Introduction

Given today's increasingly pressing environmental concerns, along with soaring fuel prices and the likelihood of continuing increases, a great opportunity exists for the municipal fleet operator to seek out new cost efficiencies while taking a leadership role on environmental issues in their community.

The following 2008 Best Practices Manual has been prepared by Fleet Challenge Ontario through the Ontario Ministry of Finance's **Strengthening Our Partnerships** initiative, with the support of the Ontario Ministry of Transportation. This Best Practices Manual is part of a broader pilot program designed to assist Ontario municipalities in understanding and delivering on opportunities to instigate fleet efficiencies and achieve associated environmental benefits.

Information in this manual has been structured so as to provide an "end-to-end" blueprint for initiating, deploying, and maintaining a green fleet. Sections have been developed in consultation with Ontario municipal fleet stakeholders, fleet management experts, and by the study team. Where applicable, information has been supplemented by additional research.

It is expected that this Best Practices Manual, through providing discussion on and tangible examples of currently available and cost-effective automotive fleet management practices, will enable fleet managers to reduce the pollution that causes global warming and poor air quality, while at the same time saving money and improving workplace health and community livability.

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About Fleet Challenge Ontario

From September 2007 – March 2008, the Ministry of Finance, with the support of the Ministry of Transportation and through the *Strengthening Our Partnerships* initiative, funded a pilot program designed to effect change in Ontario’s municipal fleet sector: “Fleet Challenge Ontario”. Fleet Challenge Ontario was designed to assist Ontario municipalities in understanding and delivering on opportunities to instigate fleet efficiencies and achieve associated environmental benefits.

This objective was accomplished through the design and execution of the following three elements:

1. A set of 12 *pro bono* municipal green fleet reviews using the E3 evaluation framework. E3 has similar principles to LEED environmental certification for buildings but is fleet focused. E3 reviews were performed to ascertain fleet operating baselines and identify areas for cost-savings;

2. Three workshops in early 2008 in order to provide interested municipalities across Ontario with the information and access to tools and resources to be able to move forward on green fleet practices; and,

3. A Best Practices manual, which would showcase municipal efficiency achievements and key findings of the fleet reviews and workshop components. Upon publication, this manual would be made available to all municipalities and serve as an ongoing reference to fleet managers.

The following *2008 Best Practices Manual* has been prepared as part of the specified outcomes of the Fleet Challenge Ontario program. It is anticipated that this information will be of interest and provide ongoing economic and environmental value to municipal fleet managers, their constituents, and other stakeholders across Ontario and Canada.

Acknowledgements

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Background

Heatwaves, storms, floods and other disastrous weather events have focused global attention on the serious threat that climate warming poses to local communities. Recent findings of the Intergovernmental Panel on Climate Change indicate that the global warming process is progressing even more rapidly than expected. Warming of the climate system is unequivocal, as is now evident from observations of increases in global average air and ocean temperatures, widespread melting of snow and ice, and rising global average sea level. Eleven of the last twelve years (1995-2006) rank among the twelve warmest years in the instrumental record of global surface temperature since 1850, with 2006 being the warmest winter on record since 1880.

Global greenhouse gas emissions due to human activities have grown since pre-industrial times, with increases on order of 70% between 1970 and 2004. In urban areas, the major greenhouse gas emissions are carbon dioxide (CO2) and methane (CH4). Carbon dioxide is emitted when fossil fuel-based energy is used by households, institutional and commercial buildings, industry, and in particular: auto transportation.

Given today’s increasingly pressing environmental concerns, along with soaring fuel prices and the likelihood of continuing increases, a great opportunity exists for the municipal fleet operator to seek out new cost efficiencies and simultaneously take on a leadership role on community environmental issues.

To start, municipal fleet managers would be well served by careful review of their fuel expenditures, an asset management perspective of fleet operations and a clear mechanism or guidelines for reducing fleet fuel costs. Although not yet widespread, comprehensive data collection and evaluation is becoming gradually more recognized as critical to effective fleet operation and cost management. For example, Fleet Challenge’s work with 12 select Ontario municipalities has identified savings on order of close to 1 m liters of fuel and costs of almost $5 m for cumulative downtime and preventative maintenance, among other aspects.

This Best Practices Guide provides examples of currently available, cost-effective automotive fleet management policies and practices that can reduce the pollution that causes global warming, while at the same time saving money and improving workplace health and the livability of our communities. The basis for this guide is the collective experience of fleet management experts and select local governments in Ontario.

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1. The International Council for Local Environmental Initiatives (2007)
2. National Oceanic and Atmospheric Administration
3. Methane is emitted in urban areas as waste decomposes in landfills and from wastewater and sewage treatment processes.
While not an inclusive list of all the climate protection activities local governments are undertaking, these Best Practices demonstrate the potential for global warming prevention through local action.4

Structure of the Report

The following Best Practices Guide has been prepared to concisely describe how and what a municipality should consider in Creating a Green Fleet Plan (Section 1), Managing Green Fleet Assets effectively (Sections 2), Maintaining Your Green Fleet (Section 3.0), Anti-Idling and Alternative Fuels (Section 4.0), and Managing Data for Optimal Fleet Usage (Section 5.0).

1. Creating a Green Fleet: This includes a short description of policies that have implications for municipal fleet management in Canada, an outline of defining elements of a green fleet, and a strategy for gaining support for green fleet plan within the municipal working environment. Examples of local municipal green fleet plans and strategies are provided when applicable.

2. Managing Green Fleet Assets Effectively: This section provides information on how to identify the best retention strategies for fleet vehicles through performing life cycle analysis, tips on improving vehicle utilization, information on how to maximize the sale and remarketing of vehicles that no longer are of use in fleet operation, and tips on developing specifications for new vehicles. Considerations in responsible end-of-life vehicle disposal are also identified.

3. Maintaining Your Green Fleet: This section provides fleet managers with technical information on how to best maintain a green fleet and green vehicles, expert tips and information on hybrid vehicle maintenance, and insights on how to reduce the environmental footprint of the working garage through the use of environmental management systems like ISO 14001.

4. Anti-Idling and Alternative Fuels: This section provides information on how to reduce the use of fossil fuels through idling reduction and considerations in the use of alternative fuels. A detailed description of biodiesel for fleet use is provided, and the section concludes with a brief discussion on responsible fuel procurement.

5. Managing Data for Optimal Fleet Usage: This section provides an overview of available frameworks for effective fleet management and important attributes to measure in such frameworks. Comprehensive data collection and evaluation is emphasized, both in this section and throughout this manual as a critical component to effective fleet operation and cost management.

At various points throughout this document, best practices from Ontario municipalities are profiled, along with top tips compiled from experts and from Fleet Challenge’s work with other stakeholders across Ontario and Canada.

The expert resources that provided original source material leading to the development of each section are listed at the end of the document in Resources, along with respective contact information (Section 6.0).

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4 For a broad overview of best practices for climate protection, a local government guide has been published by the International Council for Local Environmental Initiatives.
Section 1.0: Creating a Green Fleet Plan – the Municipal Challenge

It is estimated that Ontario’s municipal fleets, including transit fleets, contribute approximately 0.8 MT of greenhouse gas (GHG) emissions - or about 43% of Canada’s estimated 1.74 MT of municipal fleet emissions. Municipal fleet operators are becoming increasingly aware of their fleet’s impact on the environment to the point where some municipalities in Canada (i.e. Hamilton, Toronto, Victoria, Langley) have taken a leadership role on dealing with these concerns. As witnessed through program interest and workshop participation, there is a broad and growing interest across Ontario to implement “green fleet” plans that will reduce the output of harmful emissions in municipalities.

The following sections include a description of current and emerging policies that have implications for municipal fleet management in Canada. Defining elements of a green fleet are outlined, along with a strategy for gaining support for green fleet plan within the municipal working environment.

1.1 Policy Developments Affecting Municipal Fleet Management in Canada

As new generations of vehicles are introduced, fleet managers have before them the opportunity to implement evolving preferences for vehicles and fuels through their procurement decisions. More efficient choices in fleet technology are also becoming increasingly supported by policy developments that back these decisions.

Although many different types of government policy impact transportation and resultant fleet management decisions, three in particular have current relevance to municipal green fleet operators: (1) the U.S. Sulfur in Fuel and Tier II Vehicles; (2) the Canadian Vehicle Efficiency Incentive, or the “Feebate” program; and (3) evolutions in Vehicle Fuel Efficiency Standards, both in Canada and internationally.

A brief description of these three policy developments and the implications these may have for municipal fleet operators is provided in the following sections.

1.1.1 Sulfur in Fuel and Tier II Vehicles (U.S.A.)

Sulfur in Fuel: This national-level policy is designed to address air quality and smog formation through limiting the sulfur content of fuel. Specifically, the US Environmental Protection Agency (EPA) has expressed that sulphur levels in diesel shall not exceed 15 ppm, which means that as of October 15 2006, the sulphur content of on-road diesel fuel must be 15 parts per million (ppm), a 97 % reduction from the previously existing standard of 500 ppm.

Tier II Vehicles: Tier II regulations limit emissions of criteria air contaminants from vehicles (i.e. air toxics,
smog-forming pollutants, etc.). For light-duty vehicles and medium-duty passenger vehicles, information on (a) certification bins for vehicles; (b) different vehicle emissions profiles and (c) fleet-average NOx emissions are combined to limit emissions to 0.07 g/mi NOx. These regulations are to be fully phased in by 2009. For heavy-duty vehicles, engines are to be designed to achieve $g/bhp-hr$ each of 0.01 PM; 0.20 NOx; 0.14 NMHC by 2010.

Compliance with the stringent Tier II emissions standards will require a range of advanced emissions control technologies that enable low-sulphur fuel to function properly (e.g., oxidation and reduction catalysts, particulate matter filters, in-engine emissions controls).

**What does Sulfur in Fuel and Tier II mean for fleet managers?**

By 2010, these two complementary regulations are expected to result in vehicles that produce fewer smog forming emissions and air toxics on a per kilometer basis. As a result:

- Newer vehicles will generally emit fewer air pollutants per kilometer traveled;
- All vehicles will produce less SOx emissions by 2010;
- More “clean diesel” vehicles will likely be introduced into the North American market; and,
- There will be increased use of advanced after-treatment technology.

Although minimal, some manufacturers warn that operators may experience slight losses in power or slight increases in fuel consumption among new heavy-duty vehicles. The EPA has also estimated that Tier II standards could increase new truck costs by up to 1 percent.

### 1.1.2 Vehicle Efficiency Incentive, or “Feebate”

A feebate is a market-based instrument that provides a financial incentive for consumers and manufacturers to purchase more fuel-efficient vehicles. There are a wide variety of ways in which the government can structure a feebate program based on the principles of subsidizing fuel efficiency and taxing fuel inefficiency.

The Canadian Feebate program works through a schedule of rebates (“ecoAuto Rebate”) and fees (“Green Levy”) that apply to model year 2006-2008 vehicles sold in Canada. Measures are based mainly on published fuel consumption levels, but some incentives for E85 “Flex-fuel” vehicles are also included (Figure 1.1).

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6 This metric represents an energy-specific emissions rate. That is, the grams of pollutants produced per energy generated by the heavy-duty diesel engine.
The program offers rebates from $1000 to $2000, to applicants who, beginning March 20, 2007, buy or enter a long-term lease (12 months or more) for a fuel-efficient vehicle – more information on the program can be viewed at: http://www.tc.gc.ca/programs/environment/ecotransport/ecoautoinformation.htm

This ‘market pull’ strategy is designed to increase the number of fuel efficient vehicles used in Canada each year. In 2007 for example, there were 30 vehicles that would have been eligible for the rebate, an increase from the 20 in 2006.

The ecoAuto rebate program did not receive continuing funding in Budget 2008, beyond that already announced in 2007, meaning 2008 is the last model year for which rebates will be paid. However, the Green Levy remains.

**What does the Vehicle Efficiency Incentive mean for fleet managers?**

In theory, the Feebate program would mean that more fuel efficient light-duty vehicle options for cars (better than 6.5 L/100km) and for minivans and SUVs (better than 8.5 L/100km).

According to Pollution Probe, although this program is currently only relevant to fleets composed of light-duty vehicles, the approach shows promise. Should it be reenacted, it may be considered a good alternative to regulated performance standards for all types of vehicles in the future.

**1.1.3 Vehicle Fuel Efficiency Standards**

Fuel efficiency standards are being examined and developed in countries and regions all over the world, including the U.S, Japan, Australia, China, and the European Union. Properly executed, this policy measure can help to reduce fuel use through legislating improvements in new vehicle fuel efficiency levels. Effectively, these standards are intended to address an opportunity to properly value the benefits of increased fuel efficiency.
In December 2007, the U.S. approved a law requiring automakers to increase the average fuel economy of their entire fleets by 40 per cent by 2020. Under this new legislation, motor vehicles are required to meet an average 35 miles per U.S. gallon (6.7 L/100 km) within 12 years. The standard works through performing a fleet-average calculation on vehicles sold of a given model year.7

In Canada, new vehicle fuel consumption standards are set to be announced in 2008 and will be applicable to 2011 model year onward. According to the federal government’s Regulatory Framework on Air Emissions, these standards will be designed “to maximize our environmental and economic benefits and will be benchmarked against a dominant, stringent North American standard”.

**What do vehicle fuel efficiency standards mean for fleet managers?**

Properly executed, vehicle fuel consumption standards could mean:

- Significant improvements in the fuel efficiency and GHG emissions performance of common light-duty vehicle models;
- Noticeable and progressive improvements in new vehicle models introduced between 2010 and 2020; and,
- Depending upon stringency and the form of new standards, new technology innovations aimed at reducing fuel consumption could become more common (e.g., hybrids, diesel engines, vehicle mass reduction, engine downsizing, electric architecture, homogeneous charge compression ignition, gasoline direct injection, turbochargers, etc.)

1.2 **What is a Green Fleet?**8

What is a “green fleet”? Although no single definition of a green fleet exists, green fleets tend to focus on two overarching goals:

1. The optimizing of efficiency in its various incarnations (i.e. mode of travel, fuel, route planning, fleet operation, vehicle size, etc.); and,
2. Increasing the use of alternative fuels and sustainable technologies.

The City of London, UK, defines a green fleet as “one that does its best to minimize fuel consumption and exhaust emissions. It will also seek to minimize the amount of traffic it generates, by utilizing vehicles efficiently, by using alternatives to the car wherever possible and by conducting its business so as to minimize the need for travel.”

Key components of an effective green fleet plan should include fuel efficiency targets, a GHG baseline, and an overall plan which includes goals, implementation strategies, milestones, roles and responsibilities, monitoring and reporting commitments and a stated commitment on various levels of the organization to continuous improvement. A well configured fleet data management system is an important asset to a green fleet, as it provides a tool to evaluate and identify areas for improving efficiencies (and can save as much as 20% of annual operating budget, if not more).

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7 Although there are many different compliance strategies, automakers usually implement technologies to improve fuel efficiency across their entire product line rather than limiting the range of vehicles sold.
8 Content for 1.2 developed by Fleet Challenge Ontario
Excerpts of green fleets and green fleet plans in place or in development include:

- **Toronto:** “The Green Fleet Transition Plan 2004-2007 sets out to transition the City’s vehicles and equipment to lower impact alternatives such as biodiesel, natural gas and hybrid electric vehicles”.

- **UPS:** UPS seeks to provide optimal service and value to customers by striving for the highest operational efficiencies and minimizing impact to the environment. “Deploying alternative fuel vehicles and exploring renewable energy sources is one of the many ways UPS actively pursues its commitment to sustainable business practices.”

- **BC Government:** “The Province is leading by example with the addition of up to 356 gasoline-electric hybrid vehicles to the government fleet … The greening of the provincial fleet is one more opportunity to show the world in 2010 that British Columbians are leaders in our commitment to sustainable transportation and providing a cleaner, healthier environment for generations to come.” The BC goal is to have 30 per cent of the overall fleet made up of green vehicles in the next three years.

- **Ontario Public Service:** This management plan, which governs a fleet of over 10,000 vehicles, includes critical green fleet components as in: (1) fleet right-sizing, (2) hybrid vehicle acquisition, (3) lifecycle management, (4) replacement of older vehicles, (5) use of alternate fuels & technologies and (6) operational and governance changes.

- **Town of Markham:** The Green Fleet Transition Plan outlines an implementation schedule for acquiring vehicles, improving overall fleet efficiency, and adopting fuel technologies that have less environmental impact.

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12 [http://www.markham.ca/Markham/Departments/StratServ/EnvrLdshp/GreenFleet.htm](http://www.markham.ca/Markham/Departments/StratServ/EnvrLdshp/GreenFleet.htm) (Accessed 28.03.2008)
Leaders in green fleet management in Ontario include Toronto Hydro Corporation, the City of Toronto and the City of Hamilton. These organizations have been particularly successful with their green fleet programs. Common systemic attributes that have led to the success of these programs include:

1. A corporate culture that encourages environmental leadership
2. Commitment to greening the fleet at the most senior level of the organization
3. Carefully managed risk and a willingness to experiment.
4. A strong communications team to share successes
5. Green fleet commitment, stated in policy
6. Procurement policy that takes into consideration the value of life cycle costs
7. Carefully prepared green fleet plans that are based in reality and practicality
8. Capturing reliable and consistent fleet operating data
9. Measurable, measured, and achievable green fleet goals

It is worth noting that these attributes fall within two broad strategies: one being an overall receptive organizational culture and comprehensive commitment to sustainability, as evinced by policy commitments and the general willingness to accept leadership responsibility (Attributes 1 – 5); and the second that this commitment is backed by a set of measures that can apply organizational rigour and deliver on the execution of these programs (Attributes 6 – 9).

Although not meant to be an exhaustive list, a typical “Green Fleet” may have several of the following supporting operating and technical strategies in place. The best green fleet operators will have given consideration to each of these elements, among others.

1. A computerized and comprehensive Fleet and Fuel Management System which can help identify and evaluate fuel usage, asset tracking, vehicle right-sizing and life cycle optimization, vehicle sale and disposal, and a myriad of other important metrics that can identify opportunities for efficiency improvements; ¹³
2. A Preventive Maintenance Program that consists of the scheduled inspection and follow-up repairs of vehicles and equipment in order to decrease on-road breakdowns and excessive downtime;
3. “Green” maintenance and repair facilities, for example to ensure that a facility that is equipped with catch basins, uses low energy and environmentally friendly lighting and heating, has fast roll doors, recycles water in the vehicle wash, uses environmentally friendly parts cleaning fluids, and has well maintained fuelling infrastructure as well as waste oil and anti-freeze storage tanks, among other options;

¹³ Important elements include an interface to a computerized fuel management system, an automated system that will interface with an automated fuel dispensing system, cross referencing of equipment via serial number, license number and unit/asset number, tracking of parts, supply and asset inventory; tracking of warranty recovery; tracking of employee labour; tracking of repairs; tracking of repair history and repair costs; track fuel usage; enable ad hoc reports; perform Preventive Maintenance Scheduling; etc.
4. **Technician and Driver Training Programs** to keep technicians up to date on new technologies and procedures and educate drivers on how new technologies may affect them and their driving practices. This should also consider “green” maintenance and repair policies and procedures to outline the use and disposal of various chemicals and fluids used in the repair and maintenance of vehicles and equipment. Policies and procedures can also specify anti-idling policies and promote the preferred use of environmentally responsible suppliers, among other options;

5. Considers the use of **Hybrid Vehicles** and **Alternate Fuels** in various categories. Hybrids are playing a growing role in the greening of most transportation fleets in Canada today because of the significant improvements in fuel economy and GHG reduction they can deliver. Alternative fuels can lower exhaust emissions and when derived from a sustainable source, reduce a fleet’s carbon footprint. Appropriate technician and driver training, in addition to sound infrastructure planning, must accompany the introduction of these vehicles and fuels to a fleet.

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**Best Practice: Why Go Green? Hamilton’s Green Fleet Plan**

A municipal green fleet is a showcase opportunity for a City to demonstrate leadership in addressing economic and environmental concerns. The City of Hamilton's green fleet plan provides an example of a green fleet plan in action and the benefits that accrue as a result. Like many municipalities, Hamilton's fleet is a big budget item, and fuel is one of the single biggest variables in this budget. As fuel and energy costs have increased significantly over the last number of years, many city councils, including Hamilton’s, have taken interest in the issue of peak oil and how escalating energy costs and shortages will affect urban city management.

In part to address rising fuel cost concerns as well as to demonstrate an increasing focus on health care, environment, and education, the City of Hamilton developed a green fleet plan. Through its Green Fleet plan, the City has taken concrete steps to minimize its fuel usage, use alternative vehicles, and introduce renewable fuels. By the end of March 2008, Hamilton is expected to have 70 gas electric vehicles, a 5% biodiesel component, and an anti-idling policy. Results of green fleet activity to date include fuel consumption improvements of 5% and GHG intensity improvements of 2%. There have also been other notable outcomes resulting from the green fleet plan. Other municipal stakeholders as in public works, transit, and senior management have grown increasingly receptive to green fleet tenets (for example, transit acquired 12 diesel electric hybrids last year and senior management has prohibited the purchase of conventional cars on future purchase orders). Positive public profile also ensued as Hamilton became the first municipality in Canada to receive a ranking of E3 silver. The media and press around green fleet activities have been favourable and prolific in reporting on the associated environmental improvements.

Overall, Hamilton's green fleet plan is popular with council as well as voters, and sends a clear signal to the market that municipal fleet needs are changing as it makes specific and preferential reference to hybrid gas electric, biodiesel, and anti-idling opportunities.

- City of Hamilton Municipal Fleet Manager

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14 I.e. The use of re-refined and synthetic oils, the use of environmentally friendly hydraulic oils, the use of recapped drive tires, etc.
15 I.e. Smart Cars for Parking Enforcement; Hybrid Ford Escapes for By-Law Enforcement; hybrid Toyota/Nissan Pool Cars; hybrid pick-up trucks for Public Works, Parks and Road Patrols; diesel-electric hybrid Transit Buses; and diesel-hydraulic (hydraulic accumulator) garbage packers, among other options.
16 I.e. Biodiesel, Ethanol, CNG, Propane. Biodiesel or CNG for diesel powered units; E10 and E85 Ethanol for gasoline engines; CNG and Propane for gasoline engines.
1.3 Getting Management Buy-In to a Green Fleet Plan\(^\text{17}\)

Fleet managers across Canada are already producing extraordinary results through enacting green fleet plans (see Case Study: Hamilton). Municipal fleet managers across Ontario can replicate and surpass these successes by actively engaging elected officials, management and employees in the design and implementation of a sustainable Green Fleet plan.

This segment provides information and insight on how to enroll senior management in the successful development of a green fleet plan. Although fleet vehicles are essential to the provision of municipal services, fleet operations are not always well understood by elected officials and management. Building awareness of the extraordinary opportunity to reduce greenhouse gases while improving financial performance is an essential first-step of any Green Fleet strategy.

1.3.1 Designing a Sustainable Solution

While a “silver bullet” approach to fuel efficiency is appealing, it is rarely sustainable. Investment in capital equipment such as telematics, hybrids and biodiesel seldom receive an attractive return-on-investment (financially or environmentally) without addressing the broader change management issues.

The steps for creating sustainable change are as follows:

1. Develop awareness of the need for change
2. Create a clear and shared vision
3. Gain management commitment and behaviour
4. Elicit stakeholder engagement
5. Create a supportive structure and supportive Procedures
6. Identify clear performance measures

All of these steps are necessary to support a strategy of sustained change and each step has very specific requirements in the fleet context, as outlined in subsequent sections.

(1) Develop Awareness of the Need for Change

The first challenge facing fleet managers is to develop awareness of both the need for change in fleet operations and the benefits associated with these changes: for example, cost-savings, reduced GHG emissions, and municipal leadership.

Municipalities that experience frequent smog alerts understand the health impact on children and seniors of poor air quality, but the financial benefits associated with reduced emissions are at times less apparent. Municipal vehicles typically idle 35-45% of their operating time and reduced idling (without consideration of

\(^\text{17}\) Original content presented by D. Varaleau, Fleet Challenge Ontario.

Fleet Challenge Ontario
reduced engine wear—and-tear and lower maintenance and repair costs) can provide impressive savings. For example:

- Molson saves over $225,000 annually by enforcing its idling policy of restricting idling to 5% of operating time.\(^\text{18}\)
- The City of Hamilton is realizing savings of $300,000 annually through reduced idling and estimates it can save $2-3 million annually through full compliance with its idling policy of limiting idling to 3 minutes per hour of operating time.
- Toronto Police could save $570,000 annually with a 10% improvement in fuel efficiency (enforcement vehicles typically idle 65-85% of operating time)

(2) **Create a Clear and Shared Vision**

Progressive municipalities have a vision statement which embeds environmental objectives. However, subsequent plans to meet those objectives may not always consider the opportunity for more effective fleet management.

It is important that elected officials and municipal managers understand that fleet operations can and must play a key role in any environmental stewardship program. This can be accomplished by creating a vision statement for fleet operations that supports the broader municipal vision.

An excellent example of such is the City of Hamilton which expressly states: “*The Green Fleet Implementation Plan is a strategy for action that makes progress towards achieving the VISION 2020 goal of improving air quality to ensure the City has the best air quality of any major urban area in Ontario, and to reduce greenhouse gas emissions by 20% from 1990 levels.*”

(3) **Gain Management Commitment and Behaviour**

Management commitment to a green fleet program can be achieved through assigning specific budget and resources to this program and by ensuring there is a degree of and some depth to management participation in the undertaking.

**Assigning Budget and Resources**

Significant fuel savings are possible through improved fleet management and when a municipality invests in a green fleet program, however, many organizations assume that the additional responsibility of greening-the-fleet can be added to the workload without additional staff. The most successful enterprises have assigned a skilled project manager to oversee the program until new programs are fully integrated within the municipality’s hiring and performance management systems.

\(^\text{18}\) [http://www.idlefreebc.ca/index.php]
Management Participation

Active management participation is essential both to signal the importance of the Green Fleet program and to model the desired behavior to employees. Participation may take many forms; for example:
- Johnson and Johnson assessed the carbon footprint of its executive team in order to increase senior management awareness and participation in the corporate climate change program
- OPG and the Town of Newmarket installed telematics on the CEO and mayor’s car and reported idling incidence during the Repair Our Air –Fleet Challenge
- Toronto Hydro’s VP of Operations and Supply removed the keys from idling vehicles and left a note for the driver to retrieve them from his office

Senior management and elected officials’ transportation habits (including both the size and use of their personal and business vehicle) also send an important signal to employees. Ensuring that it is the correct signal is an essential part of a Green Fleet program.

(4) Engage as many People as Possible

Many staff will be affected by a comprehensive Green Fleet program. Consulting with each of the affected groups to address opportunities and constraints and including their perspectives in the program design and application will be critical to success.

Department supervisors

Department supervisors must understand the goals of a Green Fleet program and actively support improved fuel efficiency to ensure success. Accountability for driver performance must often be clarified before performance measures and reporting systems can be established. Continuous communication with department supervisors is also important to ensure that the installation of new technology (LED lights, auxiliary batteries, telematics) do not disrupt work schedules more than is absolutely necessary.

Environmental Staff

Environmental staff are not always familiar with fleet operations but are natural allies once they understand the opportunities available through a Green Fleet Plan. Regular communications with the environment department (when existing), and with councillors who champion green causes is an important part of a winning strategy.

Fleet Maintenance Staff

The installation and maintenance of new technology will require additional time and skills from maintenance personnel. There will also be challenges as new equipment is integrated across the fleet. A training program for maintenance workers and fleet operators is essential.
Communications Staff

Communications personnel can provide outstanding value to a Green Fleet program by:
- Designing a brand for the campaign
- Identifying key messages for campaign materials
- Organizing press releases for media attention
- Assisting with multimedia presentations
- Assisting with the design and implementation of awards ceremonies

Driver Training

Training programs must be designed to address green driving practices and the effective use of new technology. Messages on idling, speeding, hard-braking and tire-pressure are readily available through Natural Resources Canada’s Office of Energy Efficiency and should be communicated to drivers ([www.oee.nrcan.gc.ca](http://www.oee.nrcan.gc.ca)). In addition to this generic driver training information, customized programs must be developed in support of newly installed technologies (i.e. LED lights, auxiliary power units, cabin heaters, telematics and other options).

(5) Create Supportive Structures and Procedures

Clear accountability and reporting systems must accompany the installation of technology that facilitates the tracking of fuel efficiency (telematics) and the reduction of idling (APUS, cabin heaters and LED lights). For example, telematics can provide an extraordinary amount of performance data but without clear accountability, performance targets, and performance reporting, achieving the anticipated return-on-investment available through improved fuel efficiency may prove difficult.

Municipal departments have traditionally addressed fleet vehicles as a fixed cost rather than an operating practice that must be actively managed. As few people welcome additional performance measures, consultation with supervisors and managers is critical when designing a performance management system in order to ensure compliance and project success.

(6) Create Clear Performance Measures

Performance measurement enables evaluating the progress of a program in achieving its defined goals and objectives. In doing so it provides managers and stakeholders with an understanding of how value is created and at what cost.

A relatively small number of performance measures that are: (a) clearly linked to the program objectives, (b) focusing on the key performance issues, and are (c) timely, reliable, and easily relatable, can facilitate good outcomes.
There are several performance measures that can assist with the transition to improved fuel management. These are:

**Corporate Idling Policy**

Approval of a corporate idling policy helps to raise awareness and support for improved fuel efficiency and is an invaluable first step towards development of a performance management program.

**Fuel Efficiency Baselines**

The gathering and reporting of fuel efficiency baselines (and variances) is indispensable when measuring improvements and fuel savings, and invaluable for increasing awareness of current practices. Idling, in particular, is so habitual that it is often invisible both to drivers and supervisors. The documentation of fuel efficiency (kilometers per liter) and engine downloads of idling incidence will provide evidence of current driver performance and of fuel saving opportunities.

**Approval of Performance Targets**

Once baseline data has been gathered and performance variances have been identified, each department can develop targets that reflect their specific operating conditions. Municipalities are advised to have a 3-5 year schedule of improvements that reflect increased awareness and commitment to fuel efficiency and reflect emerging opportunities as new technology is installed.

Municipalities may also benefit from external benchmarks available through the Canadian Association of Municipal Fleet Managers (CAMFM) and E3 members.

**Reporting Program**

While the gathering of information and progress reports are essential, clear accountability for fuel efficiency is essential before progress is assured. Ideally the finance department or Council will have fleet performance targets embedded as part of the municipality’s Climate Change and/or Sustainability program and goals. If such a program does not exist, fleet operations will benefit from reporting to as senior level as possible, and especially from involving a Councillor that is a strong champion of green initiatives.

**Conclusion**

Implementation of a strong change-management program is essential to a successful Green Fleet program. Consideration of all the above elements will ensure that there is clear action towards a defined goal; that role models provide support for the program; that employees, managers and Council “own” the program; and that municipal systems are aligned and supportive of improved performance and lasting change. This systems-approach to change must be supported by a project manager and a suitable budget for success to be assured.
Best Practice: Executing a Green Fleet Plan, Perspectives from the City of Toronto

The City of Toronto has made a commitment to go green and in 2004 released its Green Fleet Transition Plan. The next stage is anticipated for early 2008. Elements include:

**Green Fund:** Low emission vehicles are offered to other departments through the use of a green fleet transition fund of $450,000.00 per year. This fund enables departments to offset the cost differential between a standard and hybrid vehicle.

**More Efficient Vehicles:** To date the City has 25 smart cars and regenerative street sweepers in its fleet of approximately 4,800 vehicles. The City also has a biodiesel garbage packer and is working towards the use of a natural gas version, so in this manner is also moving ahead on Class 8 vehicles.

**Hybrids:** By the end of 2008, it is expected Toronto will have 400 hybrids and low emission vehicles in its fleet (approximately 8% of its fleet). With the support of the Toronto Atmospheric Fund, the City has converted one hybrid to a plug-in system using a lithium battery pack and plans are underway to convert another vehicle. Overnight recharging of this vehicle from the grid costs 28 cents and the vehicle can travel up to 50 km on the charged battery pack prior to using any fuel. This can provide a significant fuel savings, particularly if vehicle usage is less than 25 km each way (as no fuel would be used, only electricity). On a city duty cycle the converted Prius uses 2.4 L per 100km, or approximately one-quarter of the gas needed in a conventional sedan.

As with other programs, budgets and funding is a continuing challenge for all municipal fleet operators. One way the city has approached this challenge is through carefully optimizing hybrid disposal. By reducing the life cycle of its hybrid vehicles from eight years to five, the City has been able to use the additional money received at auctions from early sale and reinvest these funds into new technology. This has the parallel benefit of augmenting the market penetration of hybrids in Canada as it accelerates the deployment of hybrids into the public sector market. In addition to hybrids, the City has purchased heaters for its diesel fuel vehicles, has specifications for LED lighting, and runs inverters in truck that have need of emergency lighting.

**Cleaner Fuels:** The City has enacted three cleaner fuel programs, one of which includes biofuels. The current specification is for 5% biodiesel (B5) in winter, 10% (B10) in the spring, and 20% biodiesel (B20) in summer. The City also uses 10% ethanol in its gasoline, which is more than the current provincial regulation, and purchases dyed diesel for off-road use.

**Hydrogen and Other Applications:** Other initiatives include hydrogen production from wind generation at Exhibition Place in Toronto. This hydrogen is fueling four gators and is also eventually to be spec’ed into aerial tower trucks for the forestry department. The City is also exploring hydraulic propulsion for waste applications – an endeavour which leverages the considerable energy produced from repetitive breaking. Garbage trucks can make from 900-1400 brake applications per 10 hour shift. The incorporation of hydraulic propulsion technology can use this wasted brake energy to assist in moving trucks from one house to the next.

-City of Toronto Municipal Fleet Manager
Section 2.0: Managing Green Fleet Assets Effectively

One of the single most critical factors in asset management is utilization, whether these assets are buildings, machinery, heavy equipment, vehicles, or other items. Logically, the sinking of capital in any asset would dictate that these assets should only be retained so long as they serve some worthwhile purpose toward achieving the organization’s objectives.

For example, new vehicle purchases are often repeatedly deferred in order to stretch available monies for other pressing municipal projects. Unfortunately, this decision sometimes means that worker productivity and municipal fleet efficiency can suffer in result.\textsuperscript{19}

Conversely, some fleets may have vehicles that are under-utilized. This begs the question as to why organizations continue to maintain, store, fuel, license, insure and pay all of those associated vehicle ownership costs for units that are not being fully utilized. Put another way, why not free up the capital and operating expenses tied up in under-utilized and/or redundant vehicles and invest it in upgrading the fleet to include more best-in-class, fuel efficient new vehicles?

For over-utilized units, vehicles may be double-shifting or operating in more demanding environments and will wear out more quickly. Not recognizing this situation in a timely manner will eventually lead to decreased service levels and frustration for end users because of poor reliability. Escalated maintenance and operating costs will result for the fleet section and the organization as a whole. Also, these extra costs may not be fully recovered through internal charge-back mechanisms, which will result in stranded costs.

This chapter provides fleet managers with information on how to identify the best retention strategies for their vehicles through life cycle analysis, tips on improving vehicle utilization, information on how to maximize the sale and remarketing of vehicles that no longer are of use in fleet operation, and tips on tailoring specifications for new vehicles. Considerations for responsible end-of-life vehicle disposal are also discussed.

2.1 Life Cycle Analysis and Fleet Retention Strategies\textsuperscript{20}

As mentioned in the introduction, the single most critical factor in asset management is utilization. Essentially, if capital is tied up in an asset of any kind, an enterprise needs to able to evaluate whether this asset is still serving a worthwhile purpose to the organization.

A key question to address is whether and how long an asset is retained, or whether it should be replaced. An understanding of the value of the vehicle at a particular point in time can help define the answer to this question, as when a vehicle ages there are definite financial and operational consequences with downtime. Delaying the replacement of vehicles may cost more in the long run as the following illustration shows (Figure 2.1).

\textsuperscript{19} Through for example, the rental of high-cost, short-term replacement vehicles on an \textit{ad hoc} basis to supplement the reduced vehicle availability in fleets.

\textsuperscript{20} Original content presented by A. Jardine, University of Toronto.
**Figure 2.1: Factors affecting the Economic Life of a Vehicle**

In this Figure, the *economic life* is that time when the *total* cost takes the *lowest* value – and is the time to replace this vehicle.

It is critical to identify issues associated with the buying and disposing of assets and their annual costs. Broadly speaking, life cycle optimization can be slotted into the following five categories:
1. **Constant annual utilization**, or steady use over a year;
2. **Varying annual utilization**, in that as equipment ages, it breaks down and leads to more intermittent use;
3. **Technological improvement**;
4. **Tracking individual units**; and,
5. **Repair vs. replace**.

This module will deal with **constant and varying annual utilization**, and the question of **repair vs. replace**.

### 2.1.1. Constant Annual Utilization

Take the example of a trucking fleet that has 17 vehicles that are replaced on a five-year cycle. Each of these vehicles travels 110,000 km in one year and the purchase price of a new vehicle is $85K.

**Table 2.1** describes the trend in operation and maintenance costs for the vehicles during the first five years of life, the interest rate to be used for discounting purposes (and to account for the time-value of money), and the change in resale value (trade-in cost). It is important to obtain estimates for trade in values for different vehicle ages and so calculate the *Equivalent Annual Cost* (EAC).
Table 2.1: Sample of Life Cycle Costing Data

<table>
<thead>
<tr>
<th>Age</th>
<th>Operating and Maintenance Cost (In Today’s Dollars)</th>
<th>Rate for Cash Flow Discounting</th>
<th>Trade-In Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 Year</td>
<td>29,352</td>
<td>10%</td>
<td>60,000</td>
</tr>
<tr>
<td>2 Year</td>
<td>45,246</td>
<td>10%</td>
<td>40,000</td>
</tr>
<tr>
<td>3 Year</td>
<td>52,626</td>
<td>10%</td>
<td>25,000</td>
</tr>
<tr>
<td>4 Year</td>
<td>53,324</td>
<td>10%</td>
<td>20,000</td>
</tr>
<tr>
<td>5 Year</td>
<td>42,363</td>
<td>10%</td>
<td>15,000</td>
</tr>
</tbody>
</table>

In this example, analysis of the cost function illustrates that the best replacement time is in fact on a one year cycle. This data illustrates that the Year Five trade in value is $15K, vs. the $85K purchase price for new indicating that Year Five is perhaps not the best time to sell.

The importance of this data and methodology for evaluation is equally applicable to both small and large fleets.

Essentially, deriving the equivalent annual cost allows fleet managers to understand when is the optimal time for replacement and provides evidence to council to support this decision as it allows money to be saved and fleet costs to decline.

2.1.2 Varying Annual Utilization

Figure 2.2 provides the utilization trend curve for a small municipal bus fleet. In this sample population, the more heavily used buses are represented by the newer models (Bus Numbers 1 - ~20) and the least used buses represent the older models (Bus 20+).

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22 For more information, we recommend the publication: “Maintenance, Replacement and Reliability: Theory and Applications”, AKS Jardine & AHC Psang, CRC Press, 2006. as an excellent source for further information on this subject.
Figure 2.2: Utilization trend curve for a small municipal bus fleet (Y axis: bus utilization per year, X axis: bus number ranked from busiest to least busiest vehicle in fleet)

Taking into account purchase, trend in operations and maintenance costs, interest rate and discounting, resale values, and in addition, the *varying utilization trend*, Figure 2.3 can be generated to derive EAC.

Taking all factors into consideration, the recommended Equivalent Annual Cost was estimated to be 13 years (EAC is between $116,000 and $125,000), as opposed to the 18 years that these vehicles were being replaced at (EAC between $120,000 and $129,000).

Figure 2.3 also shows the variation in the answer depending on the interest rate used for discounting.
Replacing at the EAC of 13 years would have resulted in cost savings of $216K per year ($4K per bus at 54 buses per year, in comparison to replacing at 18 years).

2.1.3 Replace vs. Rebuild

In order to illustrate this aspect of life cycle costing, consider the example of a caterpillar 992D front-end wheel loader that was being heavily used in a mining operation. The client wanted to know whether the unit should be rebuilt or replaced. In accounting for purchase price ($1M), all costs of operation, resale value, rebuild costs (approximately $500K), sensitivity and uncertainty factors, and using the methodology of life cycle costing (the total of EAC, operations and maintenance, interest rates, and variables discussed previously), the conclusion was to replace, rather than rebuild this unit, despite the high acquisition cost.

Conclusion

Essentially, fleet retention decisions should not be only made on the basis of the very visible acquisition cost of the new asset – it is also extremely important to think about all the other components of buying, operating, and replacement. The acquisition cost can always be thought of as being analogous to the small visible surface of a much larger iceberg of other considerations (see Figure 2.4).

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TOP TIPS: Strategies for Improving Vehicle Utilization

The following strategies provide suggested tips for improving vehicle utilization.

1. **Consider Developing a Key Performance Indicator (KPI) for Utilization**: In fleet management, it can be difficult to convince staff to surrender under-utilized units or to identify over-utilized units. Using a collaborative approach with senior management support and an appropriate KPI to shoot for, downsizing/right-sizing can be supported by providing an added level of fiscal responsibility.

   Tracking engine hours can help make this assessment based on actual vehicle usage, whether it’s being driven or not, as kilometers driven is not always a meaningful way to assess whether a vehicle is being utilized fully. Without this data, determining whether some vehicles are being utilized fully cannot be accomplished – rules of thumb and gut feelings are inferior processes. Remember, if you can’t measure it, you can’t manage it!

2. **Fleet Reserve Pool**: Consider maintaining a fleet reserve pool (with its own KPI for utilization) to provide spare vehicles when needed and to minimize service interruptions. Also consider other transportation options other than keeping radically under-utilized units. These can include using outsourced suppliers, external pools, use of employee vehicles, etc.

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3. **Cycle Vehicles by Age:** High utilization applications are best served by newer units and low utilization situations are best served for older units. Consider cycling newer and low km units into high kilometer applications on an ongoing basis.

4. **Look At All Available Options to Improving Utilization:** Do not limit your options; consider outsourcing, vehicle pooling, commercial car sharing, use of employee vehicles, mass transit, bicycles, etc. Be creative and imaginative and engage end users for their input. The best way to manage fleet assets in a financially responsible way is by knowing your vehicle utilization on a vehicle by vehicle basis and your utilization on a similar business sector basis.

### 2.2 Selling and Remarketing

Most fleet managers have some idea of how to buy and how to sell a vehicle, but there can often be subtle ways to maximize the selling and remarketing process so as to gain the best value for your vehicle. The following sections provide current information on how to maximize the sale and remarketing of vehicles that no longer are of use in fleet operation.

#### 2.2.1 Smart Buy

It is important to consider vehicle salability in the original Request For Quotation (RFQ), as it is prudent to ascertain what vehicle will provide the most return prior to the purchase of the vehicle. For example, currently desirable vehicle resale options include: off road options on 4X4’s such Z71 and FX4, higher trim level, and colour. Similarly, added features as in ABS, On STAR, aluminum wheels, and vehicles other than work trucks may improve returns.

**Residual Value:**

Using guidebook information and the forecasted length of ownership (i.e. 48 months), calculate the cost of ownership. At times, the most expensive vehicle will demonstrate the least expensive cost over the lifetime of ownership.

**Buy used:**

Opportunities may exist to purchase 6 month to 12-month-old vehicles from daily rental or short-term lease companies. The savings with this option lie in the first year’s depreciation. Using the guidebooks, it is possible to calculate if this option works well for the fleet. Local rental agencies should be contacted to see what vehicles are available and when they may be rotating their fleet, and some of these agencies may even have hybrids.
Leasing:

There are two basic types of leases: open and closed. In an open-ended lease, the lessee is responsible for the end value of the vehicle. If the lease company sells the vehicle at a shortfall from the residual, the lessee is responsible for the difference. The leasing companies offer other services like maintenance management, fuel cards, resale services, etc. at an additional cost to the lessees.

In a closed-ended lease, the lessee may be responsible for excess damage and/or mileage. Most captive finance companies (GMAC, Ford Credit etc.) will offer this type of lease.

2.2.2 Smart Sell – Sales and Remarketing Nuances.

There are outside forces that can change the value of the municipal fleet. These include, but are not limited to:

Supply and Demand:

For example, there is not as much demand for the minivan as there once was. The popular vehicle today seems to be what is known as a crossover.

Seasonality:

The spring market is usually the most attractive, followed by September and October. Try to have your cycles end in those periods to take advantage of the increased demand.

Manufacturers Incentives:

These will depress the price of the used market. This has been particularly noticeable recently as the strong Canadian dollar has caused manufacturers to lower the price of vehicles sold in Canada.

Canadian dollar:

When the dollar was weak, the used Canadian vehicles were often exported to the US, strengthening the price of Canadian vehicles.

Unpredictable Events:

Events such as, 9-11 or Katrina destroy consumer confidence and weaken the market.

Fuel prices:

Vehicle prices are also affected by vehicle type and fuel consumption.
2.2.3 The Sale

It is important to acknowledge that your end-of-service vehicle is a depreciating asset. Consider selling the vehicle as quickly as possible in order to avoid additional maintenance costs as the vehicle depreciates. Options for disposing of the end of service vehicles include:

**Employee sales:**
Employees are often keen to purchase these vehicles. They know the vehicle and the service history, and are therefore comfortable with buying it. However, there may be some issues that you need to consider, such as what is a fair selling price, what warranty should you offer (if any) with the sale, and whether you should assume used vehicle liability as the seller.

**Trade it in:**
This could be a simple solution but it is important to ensure that good value is received for your trade. As such, the RFQ should request that the pricing be stated both with, and without, a trade in.

2.2.4 Auctions

An auction is the only place you may get more for your vehicle than you have originally considered. There are several auction possibilities.

**Physical Auction:**
There are extra costs and time involved in this option as the vehicle must be shipped to the site and must be represented on auction day. There are a number of other things to be aware of to maximize the vehicle value, including:

- **Auction Lane:** Auctions can have up to 16 lanes that sell vehicles all at the same time. It is important to be in the correct lane for the type of vehicle being sold.
- **Lane Position:** There may be as many as 200 vehicles to be sold in each lane, which means that a position at the end of the lane is not good. Try for a position close to the start.
- **Buyers Present:** When picking an auction, ask how many buyers attend. The more buyers, the more likely the prices will be higher.
- **Brand Specific:** Some auctions have buyers that look for certain brands (i.e. ADESA Brampton is more of a Ford sale and TAA Milton is primarily GM and Chrysler).
- **Price Specific:** There are auctions that specialize in lower priced vehicles. Although they attract a different clientele, this may suit your needs.

**Internet Wholesale Auctions:**
Selling via Internet is a simple approach as it permits the fleet manager to sell the vehicle from their own property with no incurred shipping charges. There may also be a larger sellers market opportunity as the vehicle can be viewed anywhere. For this approach, the auction company sends an inspector to the location, inspects and photographs the vehicle, and then posts the vehicle information online.
Ebay:
This also permits the offered vehicles to be viewed anywhere. Ebay has an excellent online tutorial to help you get started.

2.2.5 Have a plan

Reserve Price:
You will want to set a reserve price to protect your asset. Using guidebooks and auction sales history, set this reserve as low as your comfort level permits. This is an important point, as the bidders like to know the vehicle is going to sell. When they see that the reserve has been met they become more likely to continue to bid, as they then know there is a good chance they could buy this vehicle.

Starting price:
Start reasonably close to the reserve so as not to prolong the auction.

2.2.6 Keeping Track
Benchmark against vehicle history and manage this on a vehicle-by-vehicle basis. Create a matrix that includes the following:
- Date of purchase
- Year
- Make
- Model
- Trim level
- Colour
- Options (options that may or may not enhance the value of the vehicle at sale time)
- MSRP
- Cost of purchase (less taxes)
- Guidebook Residual Value
- Sale price
- Mileage (mileage at sale time)
- Book Price (at sale time)
- % of Book (how did you do compared to the guidebook)
- Type of sale (auction, employee, etc.)
- Cost of selling (auction fees, reconditioning etc.)
- Sale date
- Retention (the difference between the cost and the sale price.)

Other data points could be added as deemed necessary. There are fleet software programs available that may be able to supply your needs or documenting such data in an Excel spreadsheet could also suffice.
2.2.7 Guide Books

*Canadian Black Book*

Canadian Black Book has been the standard in Canada for 40 years and has an excellent online site that will service your needs. They are also developing an online product for fleets, where your data becomes part of “the data”.

*Auction reports:*

Weekly auction reports can be mailed free of charge, giving the sales results from last weeks’ sales. Simply contact the auction companies to have them place you on the mailing list.

*Auto Trader:*

Auto trader.ca is a good source to provide a sense of what the retail market is asking/achieving.

2.2.8 Remarketing Information

*IARA:*

International Automotive Remarketers Alliance is an association of companies in the business of remarketing. Their member companies range and include manufactures to auto auctions, and they offer training on a number of subjects related to remarketing.

*Auto Remarketing:*

Auto remarketing is a magazine that focuses on the remarketing industry. They are primarily American but have recently initiated a free Canada exclusive newsletter that will be published weekly. Auto remarketing also hosts several three-day seminars in this area (CARS & I remarketing).
TOP TIPS: Spec'ing new vehicles to maximize environmental and cost efficiencies

Consider the following when creating new vehicle specifications:

- *Past predicts future.* Mining the cost data from your fleet management system can help you determine the most reliable and lowest cost combinations of vehicle types, engines, transmissions, rear axle ratios and more. Cost savings can be achieved by applying an understanding of past performance in your go-forward vehicle specifications.

- The *lowest cost options for many vehicle components* and systems including brake systems, charging systems, tires, etc. can be determined if your fleet management system is appropriately configured. Using the lowest cost options in your new vehicles will save you operating dollars in the years ahead.

- Consider investing in a system that will appropriately analyze data if your fleet management system can’t manage data to the level described above. Purpose-designed, low cost fleet management software is available that will easily integrate with existing municipal and corporate systems as well as modern asset management or Enterprise Resource Planning systems. It’s generally agreed that a well configured fleet management system can save as much as 20% of annual operating budget. More on this option is provided in Section 5.0.

- *Vehicle standardization* pays off in many ways. Buying quantities of similar vehicles provide greater purchasing power with vendors. Standardized vehicles also mean fewer dissimilar parts for your inventory and a shortened learning curve for your mechanics and drivers.

- *Involve end users in your vehicle specifications.* It is prudent to be flexible, collaborate and practice tolerance when it comes to vehicle specifications as drivers have particular preferences and loyalties and it is important for them to ‘buy into’ the choice of vehicles.

- *Right-size your vehicles* and tailoring them to the task at hand is the financially responsible way to do things today. The former practice of “identifying how big a vehicle you need to do the job and then buy one bigger” is no longer valid.

- *Right-size your fleet.* Study utilization trends and adjust your fleet size accordingly. A smaller overall fleet size can translate to newer, better, more economical and reliable vehicles within the same capital budget or less. E3 Fleet Review (Section 5.0), sector benchmarking and other external indicators can help make the determination of correct fleet size.
2.3 End-Of-Life Vehicle Disposal

Older vehicles that remain on the road generate more smog than new vehicles – for example, one 1995 12 year old vehicle can generate 30 times more smog than a vehicle designed today. Extrapolating this point means that 15 percent of the collective municipal vehicle fleet in the province is responsible for 50 percent of the entire fleet’s smog forming emissions.

Fleet aging has another downside, that being decreased driver/passenger and public safety as critical components and systems begin to fail. Conversely, newer vehicles are technologically superior in terms of fuel economy, emissions, safety, power & performance, comfort, drivability, and reliability. There are other, less tangible upsides to a newer fleet, including the opinion that modern vehicles will boost driver morale in an organization and present a better public image to clients and constituents.

Regardless of the reason for disposal, it is important to consider what happens to the vehicles that you are disposing of. In Ontario, almost 500,000 cars are taken off the road annually with varied fates including dismantling, shredding, exporting, abandoned, and even ‘collecting’. Although some 75% of a car is recyclable, presently it is a competitive disadvantage for many recyclers to take the time to properly dispose of older vehicles. Indeed, it is a complex, time-consuming, and costly activity to pull mercury switches and reclaim vehicle batteries versus the simple flattening and shredding inherent in a ‘typical’ recycling operation.

Moreover, there are about 700 businesses in Ontario operating in the end of vehicle life area in some form, but only 150 of these are actually identified as auto recyclers and are part of the national or provincial recyclers’ association. Their membership in these associations identifies them as being willing to be publicly accountable for their business activities, such as the proper dismantling and disposal of end-of-life vehicles.

It is important to note that although half a million cars go off the road annually, only 30 –40% of these vehicles go to recognized association members.

How should a fleet manager care for end-of-life vehicles?

Guidelines for the fleet manager in responsible disposal include:

1. Looking at the long term view for your vehicle specifications. Running vehicles into the ground does not necessarily translate into lower operating costs, and further, these emissions can be significantly higher than that for new vehicles. Supply better vehicles initially; vehicles that drivers will appreciate and perhaps treat better will likely have better surplus or salvage recovery value at the end of their life cycle. This makes their in-service costs to your organization lower.

2. When it comes to final disposal, ensure that end-of-life vehicles not destined for the auction block go to a responsible association member, such as those 150 members of the Ontario Automotive Recyclers’ Association;

3. Support burgeoning environmental codes of practice for the recycling industry; and,

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27 Original content presented by F. Dharsee, Clean Air Foundation, and S. Fletcher, Canadian/Ontario Automotive Recyclers’ Association
28 The Ontario Automotive Recyclers’ Association is working to address this and ensure that the playing field levels out for the industry. The Association has since implemented its own code of best practice that harmonizes provincial regulations in this area.
4. Explore vehicle donation to the Clean Air Foundation's Car Heaven program, which guarantees vehicle decommissioning, a charitable tax receipt (or other options), and $1000 incentive (GM) towards the purchase of a new vehicle. Car Heaven is a public engagement program that has resulted in the responsible retirement of over 72,000 vehicles in Canada since the year 2000. The program helps Canadians to understand the environmental impact of keeping their old vehicles on the road and ensures that these vehicles are responsibly recycled at the end of life.

On an operational level, fleet managers may benefit by placing data collection as an important priority. Among other parameters, we suggest the following to be important:

**Track Your Fleet Average Age**: Monitoring the average age of your fleet on an ongoing basis will help to stabilize and better predict your short/long term capital and operating plans, and improve the service levels you provide to your clients, ensuring client satisfaction.

**Monitor Operating Costs by Category/Age**: Make accurate predictions of future performance relative to fleet aging by knowing the historic operating costs and availability levels of your existing fleet. In a competitive environment such as a for-hire trucking company this strategy can mean survival. In a public sector fleet it means a new level of fiscal responsibility, stabilization of costs and service.

**Use Fleet Age Date to Define Your Retention Strategies**: Life Cycle Cost modeling is of critical importance to accurately determine your fleet retention strategy. How long vehicles are kept is directly related to success as a fleet service provider on a number of levels. It is virtually impossible to correctly determine a valid retention strategy without historic age, cost, and/or reliability data.
Section 3.0: Maintaining a Successful Green Fleet

Basic preventive maintenance (PM) is essential for optimizing fuel and emissions performance. For example, should an engine malfunction go undetected (a lack of preventive maintenance), it could overfuel the system and result in the release of unburned hydrocarbons into the air. In Ontario, this problem would eventually be detected in a DriveClean emissions test but until that point the vehicle would produce greatly accelerated rates of greenhouse gases and criteria air contaminants.

Other problems like leaking fluids are not only a sure sign that the vehicle needs repair, but are also harmful to the environment. Dirty filters can also exacerbate fuel consumption, causing an engine to consume over 2% more fuel. Rural vehicles traveling on dusty roads will need air filter changes more often. Proper tire pressure is also important and can be assessed via PM programs – tire pressure can have a significant impact on fuel economy and vehicle operation.

Emerging and chronic problems such as the above examples can be detected through implementing routine preventive maintenance inspections. Preventive maintenance saves money that could be reallocated to fund more green fleet initiatives or other worthwhile purposes. Through effective data management and careful analysis of exception management reports, a few proactive fleets have actually taken a step beyond preventive maintenance and into the realm of predictive maintenance for additional savings.

Hybrid vehicles lend another facet to vehicle maintenance. Although hybrids are becoming increasingly prevalent in today’s municipal fleets, fleet operators and technicians have yet to accrue the same experiential knowledge associated with more familiar traditional vehicles. Municipal hybrid operators in Canada are learning about hybrids “on the fly”, so to speak, and the experiences of leading adopters in this area can provide helpful information for other municipalities wishing to embark on this pathway.

In the operation of a fleet, and in particular its working garage, it is not always evident where the largest impact may be. Engine oil for example reduces wear caused by friction between the moving parts of the engine and removes acids, sludge and other harmful substances. Eventually, oil becomes contaminated and its performance additives deteriorate, so it is important that the oil be changed regularly and especially that this oil be disposed of responsibly. This means that in addition to vehicle preventive maintenance, steps should also be taken for “waste preventive maintenance” to ensure responsible management of the waste stream of the working garage such as used oils and related materials. There can also be other areas of impact of the working garage that should be considered and these can be identified through the execution of an Environmental Management System (EMS).29

This section provides fleet managers with information on how to best maintain their fleet and green vehicles, expert tips on hybrid maintenance, and insights on how to reduce the environmental footprint of the working garage.

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29 An Environment Management System (EMS) is a tool for managing the impacts of an organisation’s activities on the environment. It provides a structured approach to planning and implementing environment protection measures.
3.1 Maintaining the Green Fleet

A major component to maintaining a green fleet is regular Preventive Maintenance Inspections and follow-up repairs. A good Preventive Maintenance program consists of a number of essential elements – some of which are listed in the following sections.

3.1.1 Documenting Your Maintenance History

Keeping accurate vehicle/equipment history and maintenance files are an important data gathering aspect to sound Preventative Maintenance. This information can help a fleet manager to:

- Track equipment operating and maintenance costs
- Track fuel and oil costs
- Track tire costs
- Track downtime costs
- Track labour (technician) costs
- Track parts costs
- Track body damage repair costs
- Develop accurate life cycling models
- Enable accurate operating and capital budget forecasting
- Print ad-hoc reports on a particular piece of equipment, a particular equipment category or the overall fleet
- Cross-reference equipment by unit number, serial number or license number

Further, such records will enable the identification of fleet operation abnormalities, as in:

- Excessive fuel consumption (in comparison to identical units performing similar functions)
- Excessive oil consumption (in comparison to Original Equipment Manufacturer (OEM) recommendations and identical engines within the fleet)
- Excessive tire wear that can result in premature tire replacement
- Excessive downtime due to unscheduled repairs

Other important benefits to retaining good maintenance history files include:

- The ability to identify repeat repairs and component replacement, which demonstrate that often the end result of the problem is being repaired but the root cause of the failure is not being addressed.
- Ensuring maximum warranty cost recovery, as without good maintenance history files, the recovery of the cost of replaced parts that are still under warranty can be missed. Depending on the size of the fleet, this could be a substantial amount of money over the course of a year.
- Regular downloading of the ECM (Engine Control Module), which will enable the Fleet Manager to spot trends, potential problems and driver habits. Further, in the event of an accident, near miss or traffic violation, the Fleet Manager, and/or Police, can determine actual vehicle speed, engine RPM, hard brake application, stopping time, point of impact, etc. This data can be essential in ensuring the accuracy of the details of the incident.
3.1.2 Encourage skilled and well trained technicians

Engine and component technologies are changing rapidly as manufacturers strive to reduce emissions, increase power, increase fuel economy, increase the life cycle of the engine and components and meet the requirements of current and upcoming legislation.

In order for a Fleet Manager to operate the fleet efficiently, it is essential that all technicians are trained in the newest technologies and kept up-to-date with the latest “Technical Service Bulletins”. This can be achieved in the following ways:

- **In-house technical training programs.** Many large fleets have their own training staff. For smaller fleets, it is recommended senior technicians attend ‘Train-The-Trainer’ courses on new technologies. This senior technician can then perform the requisite in-house training for other technicians.
- **Local colleges** are developing and offering technician training and upgrade courses on new technologies to meet the ever-increasing demand from fleet operators.
- **OEM training courses.** Increasing numbers of fleets are specifying in the purchase contract that the OEM must provide technician training on the new equipment/technologies – this is especially important when it comes to technologies such as the use of hybrids which can involve very different operating protocols.
- **Subscriptions to OEM “Technical Service Bulletins”**. These are issued on a regular basis and will keep the technicians informed on recalls, “fixes” for particular failures, proper repair procedures for particular failures, etc.
- **Participation in various trade associations**, such as: NAFA (National Association of Fleet Administrators), CPWA (Canadian Public Works Association), MEOA (Municipal Equipment Operators Association of Ontario), etc.

3.1.3 A good “Predictive Maintenance” program:

“Predictive Maintenance” is a critical part of any Preventive Maintenance Program. Predictive Maintenance is the timely replacement of a part or component just prior to its known time of failure in time (hours) or kilometres.

The replacement of these parts/components should be scheduled as part of a regularly scheduled Preventive Maintenance Inspection. The replacement can be scheduled through considering:

- Components and intervals determined by the OEM and stated in the OEM Maintenance Manual
- Components and intervals determined by the fleets own maintenance history for each category of equipment (failure analysis)

The benefits of Predictive Maintenance to a fleet include the reduction of on-road failures and downtime, reduced maintenance costs and higher driver morale due to more reliable equipment.
3.1.4 A reliable “Oil Sampling” program:
Although not stipulated by the OEM’s, including Oil Sampling as part of a PM Inspection can enable fleet operators to avoid costly engine or major component failure. Oil Sample Reports will enable a Fleet Manager to:

- Monitor metal contaminants in the oil, which indicate the wear rate on internal component
- Monitor oil condition for soot, acid, etc.
- Extend or shorten oil and filter change intervals as recommended by the company performing the testing of the oil
- Obtain warranty on failed internal components

3.1.5 Well trained drivers:
A good Driver Training program will substantially increase the benefits of your “Green Fleet”. This is achieved through:

- The elimination of jack-rabbit starts and hard braking. Drivers are trained to accelerate from a stop gradually and to predict red lights and ease up to them and stop signs. This process can save as much as 30% in fuel, as well as reduce wear on brake components.
- The elimination of unnecessary engine idling will not only reduce emissions and reduce fuel costs, but it also reduces wear and tear on the engine resulting in lower maintenance costs.
- The reporting of vehicle/equipment deficiencies, unusual noises or handling characteristics and fluid leaks to the Maintenance Department. This will result in the repair of minor problems before they become serious problems resulting in safety issues or major break-down.

Additional Recommendations to Make Your Fleet Greener:

There are further initiatives that can provide cost savings and aid the environment:

- Use recap tires on all but steering axles as this reduces operating costs and reduces the number of tires for disposal
- Use re-refined oil or synthetic oils
- Use environmentally friendly hydraulic oils and greases
- Use environmentally friendly parts cleaning fluids
- Use alternative fuels; Biodiesel, E85 Ethanol, E10 Ethanol, Natural Gas, Propane, Hydrogen
- Use recycled water for vehicle/equipment washing
- Ensure proper disposal of used parts, batteries and other waste
TOP TIPS: Top Three Strategies for Improving Preventive Maintenance

Monitor Your Maintenance Ratio: Preventative/Reactive: The importance of timely preventive maintenance to ensure service excellence cannot be underemphasized.

Is Your PM Scheduling System up to the Task? Can your scheduling system forecast and schedule fleet maintenance due using multiple parameters, tailored to each unit in your fleet? These parameters may include time, kilometers traveled, hours operated, Power Take-Off (PTO) hours operated, fuel consumed and many more depending on how far you wish to drill down. Each improvement to the timing of your PM intervals results in savings of thousands of dollars. Optimizing PM intervals in large fleets can result in savings into the 6 or even 7 figures.

Don’t Over or Under Maintain Your Fleet: Servicing a vehicle prematurely is wasteful. Resources such as oils and other lubricants, as well as technician time are costly. Under-maintaining is equally damaging, and can translate into the premature failure of expensive components or induce worker/driver safety issues, negatively affecting service levels for your clients.

3.2 Understanding Hybrid Maintenance and What Every Fleet Manager Needs to Know

Across Canada, various provincial and municipal initiatives are leading to increased penetration of hybrid vehicles into the fleet vehicle profile. The City of Toronto is arguably one of the leading fleets in hybrid uptake in Ontario. FCO 2008 featured a presentation from the City of Toronto technical trainer, who offered the following important descriptions and salient technical requirements based on the City’s experience with hybrid vehicles to date, as summarized in Table 3.1.

Table 3.1: Technical Tips for Hybrid Vehicles

<table>
<thead>
<tr>
<th>Vehicle</th>
<th>Identified Service Requirements Include:</th>
</tr>
</thead>
<tbody>
<tr>
<td>2000-2006 Honda Insight Hybrid</td>
<td>- Every 6,000 Km Oil change (0W-20 oil Honda) &lt;br&gt; - Every 24,000 Km front and rear brake inspection/serv</td>
</tr>
</tbody>
</table>
Table 3.1: Technical Tips for Hybrid Vehicles (cont'd)

<table>
<thead>
<tr>
<th>Vehicle</th>
<th>Identified Service Requirements Include:</th>
</tr>
</thead>
</table>
| 2003-2005 Honda Civic Hybrid Gen 1 | • Every 6,000 Km Oil change (0W-20 oil Honda)  
• Every 24,000 Km Front and rear brake inspection/service (the Civic has been able to get extended brake life on the front as well as the rear due to the regenerative braking)  
• Every 48,000 Km/2 Years Air filter change, A/C belt tension check, Transmission fluid service, A-ATF-21 for the CVT automatics  
• Every 72,000 Km/3 Years engine coolant  
• Every 180,000 Km spark plugs and valve adjust |
| The Civic has a 4 cylinder, 1.3 litre engine that works in parallel with a 10kW AC synchronous motor. The AC motor and inverter are air cooled. |
| 2006>Up Honda Civic Hybrid Gen 2 | • Every 6,000 Km Oil change (0W-20 oil Honda)  
• Every 24,000 Km Front and rear brake inspection/service (the Civic has been able to get extended brake life on the front as well as the rear due to the regenerative braking)  
• Every 48,000 Km/2 Years Air filter change, A/C belt tension check, Transmission fluid service, A-ATF-21 for the CVT automatics  
• Every 72,000 Km/3 Years engine coolant  
• Every 180,000 Km spark plugs and valve adjust |
| The Civic has a 4 cylinder, 1.3 litre engine that works in parallel with a 15kW AC synchronous motor. The AC motor and inverter are air cooled. |
| 2001-2003 Toyota Prius Hybrids Gen 1 | • Every 12,000 Km Oil change 5W-30 oil  
• Every 24,000 Km Front and rear brake inspection/service, the Prius has been able to get extended brake life on the front as well as the rear due to the regenerative braking  
• Every 48,000 Km/2 Years Air filter change, A/C belt tension check, replace inverter coolant you need to use factory procedures  
• Every 95,000 Km/3 Years transaxle fluid Toyota type T-IV  
• Every 145,000 Km spark plugs |
| The Prius has a 4 cylinder, 1.5 litre engine that works in series-parallel with a 33kW traction motor and a secondary motor generator. Both are AC synchronous motors, and the AC motor and inverter electronics are liquid cooled with a dedicated system. |
| 2004-up Toyota Prius Hybrids Gen 2 | • Every 8,000 Km Oil change 5W-30 oil  
• Every 24,000 Km Front and rear brake inspection/service (the Prius has been able to get extended brake life on the front as well as the rear due to the regenerative braking)  
• Every 48,000 Km/2 Years Air filter change, A/C belt tension check, replace inverter coolant you need to use factory procedures  
• Every 95,000 Km/3 Years transaxle fluid Toyota type T-IV  
• Every 145,000 Km spark plugs |
| The Prius has a 4 cylinder, 1.5 litre engine that works in series-parallel with a 50kW traction motor and a secondary motor generator. Both are AC synchronous motors, and the AC motor and inverter electronics are liquid cooled with a dedicated system. |
Table 3.1: Technical Tips for Hybrid Vehicles (cont’d)

<table>
<thead>
<tr>
<th>Vehicle</th>
<th>Identified Service Requirements Include:</th>
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</thead>
<tbody>
<tr>
<td>2005-up Ford Escape Hybrid</td>
<td>• Before 16,000 Km Oil change 5W-20 oil</td>
</tr>
<tr>
<td></td>
<td>• Every 24,000 Km/1 year Front and rear brake inspection/service (the Escape is a heavier vehicle but it</td>
</tr>
<tr>
<td></td>
<td>is expected to have extended brake life on the front as well as the rear due to the regenerative braking</td>
</tr>
<tr>
<td></td>
<td>• Every 48,000 Km/2 Years Air filter change, A/C belt tension check</td>
</tr>
<tr>
<td></td>
<td>• Every 95,000 Km/3 Years transaxle fluid Toyota type T-IV</td>
</tr>
<tr>
<td></td>
<td>• Every 160,000 Km spark plugs, engine and inverter coolant</td>
</tr>
<tr>
<td></td>
<td><strong>2004-05 GM Parallel Hybrid Truck (idle stop)</strong></td>
</tr>
<tr>
<td></td>
<td>• This truck has an oil life service system, but twice a year is good</td>
</tr>
<tr>
<td></td>
<td>• Every 6 months front and rear brake inspection/service (the GM is a heavier vehicle but is expected</td>
</tr>
<tr>
<td></td>
<td>to have extended brake life on the front as well as the rear due to the regenerative braking)</td>
</tr>
<tr>
<td></td>
<td>• Every 24,000 Km/1 Year Air filter</td>
</tr>
<tr>
<td></td>
<td>• Every 80,000 Km transmission fluid at minimum</td>
</tr>
<tr>
<td></td>
<td>• Every 160,000 Km spark plugs</td>
</tr>
<tr>
<td></td>
<td>• Every 240,000 Km engine and inverter coolant</td>
</tr>
<tr>
<td>2007 Saturn VUE BAS Hybrid</td>
<td>• The VUE has a oil life service system, but every 5,000Km is good</td>
</tr>
<tr>
<td></td>
<td>• Every 6 months front and rear brake inspection/service</td>
</tr>
<tr>
<td></td>
<td>• Every 24,000 Km/1 Year Air filter</td>
</tr>
<tr>
<td></td>
<td>• Every 80,000 Km transmission fluid at minimum</td>
</tr>
<tr>
<td></td>
<td>• Every 160,000 Km spark plugs</td>
</tr>
</tbody>
</table>

Other important elements to consider in hybrid maintenance include the following:

- **Training:** Use of a trainer for basic and advanced training on the servicing of the hybrid units
- **Gloves and Safety:** Purchase of a number of different sizes of class “0” gloves for the staff if they have to work on the high voltage system. As the staff could be working on systems running from 42v to over 300v, class “0” are just over the max voltage rating. It is suggested to err on the safe side with class “0”. Safety glasses should be worn at all times when working with batteries.
- **Batteries:** All 12v batteries inside the passenger compartment are of the “absorbent glass mat” type and require a different battery charger. This means these batteries cannot be charged at the same rate as the old lead acid ones and the amperage must be under 3 amps.
- **Keys:** Keys must be out of car/truck when being maintained or serviced. Notably, usage of the Toyota vehicles, depending on the option, should require that the key be 30 feet from the car otherwise power up could occur (for the most part technicians should not have to work on a hybrid system given the long warranties, but it is important to be prepared).
3.3 ISO 14001 compliance and green shop practices

In the operation of a fleet, and in particular the working garage, it is not always evident where the largest impact may be. Activities, and their associated impacts, can range from the recycling of tires, oil filter changes, use of aerosols, water use, autobody refinishing, filters, particulates, on-site fuel usage and spills, and other areas.

In any municipal operation, it is important to have an overall management plan that (1) addresses the impact of activities, products, and processes on the environment, and (2) provides order and consistency.

An Environmental Management Systems (EMS) can be a powerful tool to improve environmental performance and enhance business efficiency. These frameworks, such as through those protocols espoused by ISO 14001 can help an organization better understand the primary impact of its activities on the environment.33

Properly executed, an EMS can help to identify and control environmental impacts before problems occur. A good EMS can provide a structured approach to planning for and implementing environment protection measures. An EMS or similar operational plan achieves environmental goals by providing resources, assigning responsibilities, and enabling ongoing evaluation of practices and procedures.

An EMS can assist an organization in the following ways:
- Minimizing environmental liabilities;
- Maximizing the efficient use of resources;
- Reducing waste;
- Demonstrating a good corporate image;
- Building awareness of environmental concern among employees;
- Gaining a better understanding of the environmental impacts of business activities; and
- Increasing profit and improving environmental performance through more efficient operations.34

Although the implementation of an EMS is usually voluntary, it can also become an effective regulatory tool for environmental production. Organizations can therefore use EMS to ensure and demonstrate that their performance is in keeping with evolving regulatory requirements, and further, to keep ahead of more stringent regulations which might be introduced in the future.

Also, a comprehensive examination of EMS and certification like ISO 140001 can confer better understanding

33 ISO 14000 refers to a series of environmental management standards, though in practice it is often used to refer specifically to the ISO 14001 environmental management systems standard. ISO 14001 is analogous to the earlier ISO 9000 series of quality management systems standards. Both are generic standards, in the sense that they do not apply to specific industries and instead are deliberately designed as abstract, high-level process standards to make them applicable to the widest possible range of organizations. Among the over 500,000 firms that have received ISO 9000 certification and the over 60,000 that have received ISO 14001 certification, one can find organizations ranging from mines to universities and from steel mills to government agencies.


Fleet Challenge Ontario
of the laws and regulations that pertain to fleet management in Canada. Some of the policies to be cognizant of as an Ontario fleet manager include The Fisheries Act, the Ontario Water Resources Act, the provincial and federal levels of the Environmental Protection Act, and further restrictions on the generation and management of hazardous waste. Municipal by-laws and guidelines are also very important.

There is a wealth of EMS-related information available on-line for fleet managers to peruse in more detail. Some good sources include:

- The US Environmental Protection Agency;\(^\text{35}\)
- The Canadian Centre for Pollution Prevention;\(^\text{36}\)
- The Standards Council of Canada.\(^\text{37}\)

Some excellent examples and case studies of the impact of various fleet operations on the environmental are available at the US Environmental Protection Agency website.\(^\text{38}\) Titles and fact sheets include information on:

- Benefit Through Prevention
- Aqueous Parts Cleaning
- Case Studies In Aqueous Parts Cleaning
- Aqueous Brake Washers
- Antifreeze Recycling
- Refillable Spray Bottles
- Reusable Oil Filters
- Oil Life Extension
- Floor Cleanup
- Oil Water Separators

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\(^\text{35}\) \url{http://www.epa.gov/ems/}
\(^\text{36}\) \url{http://www.c2p2online.com/main.php3?session=&section=162&doc_id=461}
\(^\text{37}\) \url{http://www.scc.ca/en/programs/iso_reg/environment.shtml}
\(^\text{38}\) \url{http://www.epa.gov/region09/waste/p2/autofleet/factfleet.htm}

Fleet Challenge Ontario
### Best Practice: How to Implement a Successful Environmental Management System, City of Hamilton

<table>
<thead>
<tr>
<th>Tenet</th>
<th>Involves:</th>
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<tbody>
<tr>
<td><strong>Establishing an Environmental Policy</strong>&lt;br&gt;An environmental policy involves establishing organizational objectives and targets and is a commitment to preventing pollution, ensuring legislative compliance, and fostering continual improvement.</td>
<td>- Controlling and reducing pollution discharges to sewer&lt;br&gt; - Reducing energy consumption&lt;br&gt; - Reducing waste sent to landfill&lt;br&gt; - Controlling and reducing air pollution</td>
</tr>
<tr>
<td><strong>Implementing an EMS</strong>&lt;br&gt;Carefully define how the EMS will unfold, and consider roles, budget and training needs. Properly communicate the organization’s goals and mechanisms for feedback.</td>
<td>- Defining roles and responsibilities&lt;br&gt; - Identifying budget resources&lt;br&gt; - Identifying training needs (important for documentation)&lt;br&gt; - Developing a communications plan&lt;br&gt; - Creating a plan to control documents&lt;br&gt; - Establishing process controls&lt;br&gt; - Having an emergency response plan</td>
</tr>
<tr>
<td><strong>Audit and Corrective Action</strong>&lt;br&gt;Understand what needs to be measured and develop a mechanism to deal with problems effectively.</td>
<td>- Determining what needs to be measured&lt;br&gt; - Keeping monitoring equipment properly calibrated&lt;br&gt; - Developing a procedure for preventive and corrective action&lt;br&gt; - Keeping control of environmental records&lt;br&gt; - Establishing and maintaining internal EMS audits</td>
</tr>
<tr>
<td><strong>Continual improvement</strong>&lt;br&gt;Ensure that new problems are identified and accounted for in your EMS.</td>
<td>- Identifying the root cause of problems and fix them&lt;br&gt; - Taking preventive action to determine how to avoid these problems from reoccurring.</td>
</tr>
<tr>
<td><strong>Involve Employees</strong>&lt;br&gt;Involve employees, and empower them in the tenets of the EMS program.</td>
<td>Ask:&lt;br&gt; - Are you aware of the Environmental Policy?&lt;br&gt; - What environmental aspects of your job affect the environment?&lt;br&gt; - Who is your EMS representative?&lt;br&gt; - Where do you find work instructions?&lt;br&gt; - Where do you find emergency procedures?</td>
</tr>
</tbody>
</table>

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39 As recommended by the City of Hamilton, who has successfully gained ISO 14001 certification for its fleet
Section 4.0: Reduced Idling and Alternative Fuels

Another item of considerable implication for operating costs is fuel. Many municipal fleet operators face a considerable challenge in accurately forecasting fuel cost requirements for their budget years. Often allotments for fuel are spent at a very high rate and can result in operating budget shortfalls.

In a typical vehicle fleet operation, fuel is the highest cost item after labour, to the point where municipal sources have indicated that the rising cost of fuel is impacting their ability to deliver programs and meet responsibilities effectively and responsibly.

The decision to reduce the use of traditional fuels and/or explore the use of alternate fuels and hybrids as a method of reducing environmental impact is a good one. Alternate fuels for consideration include biodiesel, ethanol, natural gas and propane; however the importance of reducing the use of the traditional fuels cannot be overstated. Anti-idling policies, for example, provide an important means to reduce traditional fuel consumption for a fleet and contribute directly to bottom-line fuel savings.

Although initial upfront costs exist, alternate fuels can mean life-cycle cost savings for fleets. For example, while the use of compressed natural gas means costly vehicle conversions and the upfront installation of fuelling devices at facilities, the overall capital expense will most often be recovered through fuel cost savings and operational savings, leaving ample time in unit life cycles to significantly capitalize on operating cost savings.

This section contains information on how to reduce the use of fossil fuels and the opportunities for alternative fuels in municipal fleet operation. Guidelines for responsible fuel procurement are also presented for consideration.

Alternative Fuels

Governments around the world, including the European Union, the United States, China, India, Japan and Brazil, have all introduced renewable fuel content requirements, as have three Canadian provinces - Saskatchewan, Manitoba and Ontario.

Ontario has implemented a renewable fuels standard (RFS) that will require gasoline sold in the province to contain an average of 5 percent ethanol by 2007. Effective January 1, 2007, a wholesaler’s annual gasoline sales must achieve an average of at least 5 percent ethanol content. This may be accomplished by the actual blending of ethanol or through the trading of renewable fuel credits.
4.1 Reducing the Use of Gasoline and Diesel: Idling Reduction

Idling has several undesirable attributes, which include but not limited to:

- Impact on engine operating life, as one hour of engine idle is equivalent to two hours of driving and results in the more frequent servicing and replacement of spark plugs, fuel injectors, valve seats, and piston crowns;
- Higher cost, through incurring an additional $1.25 in vehicle maintenance for every $1.00 of fuel consumed; and,\footnote{EcoFlotte program, Natural Resources Canada}  
- Reducing engine oil life by 75%, from 600 engine hours to 150 engine hours.

Green fleet management requires the ability to measure – and address - the financial and environmental impacts of avoidable idling. Lowering fuel costs through reduced idling can provide a quick-win for a Green Fleet program that will capture management attention and possibly provide funding for additional Green Fleet initiatives.

A change-management approach to idling offers the best opportunity to sustain behavioural change and lower fuel costs. This approach is described in the following sections.\footnote{We note that other options, such as truck stop electrification, can offer further opportunities for reduced fossil fuel usage.}

4.1.1 Need for Change\footnote{Original material presented by D. Varaleau, Fleet Challenge Ontario.}

Few fleet managers or drivers understand the extent of waste associated with unnecessary idling. In illustration, the anti-idling program “Repair Our Air” has analyzed engine data from sixty fleets during 2000-2005 with the following results:\footnote{The goal of the Repair Our Air-Fleet Challenge is to provide participants with accurate data on the extent and pattern of idling incidence and tools to assist with its reduction. Fleets will typically begin the Challenge with idling incidence of approximately 35% of operating time and, by providing drivers with constant feedback, reduce the incidence to 5%.}

- Municipal service fleets: 30 - 50 %
- Transit: 35 - 40 %
- Enforcement: 65 - 85 %
- Utilities: 30 - 75 %

The above percentages indicate the amount of operating time the fleet spent idling.

The fuel-saving opportunities associated with reduced idling are significant. In 2005, the City of Hamilton saved $300,000 in fuel costs and 720 tonnes of GHGs by controlling idling and further estimates that it could save $2-3 million annually and reduce GHGs by 4,800 tonnes if the idling policy were fully enforced.

While many drivers argue that they are idling to keep warm (or cool), protecting the engine starter and running emergency lights, most idling is unrelated to the outside temperature or equipment requirements and is simply a bad habit. That said, changing driver habits is not a simple process and requires persistence and constant reinforcement.
Fleet managers can build a solid business case for their idling program by assessing current fuel efficiency (in kilometres per litre) against best practices and estimate the municipality’s potential for fuel savings and GHG reduction.

4.1.2 Creating a Clear Shared Vision

The vision for a reduced idling program is best linked with the municipality’s Green Fleet Plan or sustainability program. It is also ideally expressed in a corporate policy that provides guidance to all managers and drivers.

RST, a freight carrier based in the Maritimes, provides an example of such a policy:

“Anyone operating a vehicle owned by or leased to RST industries shall not allow their company vehicle to idle more than five consecutive minutes when not in motion or being used to operate auxiliary equipment that is essential to the job requirements.”

A corporate policy may be complemented with a commitment to providing leadership within the community and amongst municipalities.

Other local examples of municipal fleet idling policies include:

City of Toronto

“All City of Toronto employees are expected to follow the 10 second rule: if you’re stopped for 10 seconds, turn off your vehicle. If all drivers do this, we will reduce CO₂ emissions in Toronto by 2,147 tonnes per year. That’s like taking 486 passenger cars off the road annually.” Along with the 10 second rule, the policy gives guidelines regarding vehicle warm-up times. These guidelines may be found at http://www.toronto.ca/fleet/idle-free.htm

City of Hamilton

“City employees in the City of Hamilton shall not allow a vehicle to idle for more than 10 seconds as stated in the definition of idling.” Details of the policy may be found at: http://www.myhamilton.ca/myhamilton/CityandGovernment/CityDepartments/PublicWorks/FleetServices/Green+Fleet+Plan.htm

4.1.3 Management Commitment

Management commitment is essential to the success of a reduced idling campaign. Developing the necessary commitment is best done in stages that include:

1. Provision of fuel-efficiency data for each department
2. Agreeing on efficiency targets for each department
3. Engagement in the design of a corporate idling policy
4. Participation in the design and implementation of an idling challenge
5. Participation in the development of a municipal Green Fleet plan
The level of management commitment will become evident when a budget is requested for the purchase or lease of telematics to measure idling incidence, and when direct participation in the idling campaign is requested.

While reduced idling can provide a “quick win” for any Green Fleet program, note that the measurement and control of idling will require an initial capital outlay for certain types of equipment, such as LED lights for emergency vehicles, cabin heaters for working vehicles, and/or auxiliary power units (APUs) or batteries for computers and equipment.

Fuel efficiency can be tracked by comparing mileage to fuel usage but telematics can be invaluable for providing reliable reports that identify patterns of waste and for providing regular feedback to drivers, supervisors and managers.

4.1.4 People Involvement

Research has shown that by itself, information on the financial and environmental impact of idling is insufficient to change driver behaviour. Drivers will only change behaviour patterns when they understand the frequency and impact of idling, receive regular reports on their own performance, and have personal contact with supervisors and other drivers who support reduced idling.

The importance of personal contact in changing a driver’s behaviour cannot be overstated, especially when idling becomes socially unacceptable both to members of the public and to fellow employees. A municipality’s vehicle culture can be altered through a series of informative campaigns directed both at employees and the public at large.

*Municipal Fleet Challenge*

The Repair Our Air-Fleet Challenge [www.repairourair.org](http://www.repairourair.org) provides a good blueprint of how to create behaviour change by actively engaging drivers in a competition to reduce idling incidence.

Features of the Challenge include:

- Design of the Challenge in partnership with department supervisors
- Voluntary registration of departments in the Challenge
- Selection of vehicles to participate in the Challenge over a time period
- Installation of telematics on all participating vehicles
- Launching of the campaign with an information session on idling and on the Challenge
- Broadcast of weekly reports on idling incidence
- Celebration of successes at an awards ceremony
- Preparation of a report that identifies how improved performance will be sustained
Community Participation

Reduced idling within the municipal fleet will be much easier if the public is also engaged in controlling idling within their personal vehicle and idling becomes socially unacceptable in the community. Public awareness campaigns that have succeeded in communities across Canada have shared the following similar features:

- Approval of an idling by-law
- Launch of a public information campaign that includes media releases and signage at key locations
- Regular enforcement blitzes that are supported by media campaigns
- School poster contests
- Challenges to fleet operators including utilities, transit, police and EMS, school buses, taxis, couriers, municipal contractors and private fleets

Communications tools to support idling campaigns are readily available and most are free.

The graphics for these tools can be retrieved from the following websites:

- Repair Our Air-Fleet Challenge:  [www.repairourair.org](http://www.repairourair.org)
- Natural Resources Canada:  [www.oee.nrcan.gc.ca/transportation/idling](http://www.oee.nrcan.gc.ca/transportation/idling)

An powerful video demonstrating children’s thoughts and perspectives on vehicle idling may also be found on the Children Clean Air Network website, located at: [http://www.childrencan.ca/index.php?option=com_content&task=view&id=5&Itemid=6](http://www.childrencan.ca/index.php?option=com_content&task=view&id=5&Itemid=6)

4.1.5 Supporting Structures and Process

In addition to a corporate idling policy and municipal by-law, there are a variety of structures that will support a successful idling campaign. These include clear accountability and union support.

Clear Accountability

Ideally, accountability for fuel efficiency is included within a department’s performance measures and is already assigned to a specific individual. In the absence of such, departments participating in an idling reduction program or campaign should assign a project leader who is responsible for gathering and reporting idling data to the campaign committee.

Union Support

Unions are often concerned about the increased surveillance made possible through the use of telematics. Most telematics will not only record idling incidence but can also report speeding, the location of a driver and the duration of visit to a particular location. While this information can generally be retrieved through an engine download without a telematic, the telematic will deliver the information daily to a manager’s desk, making driver behaviour more transparent. Discussions with unions regarding the reporting and use of this data are recommended as early as possible in order to identify mutually acceptable solutions.

Unions may also be concerned about driver safety and driver comfort associated with reduced idling. Fleet managers must work with union representatives to develop guidelines on acceptable cabin temperatures and on vehicle maintenance standards that will ensure the starters and batteries are maintained at a level required by the department’s workload.
4.1.6 Performance Measures

The launch of an idling program will raise a variety of performance issues, including the following:

- Who is accountable for fuel efficiency?
- What is being measured?
- How can targets be customized for different operational environments?
- How are measures reported?

Accountability

In many municipalities, accountability for fuel efficiency is overlooked, since there is often little understanding and appreciation of the efficiency opportunities that are available. Fleet managers are typically responsible for the procurement, maintenance and disposal of vehicles and have no authority over the drivers of the vehicles or how the vehicles are used.

An idling campaign will raise awareness of significant fuel savings opportunities that should be of interest to both to the Chief Financial Officer and Council. Once that awareness exists, clear accountability for driver behaviour is essential before savings can be captured.

What is being measured?

There are two parts to the question “What is being measured?”. Unions often argue that the vehicle should be measured rather than the driver, thereby avoiding potential disciplinary action. As vehicles are often shared within a department, a fleet manager can side-step this concern by not using specific keys to identify individual drivers. More importantly, municipalities have often found that continual reinforcement of good performance is more effective than disciplinary actions against recalcitrant drivers.

A second question relates to how a telematic is set up. Most can be adjusted to report all idling (the engine is engaged but the vehicle is not moving) and/or idling over an allowable period, such as two minutes (to accommodate traffic lights) or three minutes to accommodate a corporate policy. Many telematics will provide two sets of data and some will also identify the time, duration and location of idling infractions.

Customized Targets

Garbage trucks, police vehicles, public works and supervisory vehicles have very different operating requirements and will benefit from targets that accurately reflect their work environment. Fleet managers are encouraged to collect data by vehicle category and to customize guidelines and targets in partnership with client departments in order to ensure both support and appropriateness of fuel efficiency targets.

Performance Reporting

Idling data is of little value if accountability for fuel efficiency is unclear and the data is not shared with drivers and senior management. A strong idling program will require a clear communications strategy that includes weekly/monthly reporting.

Many fleets have lost their return-on-investment in telematics because fuel efficiency reports were irregular or poorly distributed. A strong communications program and clear accountability will help to avoid this circumstance.
TOP TIPS: Reducing Fuel Usage and Improving Fuel Efficiency

An idling campaign provides an excellent opportunity to increase awareness of idling incidence and the financial opportunities associated with improved fuel efficiency. Broad participation in the campaign, clear and regular reports, and clear accountability will ensure that this awareness evolves into sustained improvements in driver performance as well as lower fuel bills and reduced greenhouse gas emissions.

Operationally, there are several things fleet managers can do in assessing how idling impacts their fleet and fuel costs and further their fuel efficiency performance. These include:

1. **Manage Your Exception Units:** Track your fuel usage by the unit and category. Monitor fuel consumption data regularly. Determine the units that are performing below and above the average value for their type. Be proactive in correcting the issues that are causing poor fuel consumption and consider using vehicles that historically use less fuel in your fleet for your next vehicle acquisitions.

2. **Manage Idling & Driver Behaviors:** Consider fuel-efficient driver awareness and training programs. Consider an internal communications plan that will help change those persistent mindsets that wasting fuel is acceptable.

3. **Determine “Best in Class” Vehicles:** Through historical fuel usage data for the fleet or from external sources such as the US EPA or EnerGuide, determine the most fuel-efficient vehicles for your operation. Consider hybrids and alternate fuels for your fleet.

Taking action to manage the above high fuel consumption exception units will ultimately reduce your fuel expenses and GHG output. The following are some basic things to consider when taking action on high fuel exception consumption units:

- Are there mechanical problems in the vehicle(s)?
- Are the vehicles matched to their job requirements? (e.g., are the vehicles too big or too small?)
- Are the vehicles technologically outdated? (e.g., modern electronic diesel coupled with a programmable electronic transmission versus outdated gasoline power with a driver controlled manual transmission).
- Can lower cost/emission fuels be employed (e.g., diesel/biodiesel, compressed natural gas, hybrids, alternate fuels, etc.)
- Are there operational issues that can be improved (e.g., route planning, trip optimization)
- Are the units idling unnecessarily? (e.g., driver awareness)
- Are there idling reduction technologies that can be employed (e.g., auxiliary cab heaters or battery systems)
- Are there better transportation options available? (e.g., car-pooling, car-sharing, employee provided vehicles, modal shift to public transit, etc.)
- Is the fuel posted to units actually going into the vehicles? (e.g., perhaps its being used for gas powered tools, other fleet vehicles or is even pilfered?)
4.2 Using Biodiesel in the Fleet Environment

Biodiesel is a non-toxic and biodegradable fuel produced through a process called transesterification. Sources for biodiesel include vegetable oils, waste cooking oil, animal fats or tall oil. This is a highly desirable fuel as it needs little to no engine modification to be used successfully, and can be used as a pure fuel or blended with petroleum diesel in any percentage. B20, for example, which is a blend of 20 percent biodiesel with 80 percent diesel, has demonstrated significant environmental benefits with a minimal increase in cost for fleet operations and other diesel applications.

Biodiesel is being used in both on-road and off-road applications as fleets are beginning to adopt biodiesel into their fuel portfolio. Toronto Hydro Electrical Services, Guelph Transit and other government and private sector fleets have driven millions of kilometers on this fuel through all seasons with a variety of diesel engine vehicles.

Incorporating biodiesel in the fleet allows fleet managers to:
- Reduce exhaust emissions;
- Increase the lubricity of the fuel, which is especially important with the use of Ultra Low Sulphur Diesel Fuels;
- Increase the life-cycle of fuel system components such as pumps and injectors;
- Improve corporate image;
- Improve employee morale; and,
- Become an environmental leader.

4.2.1 Prepare the Fuelling Infrastructure

In order to have a successful biodiesel program, the Fleet Manager must ensure that the fuelling infrastructure is properly prepared. This should include the following steps:

1. Testing fuelling infrastructure integrity, including fuel storage tanks, delivery lines, vent lines, and fuel pumps;
2. Testing for moisture in the storage tanks, as any water in the tanks must be removed prior to filling the tanks;
3. Cleaning the fuel storage tanks, as residual sludge and dirt in the bottom of the tanks will affect fuel quality and should be removed;
4. Installing filters on the fuel distribution tanks - these filters should be the same micron rating as the filters on your vehicles/equipment (at least 10 micron); and,
5. Installing desiccant filters on the vent pipes if possible, as this will prevent moisture entering the tanks through the vent pipes.

In British Columbia, six municipalities announced their commitment to Canada’s largest biodiesel demonstration project, with an announced cooperative purchase of up to 80 million litres a year. Vancouver, Richmond, Whistler, Delta, Burnaby and North Vancouver will purchase and use up to 80 million litres of blended biodiesel in their vehicle fleets over the next five years.

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44 Original material presented by K. Dack, Fleet Challenge Ontario.
4.2.2 Education and Training

Training and education of all personnel on the basics of biodiesel is an essential aspect of successful adoption. This includes:

1. **Technician and Service Person Training.** Personnel must be educated in the properties and use of biodiesel. Failure to do so could result in personnel blaming the fuel for unrelated mechanical issues. Personnel must also be educated on what procedures to take in the event of any spills.

2. **Driver Training.** Drivers are the actual users of biodiesel and need to be properly educated on the benefits of its use in order to buy into the program. Drivers are the first line of contact with the general public and they need to know the basics of biodiesel in order to answer any questions raised by the citizens, or be able to direct these questions to someone that can provide the correct answer.

3. **Education of Purchasing Personnel.** The buyer is the main contact that will be dealing with the vendors bidding on your biodiesel tender. The buyer must be well educated in all aspects of the ASTM D6751 and CAN/CGSB-3.520 specifications, feed-stocks, cloud points, blending and delivery logistics.

4. **Education of Public Relations Personnel.** Public Relations officials are the personnel responsible for all media releases and interviews and must be well educated in the benefits of using biodiesel, as well as various aspects of the purchase contract in order to adequately respond to all questions from the media, senior officials and the general public.

4.2.3 Development of a Contract/Tender

One of the most important issues to be addressed when switching to biodiesel is the development and preparation of the Biodiesel Contract/Tender. In addition to pricing, term of contract and the multitude of legal clauses, it is essential that the following items be included in the contract/tender:

- The required ASTM D6751 or EN 14214 specifications for the pure biodiesel to be used in the blending of the fuel or the CAN/CGSB-3B.520 specification for a B5 blend of fuel;
- The seasonally adjusted blend of the biodiesel required;
- The seasonally adjusted cloud point and pour point of the blended biodiesel;
- The timelines for the distributor to become BQ-9000 Certified and, if required, the producer to become BQ-9000 Accredited; and,
- The required delivery logistics and procedures.
4.2.4 Selection of a Reliable Distributor

As part of the bid evaluation process, there are a number of important criteria that should be considered for each bid. Some important criteria we recommend include:

- **Vendor track record**, as per the vendor’s reputation in the industry;
- **Vendor knowledge** of biodiesel, and specifically when it comes to storage, cloud points, and pour points;
- Ensuring that **supply is consistent**, as the vendor should have an adequate supply of biodiesel stored locally in heated tanks
- **Delivery tankers dedicated to the delivery** of biodiesel, as dedicated tankers reduce the possibility of contamination to the biodiesel;
- **Method of blending**, as the method used by the vendor must ensure complete blending that meets terms of the contract; and,
- **Fuel quality**, as per ensuring the vendor has BQ-9000 Certification.

4.2.5 Monitoring of Emissions Reduction

Fleet Managers are constantly required to report on the status of their programs and the current results. The switch to biodiesel is no different, and the following information should be monitored on a regular basis:

- Average emissions reductions by vehicle category
- Average fuel consumption by vehicle category
- Average maintenance costs by vehicle category
- Comments from employees
- Comments from the general public

4.2.6 Engine Warranties and Biodiesel

Many Fleet Managers remain concerned about losing the warranty on their engines should they use biodiesel. Should there be a failure that the OEM can prove is directly related to the use of biodiesel, warranties will only be denied on the component that failed and **not** the entire engine.

Note that all major diesel engine manufacturers and the diesel pump and injectors manufacturers have approved the use of a B5 Biodiesel blend, provided that the pure Biodiesel used for blending meets the current ASTM D6751 requirements.

Manufacturer Warranty Statements are available on the internet at the National Biodiesel Board website, at: [www.nbb.org](http://www.nbb.org).
4.2.7 Engine Maintenance
The use of biodiesel does not require any additional maintenance other than additional fuel filter changes approximately four to six weeks after switching over to biodiesel.

This said, some important points to note are:

- Biodiesel may affect some rubber gaskets and O-Rings in components on the fuel system of pre-1993 engines (however if the fuel system components have been rebuilt after 1993, the rubber gaskets, O-Rings, etc. have most likely been replaced with synthetic gaskets and O-Rings and will be unaffected by the biodiesel). Engines manufactured after 1993 are generally not affected.
- The use of biodiesel may enable the ability to extend the interval between oil and filter changes; however, this should only be done in conjunction with the reports from your oil sampling program.
- The use of biodiesel will improve the lubricity of the petroleum diesel fuel. This will increase the life-cycle of the fuel pumps and injectors by as much as 50%. With the switch to ULSD (ultra low sulphur diesel) in 2006, fuel pump and injector manufacturers became concerned about the lack of sulphur shortening the life-cycle of their products and have endorsed the use of biodiesel as an excellent way to ensure the long life of these components.

4.2.8 Fuel Quality
The quality of the biodiesel will determine the success or failure of any biodiesel program. There are a few steps that can be taken to ensure that only the best quality fuel goes into the equipment fuel tanks.

1. **Perform regular maintenance on your fuelling infrastructure.** This includes removing any moisture found in storage tanks, ensuring caps are tight and sealed on storage tanks and on vent pipes, regular replacement of filters on distribution pumps, and ensure nozzles on distribution pumps are kept clean and function correctly.
2. **Ensure the regular turnover of stored fuel.** Just as with petroleum diesel fuel, long-term storage is not recommended. For best results a turnover time of approximately six months is preferred.
3. **Perform random sampling and testing of fuel being delivered.** Samples should not be taken mid-stream during the delivery, nor from the tank directly after delivery. Test the cloud point of the samples to ensure that the blend being delivered has been seasonally adjusted and matches the requirements set out in the contract.
4. **If using a blend higher than B5, ensure that the pure biodiesel being used in the blending process meets the ASTM D6751 or EN 14214 specifications** stated in the contract. The vendor should provide the appropriate certificate to confirm this fact.
5. **If using B5, ensure that the fuel being delivered meets the CAN/CGSB-3.520 specifications** stated in the contract. The vendor should provide the appropriate certificate to confirm this fact.
6. **If a BQ-9000 requirement has been stated within the contract, the vendor must provide certificates stating that they are a BQ-9000 Accredited Marketer and that the producer is a BQ-9000 Certified Producer.**

Fleet Challenge Ontario
4.2.9 Fuel Blending

Biodiesel can be used year round and can be successfully blended with both winter petroleum diesel (#1 diesel fuel) and summer petroleum diesel (#2 diesel fuel).

Many fleets use various biodiesel blends throughout the year, but the most common in Ontario appears to be the use of B20 during the summer months, B10 during the spring and fall and B5 during the winter. The lower blends are used during the cooler months to ensure that there are no problems with fuel gelling.

In order to ensure the best performance, the fuel must be thoroughly blended. The main methods of blending currently in use are:

1. Injection blending at the rack. This is the best method of blending as precise amounts of biodiesel are injected into the petroleum diesel as it loaded into the tanker truck.
2. Splash blending in the tanker truck. This is the most common method being used in Canada at this time. If the proper procedures are followed this method will result in satisfactory blending of the fuel.
3. Splash blending in the Fleet's storage tanks. This is the least used method of blending as it presents logistical difficulties to ensure that both the biodiesel tanker and the petroleum diesel tanker deliver their fuels at the same time. It is also difficult to ensure complete blending of the fuel at the correct blend.

Conclusion

Biodiesel can be successfully used year round in all fleets by following these simple steps:

1. Prepare your fuelling infrastructure in preparation for the switch to biodiesel
2. Perform regular maintenance on your fuelling infrastructure
3. Ensure that only the highest quality biodiesel is used for blending
4. Ensure that the fuel is well blended
5. Perform regular testing of the fuel to ensure that the fuel meets all of the specifications stated in the contract
What About Ethanol?

This Manual does not explore the use of ethanol in depth. This topic was not expressly addressed by expert presenters in FCO 2008, however some salient information is presented below. FCO refers readers to the Canadian Renewable Fuels Association for more information on ethanol.

While pure ethanol is rarely used for transportation fuel, there are several ethanol-gasoline blends in use today. E85 is a blend of 85 percent denatured ethanol and 15 percent gasoline. In certain areas, higher percentages of gasoline are sometimes added to E-85 during the winter to ensure that vehicles are able to start at very cold temperatures. Another common mix is E10, which is a blend of 10 percent ethanol and 90 percent gasoline.

E85 cannot be used in a conventional, gasoline-only engine. Vehicles must be specially designed to run on E85. These flex fuel vehicles, or FFVs, can run on E85, gasoline, or any blend of the two. These vehicles feature specially-designed fuel systems and other components that allow a vehicle to operate on a mixture of gasoline and ethanol, with mixtures varying from 0 percent to 85 percent ethanol. These cars and trucks have the same power, acceleration, payload, and cruise speed as conventionally fueled vehicles and are priced similarly to gasoline-only vehicles.

Presently, conventional ethanol is derived from the fermentation of starches and sugars from various crops. To date, the carbon dioxide emissions per mile traveled have been estimated to be 20-30% more for ethanol than for gasoline because the cultivation of sugar and starch crops is input intensive and only part of the crop can be used (although this depends on the nature of the crop that is used). If the whole crop could be used, including the lignocellulosic portion (i.e. the stalk), the economics and economic benefits would improve and ethanol could be produced even from wood. This is called lignocellulosic ethanol. Canada is leading research in this area through the activities of the company Iogen. A breakthrough in the production of lignocellulosic ethanol would present a major step forward in reducing greenhouse gas emissions as there are few powerful renewable energy systems can satisfy the needs of rapidly growing global transport markets.
4.3 Natural Gas Options for Fleets – Brief Perspectives from the Canadian Natural Gas Vehicle Alliance

Natural gas vehicles are another option available to municipal fleets that want to reduce their carbon footprint, decrease harmful airborne pollutants, and green their fleet. Although fleet managers may see the use of natural gas as a significant departure from the traditional use of fuels, there are benefits to natural gas usage as it is abundant, low in carbon, and of lower cost than gasoline and diesel fuel. Further, facilities built to handle natural gas vehicles can also safely handle hydrogen-powered vehicles of the future.

There are many fully commercialized natural gas technologies available. Examples of commercially available options include:

- Heavy-duty vehicles such as transit buses and refuse trucks that use compressed natural gas (CNG) in an internal combustion engine (designed for natural gas operation only).
- Light-duty vehicles such as pickup trucks, vans and passenger cars that use CNG in an internal combustion engine that is modified for bi-fuel (CNG or gasoline) operation.
- Class 8 tractor trailers that use liquefied natural gas (LNG) in a modified diesel engine, thus maintaining diesel cycle efficiencies. At present, there is no commercially available source of LNG in Canada, but this is expected to change as offshore LNG enters the market.

Canadian municipalities that have integrated natural gas vehicles into their fleet operations include: Cornwall (9 transit buses), Hamilton (121 transit buses), Moose Jaw (20 pickup trucks, vans), Toronto (138 vans, pickup trucks), Vancouver (75 transit buses), and Victoria (40 cars, pickups). Four of the transit buses running in Vancouver are operating on hydrogen-enriched natural gas, which reduces NOx emissions and accelerates the use of hydrogen in commercially viable vehicles.

In Canada, there is a distinction between what is available in each vehicle class as Original Engine Manufacturers (OEM) product versus aftermarket conversions. Heavy duty transit buses and refuse trucks are available from a range of OEMs direct from the factory. For example, New Flyer (Winnipeg) and DaimlerChrysler Commercial Bus (Mississauga) manufacture natural gas transit buses. Labrie Environmental (Saint-Nicolas, Quebec) manufactures natural gas refuse haulers. There are also natural gas ice resurfacers manufactured by Resurface (Elmira).

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46 Original material presented by A. Milner, Canadian Natural Gas Vehicle Alliance.
47 For example, heavy vehicles such as transit buses and refuse trucks use mature, fourth generation natural gas engine technology.
48 Moose Jaw introduced natural gas and further refuel these vehicles on a public station that is on city property. Conversion kits have been included in municipal tenders. Natural gas in SK is less than 60 cents/litre.
49 Toronto bought 50% of their light-duty natural gas vehicles through the Better Transportation Partnership which provided repayable capital for the vehicle premiums.
50 Based on a transit facility study for the City of Ottawa commissioned by the Canadian Natural Gas Vehicle Alliance.
In the light duty area, most OEMs do not offer natural gas options in North America, which means that available technology options are primarily aftermarket conversions. Certified facilities can install conversion kits and service natural gas for vehicles. More detailed technical information on natural gas vehicle conversions is available from the Canadian Natural Gas Vehicle Alliance, including information on forklift conversions.

With the difference in price between natural gas and gasoline ranging between 10% to 40%, natural gas vehicles can help fleet owners reduce fuel costs. This said, there is a notable capital premium to acquire a natural gas vehicle and refueling infrastructure for fleets that cannot rely on public refueling stations. Refueling infrastructure must be sized according to fleet needs. There is typically a lifecycle cost savings associated with both light- and heavy duty natural gas vehicles even when incorporating refueling infrastructure cost, and fleet managers need to understand upfront capital considerations. Refueling options include: (a) fast fill at speeds comparable to liquid fuels, (b) overnight fill which provides a cost effective option for return-to-base fleets, and (c) vehicle refueling appliances for refueling a small number of natural gas vehicles.

Another ‘natural gas’ option, that being renewably-sourced biomethane produced from landfill gas and biomass, can further reduce emissions as well as reliance on fossil fuels. This area represents an emerging opportunity, particularly for municipally operated fleets. When biogas is upgraded to a quality comparable to natural gas it is called biomethane. Sweden operates half of its natural gas vehicles on biomethane (with no vehicle technology change required). Orange County, California operates its transit fleet on upgraded landfill gas. This option is an interesting alternative as it can enable the concurrent usage of otherwise wasted feedstocks, as well as meet the fuel needs of a municipal transportation fleet.

Strategically, natural gas can be a valuable transitional fuel that reduces carbon emissions in the present while enabling the future use of hydrogen. Fleet owners can gain experience using a gaseous fuel which will assist in the future transition to zero emission hydrogen fuel cell vehicles. Facilities built for natural gas can also accommodate hydrogen, and if this is built-in as new, the cost is less than 1% of total capital (vs. the cost for retrofitting which is very significant).

**Conclusion**

There are many benefits to using natural gas. Overall, it is worthwhile for municipal fleet operators to consider awarding extra points to bidders to help drive the market for greener technology in general. Where possible or desirable, it may be of value to consider a fuel-neutral approach to procurement. Guidelines and considerations to sourcing fuel are provided in the next Section 4.4.

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2 The Province of Ontario offers a $1,000 retail sales tax rebate on light duty vehicle conversions. Payback on a converted vehicle ranges from two to four years depending on mileage. An analysis of maintenance costs for an Ontario-based fleet of light duty natural gas vehicles showed annual incremental maintenance cost with natural gas was less than $50/vehicle/year.

3 Approximately 15% of the forklifts in Ontario operate on natural gas. Conversion technology is used. Natural gas forklifts improve air quality resulting in a reduction in the number of facility air exchanges that are required.
Did you know?

Did you know that if you purchase or lease a vehicle that operates on alternative fuels, you may qualify for a rebate? In Ontario, people who purchase or lease new or used vehicles licensed under the Highway Traffic Act (e.g., automobiles, buses, trucks, and vans) may qualify for a rebate of retail sales tax (RST) if the vehicles operate or are converted to operate on an alternative fuel.

A rebate of the 8% RST paid on vehicles powered by alternative fuels, including RST paid on any conversion costs, is limited to:
- $750 for propane vehicles
- $1,000 for vehicles powered by any other alternative fuel
- $1,000 for HEVs delivered to purchasers after May 9, 2001 and before March 24, 2006
- $2,000 for HEVs delivered to purchasers after March 23, 2006 and before April 1, 2012.

The rebate dollar limits do not apply to buses.

A vehicle that is converted after purchase may also qualify for a rebate of RST. To qualify for a rebate, the vehicle must be converted within 180 days from the date it was purchased. Rebate applications must be received within four years from the date the RST was paid.

People who purchase or lease new or used vehicles licensed under the Highway Traffic Act (e.g., automobiles, buses, trucks, and vans) may qualify for a rebate of RST if the vehicles operate or are converted to operate:
- Exclusively on electrical energy
- Exclusively on propane, natural gas, ethanol, methanol, or other manufactured gases; or
- As dual-powered vehicles (vehicles that use one of the alternative fuels mentioned above and that can also be powered by gasoline or diesel fuel).

4.4 Considerations in Fuel Procurement

The principles behind how and indeed what fuel to use in your fleet can be compared to the idea of the 3Es of energy use: energy conservation, efficiency, and energy from renewables.

1. Use Less Fuel and Use it Efficiently

The single first best thing a fleet manager can do for the environment and to cut costs is to burn less fuel (i.e., encourage use of transportation alternatives, stop idling, perform regular preventative maintenance, among other options). The more a fleet can perform using less energy, the better off a fleet will be regardless of the type of fuel.

Some major fleet operators and decision makers are beginning to increasingly support alternatives to vehicle use. The Province of Ontario Shared Services Bureau, for example, is exploring mechanisms to incent decision-making to encourage telecommuting and other lower impact, very effective, alternatives.

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51 Original material presented by B. Oliver, Pollution Probe and has been modified.
Although the single most effective way to reduce fuel use is to decrease dependence on the use of vehicles, the reality is that vehicles are still in demand and in high use today. It is therefore important to try to optimize vehicle use as much as possible. As a starter, some recommended options that enable better fuel efficiencies include:

- **Use Best in Class Vehicles**: Review your best-in-class options at every opportunity when replacement vehicle strategies are being planned. For light duty vehicles including cars, vans, SUVs and pickup trucks, Canada’s EnerGuide is available. For medium/heavy duty trucks, consider including fuel economy ratings and specifying concerns around greenhouse gas output in your replacement vehicle specifications. Consider the ‘long view of your fleet assets’ – increased capital costs are sometimes mitigated by more fuel-efficient vehicles over their entire life cycle. The expression “long term gain for short term pain” is quite valid.

- **Fuel Type**: Carefully consider the expanded use of diesel/biodiesel-fuelled vehicles to replace gas units. Investigate using additional alternative fuels and inclusion of more hybrids in your fleet.

- **Operational Improvements**: Driver training in the area of fuel-efficiency and working collaboratively with your internal user departments to find ways of reducing idling, fuel use and GHGs will pay considerable dividends as employees and the public become aware of your efforts to green your fleet. You can also leverage the public’s greater understanding of the impact of global warming and climate change.

2. **Understand that different fuels have different combustion qualities, energy contents, and are derived from different feedstocks**

At this point there is no standard practice in Canada that helps to account for environmental impacts of our fuel purchasing decisions. With biofuels in particular, the common premise is that one of the primary benefits, other than renewability, is that the growth of plant-based feedstock can offset carbon dioxide from the atmosphere. This aspect is reductionist as there are many other impacts that result from the cultivation of bio crops, including soil erosion, nutrient depletion, and leaching. Further, some biofuels require significant energy inputs in terms of fertilizer and other materials that can negatively impact the energy input: output ratio of renewable fuels. Lastly, there have been increasing concerns around the practice of using food crops such as corn to produce fuel. It is believed that the current focus on biofuel production around the world is beginning to have an impact on global food prices and may pose a significant ethical dilemma insofar as food security.

It is important to note that the same complexities as far as upstream production also occur with traditional fuels – light sweet crude from Texas for example has a substantially differing environmental impact that fuels derived from oil sands crude. Upstream production is a very important part of the fuel usage equation when it comes to understanding the full impact of the vehicles we drive.

As an end-user of such fuels, fleet managers have before them the responsibility of understanding that “not all fuel is created equal.” This is further complicated by the fact different fuels have different energy components and that there is also an interplay between the engine technology and the fuel which can lead to better, or worse, fuel consumption. Such factors, among others, also contribute to the overall “efficiency” of the fuel being used and its ultimate environmental impact.
Conclusion
The important thing to impart is that as a fleet manager, one of the best things you can do is first, use less fuel, and second, look for or insist upon some type of certification that the fuel you are receiving was produced in an environmentally sound manner. Municipal fleet managers have an important and influential role to play in this arena as leading-edge fleet operators with dual concern for fuel efficiency and environmental impact.

What will help in the long run is to support a marketplace that allows fuel to compete on environmental performance. Municipal fleet managers, as early adopters of alternative fuels, are the key players in this outcome.
Section 5.0: Management Software to Optimize Fleet Efficiency

Given today’s soaring fuel prices and the likelihood of continuing increases (see Figure), juxtaposed with the need to update and upgrade the approach to municipal fleet management, a great opportunity exists for the municipal fleet operator to seek out new efficiencies. Municipal fleet managers would be well served by careful review of their fuel expenditures, an asset management perspective of fleet operations and a clear mechanism or guidelines for reducing fleet fuel costs.

For example, in British Columbia six municipal fleets recently participated in the development of the new fleet review tool launched by the Fraser River Basin Council in collaboration with various private and public sector partners. This assessment used a number of fundamental fleet operational data points to provide valuable indicators of fleet performance, including baseline fuel consumption, operating cost information, and emissions projections.

For one of the six fleets, a potential operating cost savings of over one million dollars annually was identified, illustrating that such analyses can identify potential fleet efficiencies that, in many cases, can save considerable expenditures in fleet operating and capital costs.

It is imperative that municipalities move towards implementing a modern, efficient vehicle fleet that maximizes cost savings, program operation, workplace quality, and environmental consideration. This includes establishing the true cost of fleet operations as it relates to fuel consumption, and the use of internal benchmarks for comparison (vehicle to vehicle, ministry to ministry, etc.) to reveal opportunities for improving fuel/emissions performance and/or goal setting. Further, fuel data management should, wherever possible, be used to develop estimates of greenhouse gas emissions generated as a result of fleet operation and thereby enable tracking of reductions over time.

This section provides an overview of available software for effective fleet management and important attributes to measure.
5.1 The E3 Program and Fleet Software Attributes

Municipalities in Canada have significant tangible capital assets. With such value at one’s disposal, it would stand to reason that municipalities would place top priority on the proper management of their fleet assets.

Findings to date in Fleet Challenge Ontario’s 2008 work with select Ontario municipalities indicate that many municipalities do not have easy access to their fleet data, and therefore have to retrieve statistics from different electronic and non-electronic sources from various departments, and then centralize this information in a spreadsheet in order to provide a quantitative picture of fleet operation. This is indicative of the general lack of data collection and data management in municipal fleets, as many municipalities seem to manage their fleets on a day-to-day basis, reacting to emergencies as they arise without an analytical operating matrix.

Applying E3 in Ontario – Identifying Opportunities for Saving

As part of the Fleet Challenge Ontario program, pro bono municipal green fleet reviews were applied to 12 Ontario municipalities using the E3 evaluation framework. The results have identified the following collective economic and environmental considerations:

- Cumulative Annual Fuel Usage: 20,070,086 litres
- Potential fuel savings through fleet replacement with green vehicles: 1,029,644 litres
- Median Fuel Efficiency: 29.9 l/100 km
- Cumulative Annual Cost of Downtime: $15,269,750
- Total Fuel Cost: $17,681,255
- Total Repair Cost: $14,834,769
- Total Preventive Maintenance Cost: $15,427,848
- Annual Total Cost for Repairs, Maintenance, Fuel, Capital & Downtime: $66,804,036
- Total Lifecycle GHG emissions: 67,363 CO\textsubscript{2} eq. tonnes

E3 is a tool that can assist fleet managers in optimizing fleet operation, reducing fuel costs, and improving environmental performance. E3 provides an integrated analysis and green rating system for fleets, which is modeled after LEED\textsuperscript{®} for buildings. Where LEED\textsuperscript{®} provides a complete framework for assessing building performance and meeting sustainability goals, E3, a system designed by and for fleet managers, recognizes fleets for greening in terms of bronze, silver and gold categories (with platinum soon to be developed for carbon neutral fleets).

E3 begins where traditional fleet management – that of ‘seat of the pants’ management, best guess, little data, and big budgets – leaves off. The program processes data to provide a roadmap for more effective fleet management through objective evaluation and support for sound fleet management decisions.

52 Original material presented by R. Smith, Fleet Challenge Ontario
53 Based on well-founded scientific standards, LEED emphasizes state of the art strategies for sustainable site development, water savings, energy efficiency, materials selection and indoor environmental quality. LEED recognizes achievements and promotes expertise in green building through a comprehensive system offering project certification, professional accreditation, training and practical resources.”
Three levels of data analysis are available: basic and operational information, a unit asset profile, and an asset management profile. A basic E3 report provides information on fuel efficiency, GHG baselines, key performance indicators (KPIs), performance plans, and exception management. This latter is an especially important factor as it can provide a picture of the basic life cycle analysis of the fleet (see Section 2.1).

Additional features include new tools, such as using a balanced scorecard as a business tool (which works like a KPI that is tied into performance contracting system for employees), as well as profit and loss forecasting.

Although assembling data takes time and work, the basic inputs include:
- Unit numbers;
- Review period (one year);
- Hours of potential use, cost per litre; and,
- Internal cost of capital.

The more complete a dataset that is fed into the E3 analysis will result in a greater level of detail and direction in final reports. Additional operational inputs of use include information on:
- Vehicle category
- Type and quantity of fuel used;
- Engine hours operated; and,
- Vehicle kilometres traveled (tracking engine hours, although not always a common practice, are a best practice especially in consideration of the intensity of urban duty cycles).

Other important inputs can be used to derive a unit asset profile through using information on:
- Vehicle make/model/yr;
- Leased/owned;
- Lease payments;
- Planned life cycle;
- Acquisition date; and,
- Replacement vehicle.

Lastly, a unit asset management profile can be developed, through including information on:
- Downtime;
- Preventative maintenance costs;
- Repair costs; and,
- Fuel costs/revenue.

Although many fleets do not track downtime, it is suggested that this is an extremely important factor to consider in optimizing operations. For example, application of E3 to 12 municipalities in Ontario identified over $15M in downtime costs for these fleets alone. Further, it is recommended that preventative maintenance and repair costs be tracked separately whenever possible.

The output of the E3 review and analysis is a series of 60-70 page reports that provide average and total metrics for the fleet. Bar charts are provided and highlights of top and bottom performing vehicles are identified (i.e., those vehicles that are 50% better/worse than the median points for similar vehicles in the fleet).
E3 Level Two reports help to determine the net present value of the fleet and which vehicles are coming due for replacement. Level Three reports provide a sense of asset management in terms of assessing the PM schedule to reactive asset ratio – the point here is that it is extremely important to keep vehicles on the road when active and this report can provide feedback on the fleet performance in this area.

As E3 grows across Canada and membership and data accrue, it will be possible to offer a sector by sector comparison. This will allow municipal fleet operators to compare themselves directly with the efforts of their peers in optimizing fleet operation.

**TOP TIPS: Technology Verification Options for Fleet Managers**

Fleet managers rarely have the ability to evaluate the validity of a vendor’s claim, for example that product \( x \) will result in environmental or fuel efficiency improvement \( y \).

The verification of vehicle fleet technologies is both a problem and an opportunity. Claim verification can be onerous, particularly in the aftermarket area. Fleet managers don’t always have the time to deal with verifying such claims while managing the fleet and making other important decisions.

Organizations such as ETV Canada and OCETA can assist fleet managers in verifying the actual performance of a vendor claim. Key benefits are that fleet managers as a result have access to third-party verification of performance claims based on reliable information and technical testing and data.

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54 Original material presented by S. Guerin and J. Neate, ETV Canada
Best Practice: SAP and Fleet Management – Perspectives from the City of Thunder Bay

Prior to 1999, data management for the municipal fleet of Thunder Bay was scheduled according to manufacturer recommendations. This meant that the data that was available did not interface with financial or human resources data in a manner that was meaningful and useful, as the system was focused primarily on tracking vehicles through the work that was performed on them. The capital fleet replacement data for example, was managed by a separate manual system. Most other associated data records were also manual, including for purchase order requests, logged work, and time entry, and staff had limited access to data. This scenario might be a familiar one for other municipal fleets in Ontario.

Thunder Bay's entire approach and system for data management improved enormously when the City adopted a comprehensive enterprise model (SAP) that was user-friendly, up to date, and managed through capital systems. This powerful system is privy to various applications for data management, not the least of which includes:

- Human Resources (i.e. employee records and time entry)
- Materials Management (i.e. total purchasing management)
- Financial Information (i.e. finance programs and auditing)
- Cost Control (i.e. budget management)
- Project Systems (i.e. capital project management)

Some of the key attributes that Thunder Bay found useful in its new data management program include accessibility, query functions, tracking, automated work scheduling and preventative maintenance accessibility, real-time monitoring, and the ability to create new trend reports, among other important functions. The current system is live and available to any users with access rights. Any transaction is recorded on the system and sourced by management reports. Each report has different variance and different selection criteria, and all key features are searchable (i.e. customer, group of vehicles, bin of vehicles, acquisition value of all vehicles received in 2007, etc.)

Other features include an automated work order scheduling system, which means that each new vehicle that is purchased is assigned a PM schedule. This allows the use of the vehicle to be planned effectively (i.e. there is an automatic reminder for PM two weeks before work becomes due). Further, the technicians all have access to this data on the shop floor, which is an empowering and time-effective strategy as technicians longer have to approach or wait for their supervisor to provide this information.

The system also allows tracking of labour in real time which is important for understanding how the budget is performing and any possible variance against this budget. Trend reports can be created for many different queries, and various check mechanisms can be installed (i.e., as in requiring purchase order releases prior to costs being assigned/incurred). All final reports can be excerpted to Excel format, which is extremely useful in calibrating the data needs for other specific fleet management systems like E3.

A comprehensive list of SAP data features are listed in Appendix A.

-City of Thunder Bay Municipal Fleet Manager
Section 6.0: Summary and Conclusion

This Best Practices Guide has been developed to provide examples of currently available and cost-effective fleet management policies and practices that can reduce pollution, while at the same time save money and improve workplace and community health. The basis for this guide is the collective experience of select local governments in Ontario and of fleet management experts. Information in this manual has been structured so as to provide an “end-to-end” blueprint for initiating, deploying, and maintaining a green fleet.

Creating a Green Fleet

Although no single definition of a green fleet exists, green fleets tend to focus on two overarching goals: (1) optimizing efficiency in its various incarnations (i.e. mode of travel, fuel use, route planning, fleet operation, vehicle size, etc.); and, (2) increasing the use of alternative fuels and sustainable technologies.

Key components of an effective green fleet plan should include fuel efficiency targets, a GHG baseline, and an overall implementation strategy with supporting goals and milestones, assigned roles and responsibilities, monitoring and reporting requirements, and a stated commitment to continuous improvement. A well configured fleet data management system is an important supporting asset, as this tool can help to evaluate and identify further areas for improvement - and can save as much as 20% of annual operating budget, if not more.

Building awareness of the extraordinary opportunity to reduce greenhouse gases while improving financial performance is an essential first step of any green fleet plan. This involves developing awareness and a vision, eliciting and building management and stakeholder support, and identifying clear performance measures. This “systems approach” must be supported by a project manager and have a suitable budget for success to be assured.

Managing Green Fleet Assets Effectively

If capital is tied up in an asset of any kind, an enterprise needs to able to evaluate whether this asset is still serving a worthwhile purpose to the organization. A key question to consider is if and how long an asset is retained, or whether it should be replaced. An understanding of the value of the vehicle at a particular point in time can help define the answer to this question, as when a vehicle ages there are definite financial and operational consequences with downtime.

Fleet retention decisions should not be only made on the basis of the very visible acquisition cost of the new asset – it is also extremely important to think about all the other components of buying, operating, and replacement. The acquisition cost can always be thought of as being analogous to the small visible surface of a much larger iceberg of other considerations.

Insofar as selling and remarketing, most fleet managers have some idea of how to buy and how to sell a vehicle, but there can often be subtle ways to maximize the value of this process. Vehicle salability should be considered in the original Request For Quotation (RFQ), as it is prudent to ascertain what vehicle will provide the most return prior to the purchase of the vehicle. Similarly, it is important to acknowledge that an end-of-service vehicle is a depreciating asset and to consider selling the vehicle as quickly as possible in order to avoid additional maintenance costs as the vehicle depreciates.
Lastly, older vehicles that remain on the road generate more pollutants than new vehicles of similar size. When older vehicles that are not going to the auction block are retired from service, fleet managers should be considering the end-of-life fate of these vehicles as not all of them are necessarily properly decommissioned. Ensuring that end-of-life vehicles go to a responsible recycler, such as those 150 members of the Ontario Automotive Recyclers’ Association, can go a long way to addressing this environmental concern.

Maintaining Your Green Fleet

A major component to maintaining a green fleet is regular preventive maintenance inspections and follow-up repairs. A good preventive maintenance program consists of a number of essential elements, but to start, keeping accurate vehicle and equipment maintenance files are an important data gathering aspect that should be maintained over the long term.

In order for a fleet manager to operate a fleet efficiently, it is essential that all technicians are trained in the newest technologies and kept up to date. Predictive maintenance is also a critical part of any preventive maintenance program, which is the timely replacement of a part or component just prior to its known time of failure. The replacement of these parts and/or components should be scheduled as part of a regular preventive maintenance inspection.

In the operation of a fleet, and in particular the working garage, it is not always evident where the largest impact may be. Environmental impacts can be unwittingly associated with the recycling of tires, oil filter changes, use of aerosols, water use, autobody refinishing, filters, particulates, on-site fuel usage and spills, and other areas. Properly executed, an Environmental Management System (EMX) can help to identify and control these unanticipated environmental impacts before problems occur. A good EMS can provide a structured approach to planning for and implementing environment protection measures, and achieves these goals by providing resources, assigning responsibilities, and enabling ongoing evaluation of practices and procedures.

Anti-Idling and Alternative Fuels

The decision to reduce the use of traditional fuels and/or explore the use of alternate fuels and hybrids as a method of reducing environmental impact is a good one. Alternate fuels for consideration include biodiesel, ethanol, natural gas and propane; however the importance of reducing the use of the traditional fuels cannot be overstated.

Anti-idling policies, for example, provide an important means to reduce traditional fuel consumption for a fleet and contribute directly to bottom-line fuel savings. Lowering fuel costs through reduced idling can provide a quick-win that will capture management attention and possibly provide funding for additional green fleet initiatives.

Biodiesel is a highly desirable fuel as it needs little to no engine modification to be used successfully, and can be used as a pure fuel or blended with petroleum diesel in any percentage. Biodiesel can be successfully used year round in all fleets by preparing the fuel infrastructure, performing regular maintenance, ensuring high quality fuel is used, and ensuring a good quality blend and regular testing of the fuel.
Natural gas vehicles are another option available to municipal fleets that want to reduce their carbon footprint, decrease harmful airborne pollutants, and green their fleet. Strategically, natural gas can be a valuable transitional fuel, as fleet owners can gain experience using a gaseous fuel which will assist in the transition to zero emission hydrogen fuel cell vehicles should this become a viable future alternative.

Overall, the best approach to environmentally responsible fuel use is to first, use less fuel, and second, look for or insist upon some type of certification that the fuel that is being received, traditional, alternative, or otherwise, is being produced in an environmentally sound manner.

Managing Data for Optimal Fleet Usage

There are many available frameworks for effective fleet management and a variety of important attributes to measure in such frameworks. Comprehensive data collection and evaluation is a critical component to effective fleet operation and management. For example, Fleet Challenge’s work with 12 select Ontario municipalities has identified savings on order of over 1 m litres of fuel and costs of $15 m apiece for cumulative downtime and preventative maintenance, among other aspects.

Every fleet manager would be well served by careful review of their fuel expenditures, an asset management perspective of fleet operations and a clear mechanism or guidelines for reducing fleet fuel costs. Although not yet widespread, comprehensive data collection and evaluation is becoming gradually more recognized as a critical tool for effective fleet operation, cost management, and environmental responsibility.

In conclusion, municipal fleet operators are becoming increasingly aware of their fleet’s impact on the environment to the point where some municipalities in Canada have taken a leadership role on dealing with these concerns. As witnessed through program interest and workshop participation, there is a broad and growing interest across Ontario to implement “green fleet” plans that will reduce the output of harmful emissions in municipalities.

A great opportunity exists for all municipal fleet operators to seek out new cost efficiencies and simultaneously take on a leadership role on community environmental issues. While this Best Practices manual is not an inclusive list of all the climate protection activities local governments are undertaking, the information and examples provided demonstrate the great potential for global warming prevention through local action.

It is our hope and our anticipation that the information provided in this manual will help move the yardstick forward for green municipal fleet management in Ontario and in Canada.
Resources

Chapter One: Creating a Green Fleet Plan – the Municipal Challenge

Policy Developments Affecting Municipal Fleet Management in Canada (Section 1.1)
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What is a Green Fleet? (Section 1.2)
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City of Hamilton Green Fleet (Section 1.2, Text Box)
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Getting Management Buy-In to a Green Fleet Plan (Section 1.3)
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City of Toronto - Executing a Green Fleet (Section 1.3, Text Box)
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Chapter Two: Managing Green Fleet Assets Effectively

Life Cycle Optimization (Section 2.1)
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Selling and Remarketing (Section 2.2)
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Vehicle Retirement /Car Heaven Program (Section 2.3)
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Vehicle Scrappage (Section 2.3)
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Chapter Three: Maintaining a Successful Green Fleet

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Hybrid Maintenance (Section 3.2)
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Chapter Four: Reduced Idling and Alternative Fuels

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The Use of Biodiesel (Section 4.2)
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Natural Gas for Fleets (Section 4.3)
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Perspectives on Fuel Procurement (Section 4.4)
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Chapter Five: Management Software to Optimize Fleet Efficiency

Effective Data Management: The E3 Program (Section 5.1)
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Appendix A: SAP Data Features

- SAP information is available to any SAP users with access rights;
- SAP users have access rights to transactions relevant to their job;
- SAP Project Systems – total fleet capital budget management program;
- Data drill down from work order level to Materials Management, FI/CO, HR staffing, Fuel, measurement documents (KM/HR), equipment master data and accounts payable process;
- Data is live and easily sourced by many management reports with user managed report data field variants;
- Asset tracking – vehicle data, VIN, plate, purchase date, cost etc;
- Customer assignment – single assignment or group of vehicles;
- Preventive/predictive maintenance – automated work order scheduling; labour tracking, technicians confirm time worked directly to work order; fuel use and cost, daily upload fuel use and costs;
- Technician access to data;
- Real time data reporting, work order and financial reporting;
- Capital replacement program planning and financial management;
- Human resources reporting of all fleet staff;
- Materials management reporting;
- Financial accounting management reporting;
- Purchase order release protocol by supervisors/managers for cost controls;
- Hourly use tracking of units by customer time sheet (where applicable)
- Measurement documents for all vehicles via fuel system data;
- Measurement documents for vehicles via work order system;
- Drill down from financial records to work order and purchasing data;
- Accounts payable data, invoicing data all on line from work order;
- Access to SAP via VPN and internet network anywhere;
- Data search by date range/shop/employee/equipment group etc;
- SAP reports can be easily exported/changed to excel format for data studies and evaluation;
- SAP has training module for new staff training prior to working within live environment;
- Search data by work order activity codes/work type/short text;
- Follow work history from delivery of vehicle;
- Fuel data calculates consumption rating – L/100Km for vehicles;
- Attach vendor invoices/pdf/word docs directly into work order operation text notes.
- Data capture for O/S vendor activity by fleet/work sites/staff/date/work type
- Data capture for planned and unplanned work by fleet/work site/staff/date work type.