

Green Fleet Transition Plan 2004-2007



 **TORONTO** Fleet Services





Table of Contents

Acknowledgments	6
1.0 Executive Summary	7
2.0 Green Fleet Transition Plan	9
2.1 Purpose	9
2.2 Objective	9
2.3 Indicators	9
3.0 Background	10
3.1 Environmental Plan	10
3.2 Low-sulphur fuel purchase	10
3.3 Emissions trading considerations	11
3.4 Vehicle and equipment replacement requirements 2004-2006	11
3.5 Comprehensive Corporate Air Quality Strategy (CAQS)	12
3.6 Greater Toronto Area Clean Air Council (GTA-CAC)	12
4.0 Fleet Services Activities	13
4.1 Green Fleet Technology Testing Report (July 2003) – staff report	13
4.2 Right-sizing the corporate fleet	13
4.3 Commitment to continuous improvement	14
4.4 Client services	14
4.5 ISO 14001	15
4.6 Repair our Air Fleet Challenge 2003	15
4.7 Better Transportation Partnership	16
5.0 Technology Testing Report – Greening Our Fleet	17
5.1 Natural gas vehicles and hybrid-electric vehicles	17
5.2 Biodiesel	19
5.3 Current trends	21
5.4 Future prospects	22
6.0 Air quality in Toronto	23
6.1 Other considerations	23
7.0 Implementation schedule	24
7.1 Commitment to Funding	24
8.0 Conclusions	26



Table of Contents cont...

List of Tables

Table 1 – Green Fleet Transition Plan – four-year cost summary	8
Table 2 – Vehicle replacement costs (2004 – 2006).....	11
Table 3 – Greenhouse gas emissions reduction for hybrid-electric and natural gas vehicles	19
Table 4 – Biodiesel emission factors	20
Table 5 – Greenhouse gas emissions reduction from biodiesel.....	20
Table 6 – Green Fleet Transition Plan – Incremental capital and operating costs	25
Table 7- Summary of Green Fleet Transition Plan eCO₂ reductions.....	26

Appendices

Appendix A1 – Environmental Plan Recommendations being addressed by the Green Fleet Transition Plan (29)	27
Appendix A2 – Gap Analysis at 843 Eastern Ave.	29
Appendix A3 – Repair our Air Fleet Challenge	31
Appendix A4 – Top Ten Nox and Sox sources in Toronto	32
Appendix A5 – Detailed Green Fleet Transition Plan Implementation	33
Appendix A6 – Fuel savings calculations for hybrid-electric and natural gas vehicles.....	35
Appendix A7 – Glossary of Technical Terms.....	36

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1.0 Executive Summary

The City of Toronto, Fleet Services division is responsible for more than 4,000 licensed vehicles and equipment units. The Green Fleet Transition Plan was developed to reduce the equivalent carbon dioxide (eCO₂) output of the City's inventory by 10 – 15 million kilograms, and significantly reduce other forms of pollutants over the four-years of the Plan and future years.

The Plan is affordable, sustainable, renewable and has the capacity to contribute to economic growth and development by promoting the use of biodiesel, hybrid-electric and natural gas vehicles. Fleet Services estimates the additional cost to implement the Plan will be \$1,799,021, which is less than three per cent of the forecast \$68,299,600 already planned for vehicle replacement over the next four-years from 2004 – 2007 (see Table 2 – Vehicle Replacement Costs 2004 – 2006).

Efficiency is an important part of the Green Fleet Transition Plan, and Fleet Services has an ongoing initiative through the Fleet Acquisition and Specification Support Team (FASST) to seek out efficiencies through right-sizing specifications with departmental clients. This includes optimizing engine sizes, vehicle weights, outfitting and standardizing fleet specifications across departments.

Proven technologies and methods are available at a low cost today, and are included in the Green Fleet Transition Plan. For example, fuels containing low-NO_x additives can be added to the current criteria being used in the corporate fuel purchase tender for gasoline and diesel. Participation in anti-idling campaigns has proven to be successful and future plans include a role in the National Fleet Challenge.

The alignment of the Environmental Management System in Fleet Services to meet the ISO 14001 standard will demonstrate the City's commitment through the entire Fleet Management operation and should be pursued starting with the Central Garage at 843 Eastern Avenue.

New technologies that were tested and recommended in the first Technology Testing Report (2003) are incorporated into the Green Fleet Transition Plan. As recommended in the staff report on the Technology Testing Program, biodiesel, hybrid-electric and natural gas vehicles are proposed at an incremental cost per year of existing programs as follows:

Table 1 – Green Fleet Transition Plan – four-year cost summary

	Capital Cost	*Operating Cost	Total Cost
2004	\$0	\$0	\$0
2005	\$547,000	\$104,328	\$651,328
2006	\$419,500	\$164,174	\$583,674
2007	\$419,500	\$144,519	\$564,019
Four-year total	\$1,386,000	\$413,021	\$1,799,021

Note – In 2004, the incremental cost of hybrid and natural gas vehicles is to be paid by the Toronto Interdepartmental Environment (TIE) team and the Better Transportation Partnership, respectively.

* Operating Costs are after fuel cost savings (occur each year starting in 2005), were deducted.

The Green Fleet Transition Plan outlines, in a comprehensive and affordable manner, a bold vision and implementation schedule that clearly demonstrates the City’s leadership role in Canada towards reducing its environmental impact. Based on full implementation, the Green Fleet Transition Plan proposes to replace 84 per cent of the planned vehicle replacements of light duty vehicles (cars and light trucks) with hybrid-electric vehicles (see Appendix A5).

Overall, the Green Fleet Transition Plan directly addresses as many as 29 of the 66 recommendations outlined in the City’s Environmental Plan (2000) making substantial progress towards the City’s overall plan for improving the environment. In addition, reducing the City’s impact on the environment as well as promoting energy conservation and green power were some of the top priorities identified in the Listening to Toronto public consultations that were held in January 2004. With approval by City Council and assuming full implementation, the Green Fleet Transition Plan can be expected to reduce eCO₂ emissions from the corporate fleet by as much as 23 per cent over the business-as-usual scenario.

2.0 Green Fleet Transition Plan

2.1 Purpose

The purpose of the Green Fleet Transition Plan is to outline a bold vision and implementation schedule for moving the City's fleet towards vehicles and equipment that leave fewer negative impacts on the environment. The City of Toronto operates one of the largest and most diverse fleets in Canada in an area that has persistent air quality problems. The Listening to Toronto public consultations (January 2004) revealed that concerns about air quality and smog rank high in terms of environmental challenges.

Since 2000, optimizing fleet specifications to become more efficient while meeting operational needs has been used to meet and exceed City Council's directive of a five per cent reduction in the size of the fleet. These measures will continue and are included in the Green Fleet Transition Plan. In addition, existing and proven technologies that are currently available and could have immediate benefits will be reviewed and considered for inclusion in this Plan. Last, new technologies will be tested and evaluated by Fleet Services for consideration in City applications.

2.2 Objective

The main objective of the Green Fleet Transition Plan is to reduce negative environmental impacts such as equivalent Carbon Dioxide (eCO₂). The term eCO₂ is used under the Kyoto Protocol to identify the six greenhouse gases targeted for reduction. In so doing, criteria air contaminants (CAC) will also be reduced and the associated reduction is referred to as a co-benefit. Co-benefits can be measured in terms of air quality and the impact on human health. In addition, the Plan promotes solutions that are affordable, renewable and sustainable.

2.3 Indicators

The Green Fleet Transition Plan uses eCO₂ emissions reduction as the indicator of environmental improvement compared to the business-as-usual scenario. This important indicator is used in the Kyoto Protocol, the International agreement to combat climate change. The City of Toronto has set a CO₂ reduction target of 20 per cent based on an emissions baseline of approximately 27,000,000 tonnes in 1990 as calculated by the Air Quality Improvement Branch of Works and Emergency Services. The 20 per cent target was originally set by the former City of Toronto and then re-adopted by the amalgamated City of Toronto in December 1998.

3.0 Background

3.1 Environmental Plan

The Environmental Plan was completed in 2000 by staff following the amalgamation of six local governments that made up the former, Metropolitan Toronto. It recognizes the value of a clean, green city by the residents of Toronto. The Green Fleet Transition Plan is fully integrated with no less than 29 of the recommendations outlined in the Environmental Plan under the following categories:

- pollution prevention
- land
- water
- air
- transportation
- energy
- green economic development
- education
- governance
- reporting
- implementation

For a complete list of the 29 recommendations, please see Appendix A1 – Environmental Plan Recommendations being addressed by the Green Fleet Transition Plan (29).

3.2 Low-sulphur fuel purchase

Since 2000, the City's tender for gasoline and diesel fuel has required that potential suppliers provide information on sulphur levels (parts per million - PPM) as well as costs. Staff have evaluated the bids based on cost and emissions reduced and subsequently, City Council has chosen the low-sulphur option each year demonstrating its commitment to the environment. In the future, ultra low-sulphur fuel as well as other fuels such as ethanol blends should also be reviewed when considering environmental impacts. Fuels containing pollution-reducing additives should be considered as part of the overall evaluation when considering air quality impacts. For example, some fuel suppliers blend low-NO_x fuel additives (an emission-reducing fuel additive) in their grades of gasoline at no additional cost to the consumer.

3.3 Emissions trading considerations

An important study was completed in 2002 for the City of Toronto that looked at emissions trading from an environmental and economics perspective. One of the key findings coming out of the study, called General Analysis of Emissions Trading and Its Effects in Ontario by the City of Toronto, was that the market value of emission reduction credits (ERCs) was far below the true cost of reducing emissions. The report went further to imply that if ownership of emission reduction credits could not be secured for an environmental initiative, then the entire decision to proceed should be reconsidered. Ownership of emission reduction credits from the Better Transportation Partnership (BTP) was secured through the BTP Financing Agreement. Fleet Services is working to secure ownership of any emission reduction credits attributable to the Green Fleet Transition Plan including the use of biodiesel.

In 2002, the Canadian Federal Government through its Climate Change Action Fund began purchasing emission reduction credits from municipalities to count towards its Kyoto commitment of reducing greenhouse gases by six per cent between 2008 - 2012. If the City of Toronto were in a position to sell emission reduction credits to the Federal Government as part of its Kyoto commitment; the revenue could be used to fund the Green Fleet Transition Plan. Now, a corporate policy on emissions trading is under development by an interdepartmental emissions trading policy working group.

3.4 Vehicle and equipment replacement requirements 2004 – 2006

The Fleet Services staff report, Vehicle and Equipment and Replacement Requirements 2004 - 2006 dated August 18, 2003, was adopted by the Administration Committee and consequently by City Council at their September 2003 meetings. The report identified fleet and vehicle replacement costs that Agencies, Boards, Commissions and Departments would commit to at an affordable level over the next three-years as follows:

Table 2 – Vehicle replacement costs (2004 – 2006)

2004	\$17,718,700
2005	\$15,923,000
2006	\$17,583,000
Three-year total	\$51,224,700

Note – By averaging the cost of the three-years in Table 2, a projected cost of a fourth year (2007) would be \$17,074,900. The forecasted cost for four-years would then be \$68,299,600.

The three-year replacement program was developed to leverage the City's buying power while phasing-in new vehicle standards. The new standards will eventually result in reduced parts inventory, greater mechanical expertise and reduced parts costs. This staff report showed that the costs associated with implementing Toronto's equipment and vehicle replacement needs is significant. Due to competing service level priorities, divisions have insufficient funds to replace all vehicles in service beyond their scheduled date, the gap between approved funding and actual need will grow from \$49 million in 2004 to \$64 million in 2006. Essentially, the commitment level remains too low to reduce the average age of vehicles in service. To this end, innovative financing initiatives such as the Better Transportation Partnership (BTP) currently underway, as well as potential revenues from emissions trading and external funding are being pursued by staff to offset costs and assist in the replacement of aging vehicles with newer lower-impact vehicles.

3.5 Comprehensive Corporate Air Quality Strategy (CAQS)

Recommendation 21 of the Environmental Plan (2000) outlined the development of a Corporate Strategy that would be comprehensive enough to deal with Toronto's air quality problems (see Appendix A1 – Environmental Plan Recommendations being Addressed by the Green Fleet Transition Plan 29). The work to date on the Strategy has identified the current and future work the corporation is doing now and what needs to be done in the medium to long terms. The development of a Green Fleet Transition Plan is consistent with the Strategy's objectives in the medium term. In addition, Fleet Services is engaged in the process to develop the corporate strategy and provide technical information as required.

3.6 Greater Toronto Area Clean Air Council (GTA-CAC)

The GTA-CAC is a working group of municipal employees from the Greater Toronto Area developing air quality improvement initiatives. At their October 2003 meeting, a fuels procurement report was discussed that included the potential of a bulk, ultra low-sulphur diesel and/or biodiesel purchase for their members. While a bulk purchase offers many advantages for municipalities, it could also have large repercussions for fledgling companies trying to establish themselves in Ontario, should they be unsuccessful in such a large tender.

To this end, Fleet Services is working co-operatively with the GTA-CAC on fleet issues, green economy and other technical matters on an ongoing basis. This type of partnership addresses Recommendations 22, 24, 47, 57 of the Environmental Plan regarding co-operation between governments, advocacy and the development of green industry.

4.0 Fleet Services Activities

4.1 Green Fleet Technology Testing Report (July 2003) – staff report

The staff report, Fleet Services - Green Fleet Technology Testing Report dated August 18, 2003 was developed over an 18-month period from conception to the final report that was adopted by the Administration Committee and subsequently by Toronto City Council at their meetings held in September 2003.

Based on the findings of the Technology Testing Report (2003), bi-fuel natural gas vehicles (able to use either natural gas or gasoline) as well as hybrid-electric vehicles are being added to the list of approved vehicles for the 2004 model year. The findings of the Technology Testing Report (2003) were significant and will inform the updates to the Green Fleet Transition Plan in the future.

4.2 Right-sizing the corporate fleet

Fleet Services has an ongoing initiative to seek out efficiencies through right-sizing specifications with departmental clients. This includes optimizing engine sizes, vehicle weights, utilizing idling shutoff controls, reviewing fuelling operations and standardizing fleet specifications across departments. With respect to fuel ratings, Fleet Services references the State of California Fleet Operations and their information on existing and future program enhancements introduced by the California Air Resources Board (CARB). For example, CARB uses a 13 per cent reduction in emissions over 2004 model cars to classify a vehicle as being an Ultra Low Emission Vehicle (ULEV). Based on this benchmark, both hybrid-electric and natural gas vehicles being proposed in the Green Fleet Transition Plan meet the minimum standard for ULEV.

In 2003, Fleet Services worked with clients to determine if V8 pickups could be replaced with more economical and fuel efficient V6 models in some applications. This type of approach offers the dual benefit of cost savings and emissions reduction during the process of transitioning toward a greener fleet. It is also important to understand that there is a point of diminishing returns with right-sizing exercises if operational capabilities are compromised.

As noted in the Technology Testing Report (2003), significant emission reductions have been made over the last decade to gasoline-powered, internal combustion engines. Today's new vehicles operating on gasoline have very low outputs of nitrogen oxides (NO_x), carbon monoxide (CO) and hydrocarbons (HC). To illustrate this point, the state of California has recently classified 17, 2004 car models with California emission controls operating on gasoline as PZEV vehicles (partial zero emission). At the time of this report, emissions standards in Ontario were

regulated under the Province's Drive Clean Program, and Fleet's M4 database was being expanded to record the emission test results from this program.

4.3 Commitment to continuous improvement

Continuous improvement is a key concept in the Green Fleet Transition Plan. It acknowledges that management in consultation with staff must continue to seek out efficiency improvements in all aspects of Fleet operations. In this regard, organizations such as the National Association of Fleet Administrators (NAFA), GTA-CAC, Municipal Equipment Operators Association (MEOA), Auto21 network and Provincial Best Practices Working Group will be useful in terms of establishing benchmarks for comparing efficiency.

One recent improvement has been the introduction of Shell's gas procurement card to refuel the fleet of 138 natural gas vehicles. This initiative eliminated service fees and achieved greater fuel discounts.

4.4 Client services

Fleet Services provides a quality selection and specification consultation service to its departmental clients. Clients using Fleet Services include Community and Neighbourhood Services, Economic Development Culture and Tourism, Works and Emergency Services, Urban Development Services, Corporate Services, Finance, Library, Exhibition Place and the Toronto Zoo. Education, training and consultation to identify vehicle needs and new technologies are some of the services provided to these clients. In 2003, Fleet Services introduced the Fleet Acquisition and Specification Support Team (FASST) to streamline and improve the procurement process for its clients. In addition to the vehicle component, the Fleet Services division trains, upgrades and monitors over 10,000 operators of City vehicles and equipment. An anti-idling component was added to the training program for 2004 to impress upon operators the need to reduce idling everywhere and at anytime. This program was developed in tandem with the "Making Toronto Idle Free" campaign launched in 2003.

Repair and service of existing vehicles and equipment is an important function provided by Fleet Services. Over 35,000 work orders and more than 100,000 job lines (lines on a work order) are generated annually to maintain the fleet at peak efficiency in order to meet all regulations required under the Commercial Vehicle Operators Registration, Ministry of Environment, Transportation and Occupational, Health and Safety Act. Properly maintained and tuned equipment performs well, minimizes emissions, and reduces downtime. Specialty and warranty repairs are referred to the manufacturer while Fleet Services acts as the liaison and the trusted expert authority through its Certified Automotive and Truck and Coach mechanics on behalf of the City to ensure only necessary repairs are performed.

4.5 ISO 14001

The ISO 14001 standard was established in 1996 and specifies the actual requirements for an Environmental Management System (EMS). It applies to those environmental aspects the organization has control over and which it can be expected to influence. In Canada, the City of Calgary is ISO 14001 certified for all its operations. In Ontario, the regions of Durham and York are completing the certification process.

Fleet Services is reviewing a gap analysis to determine which areas in its operations located at 843 Eastern Avenue (Central Garage) could meet higher standards of practice to become ISO 14001 compliant (see Appendix A2 – Findings of the Gap Analysis at 843 Eastern Avenue). This would enable Fleet Services to reduce the negative environmental impacts of its entire operation, and not just emissions from vehicles and equipment. Fleet Services is working co-operatively with Works and Emergency Services - Environmental Services to address the issues identified in the gap analysis at the Central Garage. In the future, garages that offer refuelling would be given priority for certification because of the potential for spills or other serious accidents from the handling and storage of fuels. In addition, the ISO process can be used to evaluate the distribution and efficiency of fuelling operations being carried out by the City. ISO certification addresses Recommendations 1, 14, 15 and 60 of the Environmental Plan regarding pollution prevention and environmental management (see Appendix A1 – Environmental Plan Recommendations being addressed by the Green Fleet Transition Plan (29)).

4.6 Repair Our Air Fleet Challenge 2003

This initiative raises the awareness of idling practices and what fleets can do to reduce the incidences of idling to save fuel costs and save our air (see Appendix A3 – Repair Our Air Fleet Challenge). In the 2003 Fleet Challenge, Greater Toronto Area municipalities participated head-to-head with fleets from private sector companies. Using global positioning systems technology (GPS), drivers were monitored against a baseline to determine the change in idling behaviour. In the challenge to achieve the lowest operating time at idle, Toronto finished third out of seven municipalities. For 2004, Fleet Services is working co-operatively with Natural Resources Canada (NRCAN) to develop the National Fleet Challenge.

Challenges bring municipalities together to work co-operatively on operational issues that impact the environment. This initiative directly addresses Recommendations 24, 28, 47, 48, 57 and 59 of the Environmental Plan regarding work with other jurisdictions, education and sustainable transportation (see Appendix A1 - Environmental Plan Recommendations being addressed by the Green Fleet Transition Plan (29)).

4.7 Better Transportation Partnership (BTP)

This innovative partnership between the City of Toronto and Enbridge Gas Distribution was developed to accelerate the replacement of the City's aging, gas and diesel vehicles with new, natural gas vehicles. For every four natural gas vehicles the City purchases, a fifth natural gas vehicle is funded through the associated fuel cost savings of all five vehicles. The City has established a special account for this initiative so that Enbridge Gas Distribution can track the fuel savings in its reporting to the Ontario Energy Board. An agreement of commitment to reserve contributions is being developed between Fleet Services and the departments that will be receiving these vehicles.

The Better Transportation Partnership is one example of how the City of Toronto is utilizing innovative financing solutions to address significant vehicle replacement costs. This initiative directly addresses Recommendation 19 of the Environmental Plan to explore financial incentives to reduce pollution.

5.0 Technology Testing Report - Greening Our Fleet

The first issue of this report was completed in July 2003 after 18-months of testing and compiling data. Staff from Fleet Services tested new technologies such as the Halo spark plug, hybrid-electric vehicles, natural gas vehicles and B100 (100 per cent soya bean-based biodiesel) biodiesel fuel under actual conditions. Since the report was released to the public, requests for copies have been strong as other municipalities and levels of government are interested in the findings. To this end, the findings of the report have been presented to TIE, the GTA-CAC, the CAOs of all municipalities in Ontario, the Cities of Calgary, Thunder Bay and the National Association of Fleet Administrators.

The results of the test showed that hybrid-electric vehicles, natural gas vehicles and biodiesel fuel are compatible with the needs of Toronto's fleet. However, initial costs are higher than conventional technologies (business-as-usual) and this is expected to continue into the foreseeable future despite incentives and rebates from other levels of government. To address the price premiums associated with new technologies, City staff are exploring all possibilities such as the Better Transportation Partnership, grant funding and other potential financing mechanisms.

The Green Fleet Transition Plan will utilize the proven performance of the technologies described above and outline a schedule for implementation including costs in section 7, Table 6 – Green Fleet Transition Plan – Capital and Operating Costs. At this time, it is expected that the Technology Testing Report will be an ongoing deliverable from Fleet Services. This report will in turn inform subsequent updates to the Green Fleet Transition Plan. The Technology Testing Program directly addresses Recommendations 1, 26, 38 and 41 of the Environmental Plan regarding pollution prevention, green industry and sustainable transportation.

5.1 Natural gas vehicles and Hybrid-electric vehicles

Natural gas vehicles (Ford NGV F150 pickup and Ford NGV E250 van) and hybrid-electric vehicles (Honda Insight and Toyota Prius) performed well in the City's testing described in section 5.0. As shown in the Technology Testing Report there are substantial reductions in the emissions of greenhouse gases and criteria air contaminants achieved by replacing conventional vehicles with natural gas vehicles and hybrid-electric vehicles. In 2004, General Motors is expected to enter the Canadian marketplace with the first hybrid-electric pickup truck. This hybrid-electric pickup also features an onboard, electric generator as standard equipment to power tools and equipment that eliminates costly after-market retrofits.

There are also significant limitations to the use of these vehicles in City operations. The availability of hybrid-electric vehicles during the period of the Green Fleet Transition Plan is

restricted to three small passenger car models and one light-duty pickup truck. If manufacturer announcements about future HEV introductions are realized it will not be until 2007 that enough hybrid-electric pickups are available to meet the majority of City requirements.

The additional cost for hybrid-electric vehicles is \$16,000 for each passenger vehicle and estimated to be \$9,500 for each pickup truck. To address the incremental cost of these vehicles, Fleet Services applied to the Toronto Interdepartmental Environment team to cover the additional, forecast cost for 10 HEV pickup trucks. If approved by Council, this application will fund the initial phase to launch the Green Fleet Transition Plan in 2004.

Clients that have used hybrid-electric vehicles report no operational issues and for this reason the Green Fleet Transition Plan proposes to order these vehicles for 84 per cent of replacements for passenger cars and light-duty pickups (see Appendix A5 – Detailed Green Fleet Transition Plan Implementation for more information).

Natural gas vehicles are restricted to only two light-duty pickup truck models and two cargo van models. Demand for these models has not yet reached a sustainable economic level and thus manufacturers are re-evaluating their commitment to this technology. For example, Ford has discontinued production of its natural gas pick-up trucks starting in 2004. Client departments report that proximity to refuelling and service availability continue to be ongoing operational issues due to the limited number of refuelling stations and natural gas vehicle repair facilities available in the City. For these reasons the Green Fleet Transition Plan proposes to order natural gas vehicles for 32 per cent of replacements to vans only (see Appendix A5 – Detailed Green Fleet Transition Plan Implementation for more information).

The estimated capital cost for new vehicles already scheduled to replace existing vehicles during the 2004 – 2007 period would increase by \$1,386,000 (See Table 6 – Green Fleet Transition Plan – Capital and Operating Costs). This assumes that no grants or subsidies become available from sources such as the Government of Canada’s Climate Change Action Fund program.

The eCO₂ reduction as a result of replacing conventional gasoline vehicles with hybrid-electric vehicles and natural gas vehicles is estimated to be 312,963 kg or 16.5 per cent over the business-as-usual scenario.

Table 3 – Greenhouse gas emissions reduction for hybrid-electric and natural gas vehicles

Year	Alternative	eCO ₂ emissions – kg
* 2004	1 HEV passenger car	-2,437
	10 HEV pickups from TIE	-32,626
	17 NGVs from BTP	-98,855
	Sub total	-133,918
	28 units all gasoline	146,606
	Emissions Reduction	-12,688
	Per cent Reduction	-8.7%
2005	17 HEV passenger cars (1+16 new)	-41,432
	38 HEV pickups (10+28 new)	-123,978
	27 NG vans (17+10 new)	-157,005
	Sub total	-322,415
	82 units all gasoline	408,658
	Emissions Reduction	-62,757
	Per cent Reduction	-16.3%
2006	28 HEV passenger cars (17+11 new)	-68,241
	61 HEV pickups (38+23 new)	-199,018
	37 NG vans (27+10 new)	-215,155
	Sub total	-482,414
	126 units all gasoline	582,568
	Emissions Reduction	-100,154
	Per cent Reduction	-17.2%
2007	39 HEV passenger cars (28+11 new)	-95,051
	84 HEV pickups (61+23 new)	-274,059
	47 NG vans (37+10 new)	-273,305
	Sub total	-642,415
	170 units all gasoline	802,714
	Emissions Reduction	-137,364
	Per cent Reduction	-17.6%
Total	Emissions Reduction	-312,963 kg eCO ₂ or -16.5%

Note: Emission reductions to eCO₂ shown above are based on the Technology Testing Report (2003).

*Emission reductions for 2004 have been included despite no direct funding from the Green Fleet Transition Plan. For illustrative purposes, emissions reductions have been shown against the funding year.

5.2 Biodiesel

Biodiesel performed well in the City's initial testing described in section 5.0. A second and more substantial test followed with B50, a 50:50 blend of biodiesel and conventional diesel in 2003. This was the largest trial of B50 in Canada to date. The City consumed over 800,000 litres of

B50 biodiesel in a wide and diverse array of vehicles and equipment without any negative operational impacts. As a result of this testing and the success experienced by other fleets, biodiesel is being recommended in this Plan to partially replace the 6,900,000 litres of diesel fuel forecast for use by the corporate fleet starting in 2005. Further, biodiesel in different blends is being recommended for use in all stationary diesel equipment and in all standby power generators (see Appendix A5 – Detailed Green Fleet Transition Plan Implementation). Biodiesel is well suited to Toronto’s needs and represents an affordable, renewable and sustainable solution for reducing eCO₂ from the corporate fleet. According to emission factors developed with Natural Resources Canada (NRCAN), the Canadian Agricultural New Uses Council (CANUC) has published the following greenhouse gas emission rates for biodiesel from different sources based on eCO₂/L:

Table 4 – Biodiesel Emission Factors

Regular diesel	3.12 kg
Soybean	1.27 kg
Canola	1.25 kg
Recycled cooking oil	0.71 kg
Animal fats	0.29 kg

Note – Based on a life-cycle analysis and not emissions from the tailpipe.

Using the emission factors from Table 4, reductions to diesel emissions using biodiesel (derived from animal fat and soy) against business-as-usual would be:

Table 5 – Greenhouse gas emissions reduction from biodiesel

Year	Fuel blend /duration	Regular diesel (kg eCO ₂ emissions)	Animal fat (kg eCO ₂ emission reductions)	Soy (kg eCO ₂ emission reductions)
2005	B10 for 8 months	14,352,000	-1,301,800	-851,000
	B30 for 4 months	7,176,000	-1,952,700	-1,276,500
			-3,254,500	-2,127,500
2006	B20 for 8 months	14,352,000	-2,603,600	-1,702,000
	B50 for 4 months	7,176,000	-3,254,500	-2,127,500
			-5,858,100	-3,829,500
2007	B20 for 8 months	14,352,000	-2,603,600	-1,702,000
	B50 for 4 months	7,176,000	-3,254,500	-2,127,500
			-5,858,100	-3,829,500
Total		*64,584,000 kg	-14,970,700 kg or -23.2%	-9,786,500 kg or -15.2%

Note – Biodiesel from animal fat and soy represents the high and low ranges of eCO₂ reductions. *The three-year total of emissions from regular diesel is not intended to represent the baseline of diesel emissions from the City’s fleet. For illustrative purposes, the emissions reductions have been shown against the funding year.

It is important to note that the eCO₂ reductions presented above are based on a life-cycle analysis and not emissions from the tailpipe. A life-cycle analysis considers all relevant emissions from exploration, extraction and transportation related to fossil fuels.

In contrast, biodiesel as a renewable resource emits and then captures carbon dioxide in its life cycle that would otherwise be emitted from non-renewable fossil fuels. To this end, the reductions presented in Table 5 (above) are estimates and actual emissions reductions will depend on variables such as the quantity of fuel consumed and the feedstock used for the biodiesel. Nonetheless, the use of biodiesel can reduce eCO₂ emissions by 9,786,500 – 14,970,700 kg or 15.2 – 23.2 per cent over the business-as-usual scenario. Fleet Services will report out the emissions reductions annually for each year of the Green Fleet Transition Plan based on actual emissions reductions. The reporting format will be consistent with the standards currently being developed by TIE.

According to CANUC, the next generation of biodiesel could be derived from the Industrial Mustard Plant because of this crop's ability to grow on marginal lands and natural resistance to insects. In terms of economy, a boost to agricultural communities and related industries could be substantial if a viable biodiesel market were to develop in Ontario. This would represent a win-win-win scenario for environmental sustainability, economic vitality and social development. This outcome is consistent with the City of Toronto's Strategic Plan (2001) in terms of achieving its goals.

The estimated operating cost for biodiesel and ISO is estimated to increase by \$413,021 based on a \$0.10/L premium for biodiesel (See Table 6 – Green Fleet Transition Plan – Capital and Operating Costs) although price differentials between petroleum-based diesel and biodiesel will vary. The increase is after the accumulated fuel cost savings have been included since hybrid-electric vehicles use less gasoline than conventional vehicles. Natural gas vehicles benefit from a lower cost-per-litre for natural gas compared to gasoline and the Better Transportation Partnership assumes a difference of \$0.20/L.

5.3 Current trends

Four-stroke engine technology reduces emissions from small motors and has been available for years. Four-stroke engines are being promoted as the cleaner alternative to two-stroke engines used in lawn mowers, trimmers and snow clearing equipment. In a comparison test for one hour conducted by Natural Resources Canada, emissions from an older, two-stroke lawn mower were equal to the total emissions from 40 newer model cars. In April 2003, the Federal Government under the Climate Change Action Fund encouraged the purchase of these products by offering a tax rebate on the purchase of four-stroke lawn mowers under a campaign called "Mow Down Pollution." In November 2003, the Federal Government announced its intent to introduce

tougher emission standards for small, motorized equipment such as lawn mowers starting in 2005. The emissions reduction associated with the four-stroke engine would have an immediate impact on local air quality. Fleet Services is working closely with their clients to replace two-stroke equipment with cleaner and more fuel efficient, four-stroke engines while meeting operational needs.

Cleaner fuels such as low-sulphur, ethanol blends and those containing additives to reduce harmful emissions such as NO_x are available today. The Federal Government will introduce new standards on sulphur levels in gasoline and diesel fuels that will be phased in between 2006 and 2010. Ethanol blends at up to 10 per cent (E10) and 15 per cent (E15) are available in Ontario today. In this respect, the City could realize meaningful emissions reductions by selecting a fuel supplier that offers these products.

5.4 Future prospects

Automobile and truck manufacturers have introduced several models that run on alternative fuels. Volkswagen announced in 2004 that it would be the first manufacturer to conduct research on the use of biodiesel in their diesel products. This is encouraging news as other automobile manufacturers have not made such a commitment to biodiesel as yet, and warn that using any fuel that does not meet their fuel specifications could void manufacturer warranties. Based on the City's experience and test of B100 in 2002 and B50 in 2003 and data from other users, Fleet Services does not anticipate that biodiesel will be a factor in component failures. In 2002, the American Society of Testing and Materials (ASTM) approved a standard for biodiesel fuel that is recognized by automobile manufacturers. The City's purchase of B50 in 2003 was made from Biodiesel Canada – a Canadian company that ensures their fuel meets the ASTM standard thus eliminating any potential risk that using their fuel could void manufacturer warranties. Furthermore, the environmental and human health benefits from using biodiesel are expected to far outweigh any negative outcomes that might be experienced in vehicles or equipment.

New technologies are transforming the automobile in ways that leave fewer negative impacts on the environment. In the future, fuel cell (hydrogen) vehicles are expected to replace hybrid-electric vehicles. Fleet Services will monitor these trends and use the Technology Testing Report on an ongoing basis to test these new technologies and their suitability for City fleet applications.

This report will in turn inform subsequent updates to the Green Fleet Transition Plan. This initiative directly addresses Recommendations 1, 26, 38 and 41 of the Environmental Plan regarding pollution prevention, green industry and sustainable transportation.

6.0 Air Quality in Toronto

Information provided in the National Pollutant Release Inventory (NPRI) shows that gasoline and diesel emissions from the transportation sector are significant sources of NO_x and SO_x emissions in Ontario (see Appendix A4 – Top Ten NO_x and SO_x Sources in Toronto). The City of Toronto’s complement of fleet vehicles and motorized equipment consists of over 4,000 licensed vehicles and equipment units. A large fleet such as this can impact on local air quality and the health of Torontonians. The Green Fleet Transition Plan promotes solutions that reduce the negative air quality impacts of our operations.

6.1 Other considerations

The Green Fleet Transition Plan was developed for the City of Toronto’s Fleet operations and the services currently delivered by the City of Toronto utilizing its own equipment. Should the scope of services change or alternatively, if services were delivered by an external supplier, consideration should be given to how emissions may be increased if a supplier is not held to the same high leadership values presented in the Green Fleet Transition Plan.

7.0 Implementation Schedule

This section is intended to show the incremental costs of hybrid-electric vehicles for passenger vehicles and pickups, natural gas vans, biodiesel blends and ISO certification by each year of the Plan. It also assumes a scenario where the City receives no funding from the Federal Government under their Climate Change Action Fund.

It is important to note that Table 6 – Green Fleet Transition Plan – Capital and Operating Costs is based on full implementation. For the purposes of costing out the Plan over four-years, year three (2006) was repeated for 2007.

7.1 Commitment to funding

The Green Fleet Transition Plan will require a commitment to funding from City Council. This point was also made in Recommendation 64 of the Environmental Plan regarding the adequate provision of resources to carry out environmental initiatives. To this end, an estimate of funding requirements for the next four-years has been provided in Table 6. In addition, innovative financing options such as the Better Transportation Partnership, revenue from the sale of emission reduction credits, external funding opportunities, incentives and grants will be investigated and pursued to fund the Green Fleet Transition Plan.

Table 6 – Green Fleet Transition Plan – Incremental Capital and Operating costs

Year 1 – 2004	Capital Costs	Operating Costs	Total
1 HEV (passenger) @\$16,000			
*10 HEVs (pickups funded via TIE) @\$9,500			
*17 NGVs (vans funded via BTP) @\$2,500			
Less: Fuel savings from HEVs and NGVs			
Year 1 Total	\$0	\$0	\$0
Year 2 – 2005			
*16 HEVs (passenger) @\$16,000	\$256,000		
*28 HEVs (pickups) @\$9,500	\$266,000		
*10 NGVs (vans) @\$2,500	\$25,000		
B10 (8 months) @\$0.10/L		\$46,000	
B30 (4 months) @\$0.10/L		\$69,000	
ISO 14001 certification at Central Garage		\$12,500	
Less: Accumulated fuel savings from HEVs + NGVs		(\$23,172)	
Year 2 Total	\$547,000	\$104,328	\$651,328
Year 3 – 2006			
*11 HEVs (passenger) @\$16,000	\$176,000		
*23 HEVs (pickups) @\$9,500	\$218,500		
*10 NGVs (vans) @\$2,500	\$25,000		
B20 (8 months) @\$0.10/L		\$92,000	
B50 (4 months) @\$0.10/L		\$115,000	
Less: Accumulated fuel savings from HEVs + NGVs		(\$42,827)	
Year 3 Total	\$419,500	\$164,174	\$583,674
Year 4 – 2007			
*1 HEVs (passenger) @\$16,000	\$176,000		
*23 HEVs (pickups) @\$9,500	\$218,500		
*10 NGVs (vans) @\$2,500	\$25,000		
B20 (8 months) @\$0.10/L		\$92,000	
B50 (4 months) @\$0.10/L		\$115,000	
Less: Accumulated Fuel savings from HEVs + NGVs		(\$62,481)	
Year 4 Total	\$419,500	\$144,519	\$564,019
Total accumulated fuel savings from HEVs + NGVs		(\$128,480)	
Total incremental operating cost (2004 – 2007)		\$413,021	
Total incremental capital cost (2004 – 2007)	\$1,386,000		
Total cost of the plan (2004 – 2007)			\$1,799,021

Note – Fuel cost savings do not occur in 2004 based on funding from the Green Fleet Transition Plan. Fuel cost savings begin in 2005 and accumulate for each year of the Plan and into future years. *Subject to model availability.

8.0 Conclusions

The Green Fleet Transition Plan outlines a bold vision and implementation schedule for moving the City's fleet towards vehicles and equipment that leave fewer negative impacts on the environment. It is integrated and complementary with the recommendations of the Environmental Plan and partly addresses the challenges identified in the Listening to Toronto (January 2004) public consultations. In terms of emissions reduction using the eCO₂ indicator, the Green Fleet Transition Plan is expected to achieve emissions reductions as follows:

Table 7 – Summary of Green Fleet Transition Plan eCO₂ reductions

NGVs and HEVs	-312,963 kg or -16.5%
Biodiesel (soy)	-9,786,500 kg or -15.2%
Biodiesel (animal fat)	-14,970,700 kg or -23.2%
Total (dependent on the feedstock of biodiesel)	-10,099,463 kg (-15.2%) to -15,283,663 kg (-23%)

Note – eCO₂ reductions from biodiesel are based on a life-cycle analysis and not tailpipe emissions.

The Green Fleet Transition Plan represents an effective means of reducing eCO₂ from the operation of the City's fleet and equipment. With full implementation, eCO₂ emissions were estimated to reduce by up to 23 per cent over the business-as-usual scenario. As a municipal leader in fleet operations and its commitment to the environment, the City of Toronto can lead change through its programs and practices.

The decision to implement the Green Fleet Transition Plan sends a compelling signal to the automotive industry, other governments and the public that the City's fleet operations are at the forefront of major actions to be taken that improve the environment in a sustainable and cost effective way.

Appendix A1 – Environmental Plan Recommendations being addressed by the Green Fleet Transition Plan (29)

1. Adopt Principle of Pollution Prevention Planning.
9. Increase the Diversion of Solid Waste.
14. Prevent Discharge of Pollutants into Sewers.
15. Reduce Water Use.
19. Explore the Use of Financial Incentives to Reduce Pollution.
20. Recognize the right of Torontonians to Clean Air.
21. Develop a Comprehensive Air Quality Strategy.
22. Reduce Air Emissions.
23. Monitor Ambient Air Quality and Standard Setting.
24. Integrate City Efforts on Air Quality with Other Jurisdictions.
25. Recognize the Importance of Sustainable Transportation.
26. Plan for and Implement Sustainable Transportation.
27. Adopt a Goal of Sustainable Energy.
28. Co-ordinate Toronto's Efforts on Sustainable Energy.
29. Increase Energy Efficiency in City Operations and Facilities.
30. Support Green Power.
34. Develop Investment Strategies for Sustainable Energy Plan Implementation.
35. Promote Environmentally Sustainable Development and Urban Form.

Appendix A1 continued...

- 38. Promote the Development of Green Industry.
- 39. Promote Local Food Production.
- 41. Become a World Leader in Environmental and Sustainability Education and Outreach.
- 47. Support and Enhance Environmental Education Centres.
- 48. Improve the Availability of Information on Environment and Sustainability.
- 57. Support Environmental Advisory Committees.
- 59. Develop Indicators to Measure Sustainability and the Health of the Environment.
- 60. Develop an Environmental Management System for the City.
- 61. Report on Sustainability Progress and Environmental Conditions.
- 63. Integrate the Environmental Plan with Other Planning Processes.
- 64. Provide Adequate Resources for Implementation.

Note – A detailed Status Report on the implementation of the Environmental Plan recommendations was completed in August 2003 and is available on the City of Toronto Web site in PDF format.

Appendix A2 – Gap Analysis at 843 Eastern Avenue

High Risk: High probability and significant consequences such as:

- risk to health / safety of staff or the public
- risk of actual environmental damage that would be costly to clean up (over \$5,000)
- risk of regulatory penalty or legal action / media coverage

Medium Risk: Moderate probability and consequences such as:

- small risk to health / safety of staff or the public
- temporary environmental damage that would cost less than \$5,000 to clean up
- risk of administrative regulatory penalty

Low Risk: Minor probability and consequences such as:

- little to no risk to health / safety of staff or the public
- temporary environmental damage that would be cost less than \$1,000 to clean up
- risk of a phone call or visit from an enforcement agency

Key EMS Opportunities for Improvement:

From a risk perspective, the following areas were found to present the largest degree of risk to the City:

- ISO 14001 Section 4.3.2 - Legal and Other Requirements
- ISO 14001 Section 4.4.2 - Training, Awareness and Competence
- ISO 14001 Section 4.4.7 - Emergency Preparedness and Response

Appendix A2 continued...

Positive Observations:

There are many positive environmental initiatives, which are in place. Examples are:

- a) Recycling of waste oil and antifreeze
- b) Procurement of recycled oil
- c) Tire disposal as part of Goodyear contract
- d) Air conditioning CFC recovery
- e) Used battery recycling
- f) Replacement of rags with paper towels
- g) Solarwall heating system
- h) Scrap metal recycling
- i) Investigating use of oil filter crusher and potential use of recycled lubricants
- j) Parts washer water recycling
- k) Procurement of green parts washer cleaning fluid
- l) Although housekeeping could not be described as exemplary, given the age of the facility, housekeeping did not pose any major environmental concerns, although there are opportunities for improvement (e.g. facilities to store used fluids).
- m) Except for the used oil storage area, there was very little evidence of spills from vehicles that had not been cleaned up.
- n) Quantities of hazardous materials were not apparently excessive.
- o) Staff from Fleet Services assisted in conducting the gap analysis.

Appendix A3 – Repair Our Air Fleet Challenge

How the Fleet Challenge works

- Each participant attempts to achieve the lowest level of engine idling. The collective effort is measured against results submitted by other organizations participating in the Fleet Challenge (16).
- By not idling, emissions are reduced, fuel expense is lowered and a positive reputation is earned.
- Each participant’s corporate vehicle is equipped with a device that accurately measures idling time.
- Participants will extend the campaign to their respective employees and promote the message.
- Vehicles are left idling more than we suspect, between 20 per cent and 60 per cent of total running time. Much of this is not necessary for either operations or comfort. This is true of equipment as well as trucks.

Spreading the news

- Fleet Services and Corporate Communications partnership established.
- Fleet Services and Energy Efficiency Office are working together.
- Idling messages going to all City employees.
- Smog warning and smog alert voice message from CAO.
- Public information displays at all civic centres.

Appendix A4 – Top Ten No_x and So_x Sources in Toronto

Top ten NO_x sources in Toronto

Source	Metric Tonnes	Per cent of Total
Off-Road Use of Diesel	13,044	31
Industrial	5,002	12
Heavy-Duty Diesel Vehicles	4,448	10
Light-Duty Gasoline Vehicles	4,379	10
Residential Fuel Combustion	3,636	9
Electric Power Generation	3,574	8
Commercial Fuel Combustion	1,946	5
Off-Road Use of Gasoline	1,887	4
Light-Duty Gasoline Trucks	1,500	4
Marine Transportation	939	2
Other Sources	2,084	5

Top ten SO_x sources in Toronto

Source	Metric Tonnes	Per cent of Total
Industrial	4,230	38
Marine Transportation	1,985	18
Off-Road use of Diesel	1,231	11
Residential Fuel Combustion	1,029	9
Heavy-Duty Diesel Vehicles	714	6
Electric Power Generation	714	6
Commercial Fuel Combustion	514	5
Light-Duty Gasoline Vehicles	266	2
Incineration – Other Utilities	104	1
Light-Duty Gasoline Trucks	94	1
Other Sources	323	3

Emissions estimates used in this report are taken from the 1995 Criteria Air Contaminants Inventory, for Toronto, postal code “M.” Environment Canada’s National Pollutant Release Inventory.

Appendix A5 – Detailed, Green Fleet Transition Plan Implementation

Year	Passenger fleet	Trucks under 350 series (cannot use biodiesel)	Trucks 350 series + (HEV and NGV not available in this category)	Facilities
2004	<p>Total requirements in year: 18 vehicles \$35,000 per HEV vs. \$19,000 for gasoline models. \$16,000 X 18 units = \$288,000 (incremental cost) Recommend no HEV order in 2004 due to requirement to increase approved budget.</p>	<p>Total requirements in year: 16 pickups + 41 vans BTP will provide 17 NGVs at no immediate cost (repaid over 3 years) HEV pickups have incremental cost of \$9,500 per unit. TIE will fund the incremental cost of HEV pickups at \$9,500 per unit. PST rebate of \$1,000 per unit *Subject to model availability Recommend 10 HEV pickups + 17 NG vans. Cost to be covered by TIE and BTP.</p>	<p>Total requirement in year 6.9 million litres of diesel fuel Biodiesel is approx. \$0.10/L more costly than conventional diesel. (Assume no funds from Climate Change Action Fund) Recommend no biodiesel in 2004 due to requirement to increase approved budget.</p>	
2005	<p>Total requirements in year: 16 vehicles Recommend 16 HEV at same cost as previous year. \$16,000 X 16 units = \$256,000 (incremental cost)</p>	<p>Total requirements in year 28 pickups + 45 vans Recommend 28 HEV + 10 NG vans: HEV \$9,500 x 28 units = \$266,000 NGV \$2,500 x 10 units = \$25,000 *Subject to model availability</p>	<p>Total requirement in year 6.9 million litres of diesel fuel Biodiesel is approx. \$0.10/L more costly than conventional diesel. (Assume no funds from the Climate Change Action Fund). B10 for 8 months 460,000L x \$0.10/L = \$46,000 B30 for 4 months 690,000L x \$0.10/L = \$69,000</p>	<p>ISO certification at 843 Eastern Ave. \$12.5K B10 for standby power generators Partial year Quantity TBD</p>

Appendix A5 continued...

2006	Total requirements in year: 11 passenger vehicles. Recommend 11 HEV \$16,000 X 11 units = \$176,000	Total requirements in year 23 pickups + 33 vans Recommend 23 HEVs + 10 NG vans HEVs \$9,500 x 23 units = \$218,500 NGVs \$2,500 x 10 units = \$25,000 *Subject to model availability	Scenario as in 2005 Increase blend of biodiesel to B20 for 8 months and B50 for 4 months. B20 : 920,000L x \$0.10 = \$92,000 B50 for 4 months: 1.15m L x \$0.10/L = \$115,000	B20 Full year Quantity TBD
2007	Total requirements in year 11 vehicles. Recommend 11 HEV \$16,000 X 11 units = \$176,000	Total requirements in year 23 pickups + 30 vans Recommend 23 HEVs + 10 NG vans HEVs \$9,500 x 23 units = \$218,500 NGVs \$2,500 x 10 units = \$25,000 *Subject to model availability	B20 : 920,000L x \$0.10 = \$92,000 B50 for 4 months: 1.15m L x \$0.10/L = \$115,000	B20 Full Year Quantity TBD
Total HEVs and NGVs	Total car requirements: 56 Recommend 38 or 68% HEVs	Total pickup requirements: 90 Recommend 84 or 93% HEVs Total Van requirements: 149 Recommend 47 or 32% NGVs		

Note – The \$12,500 cost to implement ISO 14001 can be broken down to \$7,500 for consulting fees to audit the environmental management system and \$5,000 for the registration process.

Note: The Green Fleet Transition Plan proposes to replace 84 per cent (122/146) of new, light-duty car and pickup truck planned vehicle replacements with hybrid-electric vehicles.

HEV – Hybrid-Electric Vehicle

NGV – Natural Gas Vehicle

BTP – Better Transportation Plan

B10/20/30/50 – Percent of biodiesel mix

Trucks <350 – ½ to ¾ ton pickup class

Trucks 350 – 1 ton+ pickup class and all other medium and heavy duty diesel powered trucks

Partial /Full Year – partial /full implementation

Appendix A6 – Fuel savings calculations for Hybrid-electric and Natural Gas Vehicles

Assumptions:

- Gasoline price \$0.70/L for low sulphur regular unleaded gasoline purchased in bulk.
- Natural gas price \$0.50/L equivalent
- Passenger HEV annual travel 15,000 km
- Pickup HEV annual travel 20,000 km
- NG van annual travel 20,000 km
- Standard gasoline car fuel consumption rating 11.2 L/100 km
- Passenger HEV fuel consumption rating 6.1 L/100 km
- Standard gasoline 150-series pickup rating 8.2 L/100 km
- HEV pickup rating 7.0 L/100 km
- Standard gasoline 250-series van rating 14.0 L/100 km
- NG van rating 9.7 L/100 km

Fuel savings have not been calculated for 2004 because the Green Fleet Transition Plan has no funding in that year. However, emission reductions have been included for 2004 because of the Green Fleet Transition Plan's influence.

Vehicle Replacements	Year 1 Savings 2004	Year 2 Savings 2005	Year 3 Savings 2006	Year 4 Savings 2007
2004				
Sub-total				
2005				
16 HEV cars		\$8,568	\$8,568	\$8,568
28 HEV pickups		\$4,704	\$4,704	\$4,704
10 NG vans		\$9,900	\$9,900	\$9,900
Sub-total		\$23,172	\$23,172	\$23,172
2006				
11 HEV cars			\$5,890.50	\$5,890.50
23 HEV pickups			\$3,864	\$3,864
10 NG vans			\$9,900	\$9,900
Sub-total			\$19,654.5	\$19,654.5
2007				
11 HEV cars				\$5,890.50
23 HEV pickups				\$3,864
10 NG vans				\$9,900
Sub-total				\$19,654.5
Yearly Totals	\$0	\$23,172	\$42,826.50	\$62,481
Plan Total				\$128,479.50

Note: Fuel cost savings do not occur in 2004 based on funding from the Green Fleet Transition Plan. The methodology for calculating fuel cost savings was developed in the Technology Testing Report (2003).

Appendix A7 – Glossary of Technical Terms

CAC – Criteria Air Contaminants are those pollutants most responsible for poor air quality as defined and tracked by Environment Canada. These include Total Particulate Matter (TPM), PM10, PM2.5, Sulphur Oxides (SO_x), Nitrogen Oxides (NO_x), Volatile Organic Compounds (VOCs), Carbon Monoxide (CO) and Ammonia (NH₃).

CARB – California Air Resources Board established in 1967 by the California Legislature to attain and maintain healthy air quality. The state of California has special authority under the Clean Air Act to set its own emission standards because of unique air quality problems.

eCO₂ – Equivalent Carbon Dioxide as defined under the Kyoto Protocol are the six greenhouse gases targeted for reduction (Carbon Dioxide, Methane, Nitrous Oxide, Hydrofluorocarbons, Perfluorocarbons and Sulphur Hexafluoride).

HEV – Hybrid-Electric Vehicle uses a combination of a conventional gasoline engine typically assisted by an electric motor.

Emission Standard Level (listed from least clean to cleanest)

T1	Tier 1	The least stringent emission standards
TLEV	Transitional Low Emission Vehicle	More stringent than Tier 1 standards for hydrocarbons (HC)
LEV	Low Emission Vehicle	More stringent than TLEV standards for both hydrocarbons (HC) and nitrogen oxides (NO _x)
ULEV	Ultra Low Emission Vehicle	More stringent than LEV standards for HC
SULEV	Super Ultra Low Emission Vehicle	Even more stringent standards than ULEV for both HC and NO _x
ZEV	Zero Emission Vehicle	The strictest emission standard, permitting no emissions

Source <http://www.epa.gov/greenvehicles/about.htm>