiesel blend fuel are showing fuel use marginally higher than that of regular diesel fuel overall.

For over a year, Ethanol E10 blend fuel has been tested in four City pickups, as well as B5 and B10 blend biodiesel fuel in five heavy trucks and three Transit buses. Vehicle performance, fuel economy, and maintenance costs associated with the use of alternate fuel were reviewed and compared to conventional fuels. The result of tests for the units using Ethanol blend fuel has generally showed no change to the overall operation of the units, with the exception of fuel economy. Calculations of fuel economy noted the test units using Ethanol E10 during the test period decreased in average fuel economy by approximately ten (10%) per cent. Ethanol blend fuel does not provide a good return on emission reductions due to the fact of increased consumption for the same service level resulting in an additional annual cost of $150,000 to the Corporation.

3.2 Strategy 2 Procurement of Fleet Assets

In order to effectively reduce emissions, reduction of fuel consumption will be the main focus of this plan while incorporating equipment and practices that reduce fuel consumption, emissions and idling of any fleet unit.

Reduction of fuel consumption can be managed though the purchasing of fuel efficient and right sized vehicles as a standard practice across all divisions, where they are commercially available and meet operational needs. Approximately 50 vehicles/equipment units are replaced annually with the latest emissions technology commercially available in Thunder Bay.

Recent and ongoing vehicle procurement with reduced emissions:

- Replacing older street sweepers offer better sweeping performance that trap fine street debris particulate matter (PM_{10}) pollution in addition to having cleaner diesel engines.

- Fleet Services has investigated the options and costs for adding electric, zero-emission ice resurfacers and forklifts within the City's fleet. Options for the introduction of these new and emerging technologies will be reviewed and considered in future capital replacements. Fleet Services will also continue to review the merits of natural gas vehicles.

- Increase low power LED lighting, batteries, inverters, space heaters and other auxiliary equipment that reduces the need to idle a vehicle for long periods in order to operate lights, arrow boards and other necessary tools where possible.

- In the last 12 months Fleet Services has replaced nine full size pickups with midsized pickups which fuel consumption ratings indicate have 18% improved fuel economy over full size half ton pickups of the same make. General fleet pickups and vans account for approximately 25% of the fleet or 150 units. It is estimated

that one third of this class could be changed to smaller units when the units are due for replacement.

- Two SMART cars were introduced within the Building Services Division in June 2007 to offer opportunities for cost savings, education, promotion of low emission vehicles, and reduction of GHG while performing the similar work. After one year of use, calculated savings using each Smart Car has shown a $ 1,900.00 savings, in lieu of paying mileage to staff using their own vehicles for City business. Actual fuel consumption for the first year of use was calculated at 5.6 litres per 100 km (city and highway combined) compared to the new vehicle fuel economy rating of 4.6 litres per 100 km (combined). Vehicles typically used for the same work had fuel consumption of more than 10 litres per 100 km.

- Delivery in 2008 of eight new buses, nine motor graders and six new heavy trucks which use the newest 2007 EPA emissions standards reducing smog forming emissions by 90% for hydrocarbons (HC), 98% for nitrogen oxides (NOx), and 98% for particulates compared to the vehicles being replaced.

- All equipment replacement tenders request options for the latest emission reduction available within each specific vehicle/equipment class.

The long term fleet capital replacement plan recognizes the importance of replacing less effective vehicles built prior to 1996 and continues to seek green fleet alternatives as they become available and reasonable in cost and performance.

3.3 Strategy 3 Operator Education and Training

2008 Fleet Initiatives have focused on opportunities which include low emission vehicles, right sizing options, new emissions technologies for new fleet purchases, fleet training and driver education, all with the goal of improving fuel economy, reducing idling and reducing overall vehicle GHG emissions.

Driver behaviour and habits can affect vehicle performance either in a positive or negative manner. Drivers and operators who are well informed of optimum vehicle performance are more likely to have better fuel economy and fewer breakdowns than operators who are uninformed.

Natural Resources Canada (NRCan) Office of Energy Efficiency offers a new no fee program called “SmartDriver in the City”. The program is delivered in a number of topical segments and assists fleets to lower their fuel consumption, reduce wear and tear on vehicles, improve driver skills aimed at lowering vehicle accidents or damages and help to improve the company image by ensuring a cleaner healthier environment.

Fleet Services proposes to supplement existing fleet training programs with programs like the NRCAN “SmartDriver in the City” program starting in 2009 for all existing and new operators.

Fleet Services continues to provide new vehicle orientation upon delivery. New vehicle vendors are required to provide specialized operator orientation to operators ensuring in depth knowledge of the vehicles used day to day. Fleet Services will be continuing to improve driver performance through increased training and education of all municipal vehicle operators.

Fleet Services is estimating up to 2% reduction in fuel consumption and even a greater return with reduced vehicle incidents by including programs like the “SmartDriver in the City” program. Return on investment in this area will be monitored by fuel use and annual reports for vehicle related incidents.

3.4 Strategy 4 New and Emerging Technologies

Hybrid-electric vehicles (HEVs) have been in production since 1997 with a limited production of hybrid pickups and hybrid utility vehicles. Today additional hybrid options are available to consumers and fleets utilizing second generation and even third generation improvements.

HEVs are estimated by manufacturers to reduce fuel consumption by up to 50%, compared with similar conventional models, and emissions of key air pollutants are reduced by over 50%. When fuel consumption is reduced, all exhaust emissions are also reduced, including eCO_2 and the compounds which produce smog.

HEVs are the best in vehicle efficiency in the last several years. The initial models of HEVs were all small cars, which limited their usefulness for the City. As more pickups and light duty trucks become available with hybrid systems, the City may have applications for effective use of HEVs. The additional cost for hybrid cars and pickup vehicles exceeds $5,000 based on current available models. Hybrid options for heavy trucks are becoming available for commercial uses, however the capital cost increases are now 50% over conventional truck engine options. Pay back for heavy truck hybrid options exceed the life of the vehicle. Fleet Services has and will continue to request hybrid options in purchase tenders for all vehicle replacements.

The Canadian Urban Transit Association (CUTA) is currently undertaking a study to evaluate and report on the many hybrid bus systems available and their past, present and future performance and expectations of various models. The report is expected to be presented to participating municipalities by the end of the second quarter of 2009.

Recent public tenders for the purchase of diesel electric hybrid buses meeting Ontario bus standards for accessibility noted a price addition of just over $200,000 per bus, compared with conventional diesel powered buses. Comparing the average fuel usage per conventional bus current reported hybrid fuel consumption savings of up to only 15% the

annual fuel savings, resulting in only 7500 litres or approx $8000 per year at current pricing. Payback for the hybrid option would therefore exceed the expected life of the bus currently at 18 years. Hybrid buses need to be utilized in a slow paced stop and start environment to effectively reduce fuel consumption.
The current Thunder Bay Transit system has limited applications for slow start and stop traffic reducing the return of the hybrid operating system. Administration is not recommending the purchase of hybrid buses in 2009 or 2010 however will review the hybrid options following the CUTA report and continue to request and monitor hybrid options in tenders for new bus purchases.

Plug in hybrid/electric cars will increase in availability in the coming decade. With the introduction of higher performance lithium ion battery systems, the plug in hybrid/electric cars could travel up to 50km per day or more without the need for an internal combustion engine. Plug in hybrid/electric vehicles perform best in low speed and low acceleration travel. Currently only a few vehicle models are being tested with Plug in Hybrid/electric mode options with additional models coming available in the next few years. Plug in Hybrid/Electric options are approximately $10,000 over and above the hybrid car models available while posting twice the fuel economy than the hybrid only option at 2.8 litres per 100 km.

Significant emission reductions have been made over the last decade by gasoline powered, internal combustion engines. Today's new vehicles operating on gasoline have very low outputs of nitrogen oxides, carbon monoxide and hydrocarbons.

The long term goal for the automotive industry is to produce vehicles with zero emissions. One of the technologies for future power sources is fuel cells which convert hydrogen into electricity. While a few demonstration fuel cell vehicles are active today, the consensus in the industry is that affordable production of these vehicles is unlikely before 2020.
A test of hydrogen fuel cell buses in British Columbia is currently planned for 2009 in preparation of the 2010 winter Olympics. When data from the pilot fuel cell project is available Fleet Services will be able to report back to Council with any information on the project. Currently cost for a single fuel cell bus is in the range of $2.5 Million per unit.
A typical conventional accessible transit bus price per unit is approx $ 430,000 per unit including taxes. The payback for hydrogen fuel cell bus far exceeds its lifecycle, and the consistent availability of the required hydrogen fuel and storage systems are limited at this time.
Thunder Bay Transit has a relatively small transit fleet and having limited models in service benefits fleet availability, training of service personnel and reducing shop infrastructure and tooling costs.

Over the past few years an ever increasing number of vendors are approaching municipalities everywhere with offers for using their latest after market add on component or lubricant with the claim of large reductions of emissions. Most of these after market items are not well documented by performance testing and or validated by qualified and proven verification protocols and processes.

To ensure only tested and validated after market products are considered for use by the City, Fleet Services supports the direction of the Canadian Association of Municipal Fleet Managers (CAMFM) by requiring any vendor soliciting after market technologies with claims of improved vehicle performance and emissions reductions to have their product claims verified by a qualified testing laboratory. Testing laboratories such as ETV Canada (Environmental Technology Verification) have been supported by CAMFM as one of the few testing labs in Canada able to provide verification testing for technologies claiming reductions in emissions.
Other verifications acceptable are those provided by the original vehicle manufacturers. Most original equipment manufacturers discourage and void warranties for use of non approved lubricants, fuels, and added components.

3.5 Strategy 5 Fleet Efficiencies

IDLING

Idling is defined as leaving a vehicle‘s engine running unnecessarily while the vehicle is parked, either in a yard or at the side of a roadway and not required for powering of tools or equipment.

Fleet Services has added a new procedure AH-100-07 ‘Engine Idling Procedures’ (Attachment #1 and #2) and includes restrictions and permissions for idling of combustion engines. In addition to the implementation of the new engine idling procedures, Fleet Services Division has installed signage (Attachment B) at the entrances to seven of the main city operation yards to create “Idle Free Zones” within these City yards. The “Idle Free Zone” signage is to promote awareness and education with the goal of reducing unnecessary idling, consumption of fuel, harmful emissions and engine wear.
Transit buses have electronics which allow automatic shutdown after ten minutes of idling. The ten (10) minute limit for transit buses was reduced from fifteen (15) in 2008.
Bus idling at terminals is required where passengers are on board and where ventilation equipment is needed to operate. The idling reduction program is expected to achieve up to 1 % reduction in fuel consumption along with limited reductions in engine wear.

VEHICLE USE AND OPTIMIZATION

Fleet Services has engaged discussions with Divisions utilizing city vehicles and equipment with the goal of rationalizing fleet assets, reducing fuel consumption and increasing fleet efficiencies. Discussions with operating areas will continue in the first quarter of 2009 to establish goals and opportunities for reducing fleet cost and energy consumption.

4.0 IMPLEMENTATION SCHEDULE

Implementation of some fleet efficiencies is subject to available annual funding and the any required City Council approvals. Measures to improve the environmental impact from vehicles operated by the City of Thunder Bay have been in progress since 2004 with the introduction of EPA Tier 2 diesel engines and a structured capital replacement plan to replace pre 1996 units which were designed and built with less effective emission standards. Availability of alternate technologies is requested in all tenders for procuring new vehicles and will be evaluated at each purchase.

Continuing diligent preventive maintenance programs and an effective Capital Asset Management Program have resulted in emissions improvements since 1999 required by the annual provincial diesel engine emissions testing.

It is assumed in both cases that biodiesel blend fuel use would begin by the middle of 2009 and continues through 2016. Ethanol is not recommended for use in the city fleet due to the cost increase to implement ethanol fuel use as well as a marginal reduction of $eC0_2$ emissions overall.

Improving operator driving skills with the goal of reducing fuel consumption is an essential part of this plan. Starting in mid 2009 Fleet Services will introduce the NRCan SmartDriver program. This program has no fees and offers instruction materials and programs for our Fleet Training sessions with city fleet operators.

Fleet Services has started a process of meetings with divisions operating fleet vehicles with the purpose of reviewing policies relating to fleet utilization, use of employee supplied vehicles for city business, and vehicles approved for after hours use and vehicles going home. Fleet services will be providing recommendations based on these discussions in 2009.

A procedure to regulate and reduce vehicle idling has been prepared by Fleet Services and was forwarded to all City sections in October 2008 for implementation and monitoring. (see Attachment #1)

Fleet Services will continue to ensure all operating Divisions are up to date with the procedure for monitoring idling and measuring reductions and regularly providing employees with instruction to maintain compliance.

5.0 RETURN ON INVESTMENT

Fleet greening is an investment in efficiency and planning.

Hybrids create less pollution by being more fuel efficient however they are an interim step that must be perfected before they become more affordable and payback is within the physical life of the hybrid components.

Biodiesel and ethanol blend fuels are the first alternate fuels that do not require a significant infrastructure or business process change, unlike natural gas or hybrid systems.

The return on investment could be measured in terms of progress towards greater efficiency in vehicle technology and changing from conventional fossil fuels to those from renewable sources. Most new technologies carry a higher price when first introduced and decrease as production levels increase. The same is to be expected for hybrid vehicles and biofuels.

The return on investment for the anti idling initiatives is difficult to estimate however industry standards note a 1% reduction in the fuel consumption could be reasonably achieved with an idling reduction program. For the City of Thunder Bay this would result in a potential reduction of fuel by 37,000 litres annually. The idling rules will not eliminate all idling, nor will the reduction be evenly distributed across all equipment types. Another benefit of this policy will will be social marketing, by demonstrating care and reducing wasteful practices.

6.0 OTHER CONSIDERATIONS

This plan was developed primarily for the fleet operated by the City of Thunder Bay. Consideration for similar emissions reductions for services delivered by external service providers (contractors working for the City of Thunder Bay), may also need to be assessed as part of any municipal green procurement initiatives and evaluations. This point is important as contracted services would automatically reduce the fuel use and eCO_2 emissions from the corporate fleet. However, the contractor fleet is an additional source of eCO_2 emissions resulting from work completed for municipal operations. The City does not currently take emissions into consideration when evaluating the use of contractors to provide municipal services however these emissions are included within the emissions from the community.

The emissions reductions and recommendations within the ICLEI Emissions inventory do not quantify or include reductions of smog producing emissions as they focus solely on reductions of $eC0_2$ emissions. Vehicle engine technologies today reduce smog producing

emissions by 90% compared with vehicles produced before 2000. These added value air quality emissions improvements are not included in the emission reduction calculations within this report or within the GHG emissions reduction target set out by the CEAP.

The Federal Government has approved legislation to require mandatory use of renewable fuels for vehicles starting approximately 2010 to 2012. As details become available Administration will be able to update this plan to include the mandatory use of alternate fuels and the emissions changes they allow.

There are new requirements for vehicle paint materials which will take affect in 2009 requiring all paint materials used in the manufacture of vehicles to be water based products greatly reducing volatile organic compounds (VOCs) and their affect on smog forming pollutants. These VOCs reductions are not included in GHG reductions.

7.0 CONCLUSIONS

Fleet tailpipe GHG and Smog forming emissions have been declining since 2002 with the introduction of strict measures for the manufacturing of vehicles and the internal combustion engines which propel them. Additional emissions reduction requirements are to be in place for the 2010 model year vehicles including off road equipment emissions reduction limits. These new emission reductions will see smog forming emissions reduced by 90% from 2002 levels.

This strategic plan will establish the framework to reduce by 2016 the annual Corporate fleet emissions (Table 4) by up to 2100 tonnes or 21.5% from 2005 baseline levels (table 1) and contribute towards the Community Environmental Action Plan (CEAP) and its goal of reducing GHG emissions. From 2009 to 2016 inclusive, the plan is expected to reduce emissions from internal combustion engines by 9774 tonnes overall combined.

The Plan will be updated every three (3) years to review target achievements as well as seeking opportunities for further emissions reductions as technology improves and availability and affordability change.

Table 1

2005 Base Year Vehicle Fleet Emissions (tonnes) by Fleet Section

Vehicle Group	Number of Vehicles	Gasoline Volume (L)	Gas GHG (t)	Diesel Volume (L)	Diesel GHG (t)	TOTAL GHG (t)
Fire Dept Fleet	31	9,566	23	52,863	144	167
EMS Fleet	48	52,139	123	65,762	180	303
Police Fleet	65	353,313	834	2,863	8	842
Municipal Fleet	435	495,402	1,169	980,025	2,675	3,844
Transit Bus Fleet	49	N/A	N/A	1,681,139	4,590	4,590
Total	628	910,420	2149	2,782,652	7597	9746

In 2005 municipal fleet units accounted for 27.4 % of the local government green house gas production.

Table 2

2005 Base Year Fleet GHG Summary by Fuel Type

Energy Type	Total Use	Total GHG (t)	% -Total Fleet GHG
Diesel (L) Municipal Fleet	1,101,513	3,007	31
Diesel (L) Transit	1,681,139	4,590	47
Gasoline (L)	910,420	2,149	22
Total	3,693,072	9,746	100

Table 3

Fuel Emission Coefficients Used in Thunder Bay's GHG Inventory

Fuel Type	Units	eCO2 Kg/litre
Diesel ULSD	Litres (L)	2.73
Biodiesel (B5)	Litres (L)	2.59
Biodiesel (B10)	Litres (L)	2.46
Biodiesel (B20)	Litres (L)	2.18
Gasoline	Litres (L)	2.36
Ethanol (E10)	Litres (L)	2.12
Ethanol (E85)**	Litres (L)	0.35

** E85 is not currently available to the City of Thunder Bay
*** Natural gas vehicles have limited purchase availability along with high cost of implementation.

Table 4

Annual Projected Green House Gas (GHG) Reductions ($eC0_2$ Tonnes) by Reduction Strategy

STRATEGY	INITIATIVE	2005 Base	2009 Base	2009	2010	2011	2012	2013	2014	2015	2016
1	Municipal Fleet Diesel (ULSD)	3007	2629	2629	2629	2629	2629	2629	2629	2629	2629
1	Transit Fleet Diesel (ULSD)	4590	4641	4641	4641	4641	4641	4641	4641	4641	4641
1	Municipal Fleet Gasoline	2149	2327	2327	2327	2327	2327	2327	2327	2327	2327
1	Municipal Fleet Biodiesel			-30 B5	-60 B5	-189 B10	-189 B10	-328 B15	-328 B15	-467 B20	-467 B20
1	Transit Fleet Biodiesel			-53 B5	-106 B5	-333 B10	-333 B10	-579 B15	-579 B15	-824 B20	-824 B20
1	Municipal Fleet Ethanol (E10)										
3,4,5	Idling policy reductions (1%)			-95	-95	-95	-95	-95	-95	-95	-95
2	Right size vehicles (1%)				-95	-95	-190	-190	-190	-190	-190
3,5	Driver Training (1%)				-95	-95	-95	-95	-95	-95	-95
3,5	Vehicle Use Efficiencies (1%)				-95	-95	-95	-95	-95	-95	-95
4	New and Emerging Technologies					-95	-95	-95	-190	-190	-190
2,4	Legislated EPA emissions	EPA emissions relate to reduction of Smog forming pollutants not GHG									
	Total GHG ($eC0_2$) Produced by Year of Program	9746	9597	9419	9051	8600	8505	8120	8025	7641	7641
	GHG ($eC0_2$) Reduction - Tonnes										2105 (21.6%)

Table 5

Implementation Costs (accumulated 2009 to 2016)

Energy Type	Total litres (2009 to 2016)	Consumption Increase (Decrease) 2009 to 2016	Cost for fuel consumption increase (decrease) 2009 to 2016 (3%inflation added)	GHG Reduction tonnes 2009 to 2016	Implementation cost 2009 to 2016 (3% inflation added)	Total Added (decrease) Cost for Strategy Options 2009 to 2016	Cost or (savings) per tonne of GHG Average 2009 to 2016
Biodiesel Fuels*	21,944,000 Litres	640000 Litres	$707,200	5689	$220,000 (1 c/lt)	$927,200	$162.98 (5689 tonnes)
Ethanol E10 Fuel** NOT RECOMMENDED	8,676,800 Litres	788800 Litres	$871,264	224	$400,000 (4.5 c/lt)	$1,271,264	$5,676,89 (224 Tonnes)
Idling Reductions (1%)		(296000 litres)	($327,080)	760	0	($327,080)	($430.36) (760 tonnes)
Vehicle Right Sizing		(440000 litres)	($502,830)	1140	0	($502,830)	($441.08) (1140 tonnes)
Driver Training (1%)		(259000 litres)	($290,080)	665	0	($290,080)	($436.21) (665 tonnes)
Vehicle Use Efficiency (1%)		(259000 litres)	($290,080)	665	0	($290,080)	($436.21) (665 tonnes)
Alternate Technology Hybrids		(333,000 litres)	($382,950)	855	$100,000 (20 units)	($282,950)	($330.93) (855 tonnes)
Totals		(947000 litres)	($1,085,820)	(9774)	$320,000	($765,820)	

- * pilot project tests indicate an increase in consumption of up to 3% with the use of Biodiesel blend fuels.
- **Pilot project tests indicate an increase in consumption of over 10% using of E10 ethanol blend fuel. (not recommended)
- any bio diesel implementation would be able to start approximately mid 2009

ATTACHMENT #1 – IDLING PROCEDURE

SECTION:	**FLEET TRAINING**
DEPARTMENT:	FACILITIES AND FLEET
DIVISION:	FLEET SERVICES
SUBJECT:	**COMBUSTION ENGINE IDLING PROCEDURE**

POLICY REFERENCE:

Corporate Policy 13-01-03 – Driver Development

DEFINITIONS:

Idling:
The operation of any vehicle or equipment which is not in motion, is not being used to operate auxiliary equipment and that is not essential to the basic operation of the vehicle.

Vehicle or Equipment::
A motor vehicle, trailer, traction engine, farm tractor or road-building machine as defined in the *Highway Traffic Act* and any vehicle drawn, propelled or driven by any kind of non-muscular power. Vehicle also includes a motorized snow vehicle (or other which operates by way of a combustion engine) *and* personal vehicles used for work related activities.

Transit Vehicle:
Public transit vehicles, tour buses and motor coaches.

Stopover:
A scheduled delay of a maximum of 10 minutes at a public *transit vehicle terminal* to allow public transit vehicles to adjust service schedules.

Mobile work vehicles:
i) a vehicle containing equipment that must be operated within or in association with the vehicle (i.e. garbage and snow removal vehicles); or
ii) a vehicle used for the purpose of police, fire or ambulance service.

Combustion Engines:
i) An engine whose fuel is burned inside the engine itself and includes those powered by gasoline or diesel fuel,

Idle Free Zones:

The following City Operations sites have been designated “Idle Free Zones”.

155 Front Street – North Operations Yard

410 Mountdale Ave – South Operations Yard

645 Cumberland Street – Parks North

625 Cumberland Street – Street Lighting

570 Fort William Road - Transit

901 Atlantic Ave – Water Pollution Control Plant

RR 13 Bare Point Road – Water Treatment Plant

PROCEDURE STATEMENT:

Unnecessary combustion engine idling impacts air quality, respiratory health, increases operational costs and wastes vehicle fuel.

This procedure applies only to vehicles and equipment operated by the Corporation of City of Thunder Bay and those hired under contract to perform services for the City of Thunder Bay.
This procedure includes idling restrictions exceeding those of By-law 131-2005, being a By-law to regulate noise in the City of Thunder Bay.

To idle a combustion engine for more than ten seconds uses more fuel than turning off the vehicle and restarting it again. If a vehicle is going to be stopped for ten seconds or more, the engine should be turned off.

PROCEDURE:

Employees of the City of Thunder Bay or those hired under contract to perform services for the City of Thunder Bay, shall not allow any vehicle or equipment engines to idle for more than ten seconds as stated in the definition of idling.

Workers/drivers/operators will:

• Abide by the 10 second rule: if stopped for more than 10 seconds in a non-operational setting, turn the vehicle off

• Follow these warm-up times for vehicles:
Heavy duty vehicles and equipment:
- Above 0 degrees Celsius (°C) up to 5 minutes
- Below 0°C up to 5 minutes
Light duty vehicles (cars, vans, light trucks and utility vehicles):
Gasoline Engines Diesel Engines
- Above 0°C up to 30 seconds
- Below 0°C up to 60 seconds
• Use recommended shut-down idle time of diesel engines: up to 30 seconds
• Ensure that oil pressure and air pressure are within the normal operating ranges, and all windows are clear of ice and snow before operating any vehicle.
• After a short warm up period, and for the first few minutes of use, operate the engine at a gentle throttle until the normal operating temperature is reached

The idling procedure **<u>does not</u>** apply to the following:

- Police, fire or ambulance vehicles while engaged in operational activities, including training and patient transfer activities;
- Vehicles assisting in an emergency activity;
- Mobile work vehicles while they are in the course of being used for their basic function;
- Vehicles where idling is required as part of the repair process or to prepare the vehicle for service;
- engines which require specific shut down procedures;

- During extreme cold weather/heat alerts where idling may be necessary for the well being of the operator and/or transit passengers and to ensure window areas are clear of frost.

- Vehicles engaged in a parade or race or any other event authorized by the municipality;

- Transit vehicles while passengers are embarking or disembarking en route or in terminals;

- Transit vehicles while at a stopover location and with passengers on the bus. *(where no passengers/operator are on board the engine should be turned off).*

- Vehicles transporting a person where a medical doctor certifies in writing that for medical reasons a person in a vehicle requires that temperature or humidity be maintained within a certain range;

- Vehicles that are required to idle in order to keep in operation a heating or refrigeration system necessary for the welfare or preservation of the cargo contained therein;

- Safety is the primary consideration of the operator. In situations where shutting off the engine may compromise safety, vehicles may idle under the discretion of the operator (i.e. stopped in traffic).

RESPONSIBILITIES AND ENFORCEMENT:

Idling is a community issue and requires broad participation. As leaders in the community, it is important that all City of Thunder Bay employees lead by example to demonstrate to the public a higher standard of care.

This procedure supports the reduction of exhaust emissions caused by unnecessary idling of combustion engines to improve air quality and respiratory health of all persons.

Managers and Supervisors will participate in the effective administration of this combustion engine idling reduction program, supporting it by both example and enforcement within their sections.

The Fleet Training Section may also monitor vehicles/equipment left idling or unattended by operators and may make appropriate recommendations to department Managers on performance.

ADDITIONAL REGULATIONS and PROCEDURES:

City of Thunder Bay By-law 131-2005 - a By-law to regulate noise in the City of Thunder Bay.

City of Thunder Bay Driver Development Procedure AH-100-04 - Unattended Vehicles.

City of Thunder Bay Driver Development Policy - 13-01-03.

ATTACHMENT #2 – IDLE FREE ZONE SIGNAGE