City of Richmond

Report to Committee

To:	Public Works and Transportation Committee	**Date:**	September 24, 2013
From:	Tom Stewart, AScT. Director, Public Works Operations	**File:**	02-0780-00/Vol 01
Re:	**Green Fleet Action Plan**		

Staff Recommendation

That the "Richmond Green Fleet Action Plan" as outlined in the report from the Director, Public Works Operations dated September 24, 2013, be approved as the City of Richmond's action plan and business strategy for improving fuel efficiency, reducing greenhouse gas emissions and reducing overall environmental impact of equipment and vehicle operations.

Tom Stewart, AScT.
Director, Public Works Operations
(604-233-3301)

Att. 2

REPORT CONCURRENCE		
ROUTED TO:	**CONCURRENCE**	**CONCURRENCE OF GENERAL MANAGER**
Sustainability	☑	
REVIEWED BY DIRECTORS	**INITIALS:** DW	**APPROVED BY CAO**

Staff Report

Origin

Council has adopted a number of goals, strategies and performance targets to advance initiatives in response to climate change and energy efficiency. Key among these is a community target of 33% greenhouse gas reduction by 2020 and 80% reduction by 2050, based on 2007 levels.

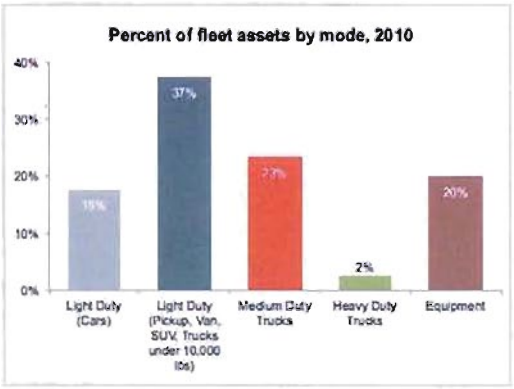
Corporately, the Green Fleet Action Plan is a component of the Corporate Energy and GHG Reduction Program identified in the Sustainability Framework that addresses all greenhouse gas emissions and energy use from City operations. An overview of key program initiatives is provided in ***Attachment 1***, which identifies fleet related activities as a key opportunity for reducing fossil fuel use. Fleet and building related emissions account for the vast majority of corporate GHG emissions.

A related initiative specific to the City's corporate fleet operations is the E3 Fleet Rating system (Energy, Environment, Excellence) managed by the Fraser Basin Council. This program rates organizational fleet performance and is designed to help promote green transportation as part of lowering emissions.

To respond to our overall emission reduction targets and as a key requirement for working towards an E3 rating for the City's fleet, this report presents the Richmond Green Fleet Action Plan (***Attachment 2***). This plan highlights actions taken to date to reduce our corporate emissions, establishes proposed reduction targets, and presents recommendations and detailed actions to achieve them.

Analysis

The City's corporate fleet is made up of over 525 vehicles and equipment, not including fire. Due to the variety of service level functions performed, the City's fleet is dynamic in nature and includes various items such as grass cutting equipment, street sweepers, snow plow equipment, excavating equipment and a host of light/medium-duty trucks and equipment with specialized outfitting. As noted in the "Percent of fleet asset by mode, 2010" graph, only 18% of the City's fleet is passenger-type cars, with the majority being vans, trucks and equipment.



The fleet's varied make-up and functionality requirements present unique challenges in pursuing readily available green technologies and as such, a variety of approaches are required as part of greening the City's fleet. These include acquisition strategies, sound operating practices, driver education/awareness and sound maintenance programs. The City has made good strides with incorporating green initiatives to date, and the Green Fleet Action Plan presents a cohesive approach to establishing our current benchmark, capturing past and current successes, setting targets and establishing a set of future actions to meet these targets.

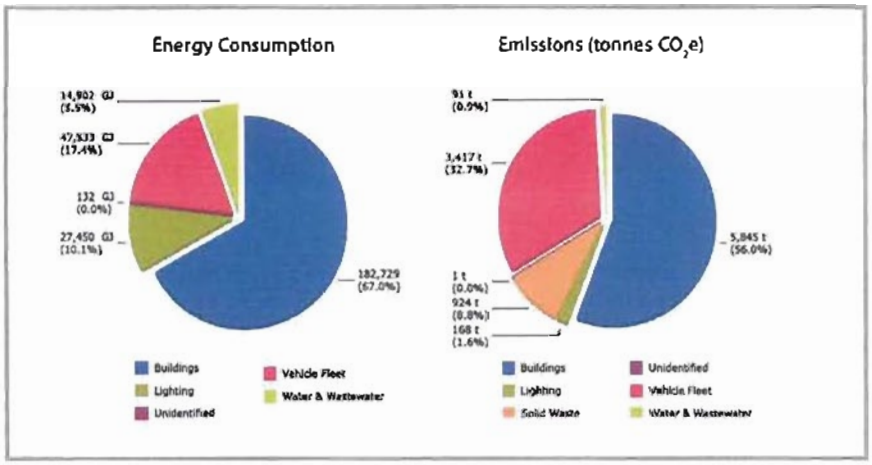
Current Benchmark

Corporate emissions relate to those emissions generated by the City's activities as a business.

Community emissions are overall/total emissions generated in Richmond.

As part of establishing a baseline from which to measure our actions and performance, the City undertook an inventory of our 2007 ***corporate*** emissions covering buildings, lighting, fleet, water/wastewater and solid waste. The overall ***community*** energy and emissions inventory was undertaken by the province for 2007 and 2010. These combined inventories showed that Richmond's corporate emissions are slightly more than 1% of the wider community emissions. This context is important in helping to set responsible targets for emissions reduction, including from the City's fleet operations. Actions taken at the corporate level will therefore be more impactful in demonstrating leadership and helping to foster community-based momentum, which is needed to have meaningful emission reduction impacts at the broader community scale.

In relation to fleet specifically, the City's corporate inventory showed that fleet operations represents 17.4% of total energy consumed corporately, yet is responsible for emitting 32.7% of the City's total corporate emissions.



Responsible fleet management is an important consideration as it relates to corporate emissions and a number of measures have been undertaken to date with good results. To help identify new methods and approaches to achieve further emissions reduction, external expertise was retained through the Pembina Institute to support development of the Green Fleet Action Plan.

Actions and Results to Date

Through Council's leadership, a number of green fleet initiatives have been undertaken over a number of years, including an employee carpool program, acquisition of Smart Carts and hybrid units, electric vehicles (including all 5 electric ice resurfacers used at arenas) and the installation of electric vehicle charging stations at community centres and City Hall. At the policy level, the City's Sustainable Green Fleet Policy seeks to promote innovation, leading edge technology and sound management practices relating to acquisition, operational safety, efficiency, education and awareness.

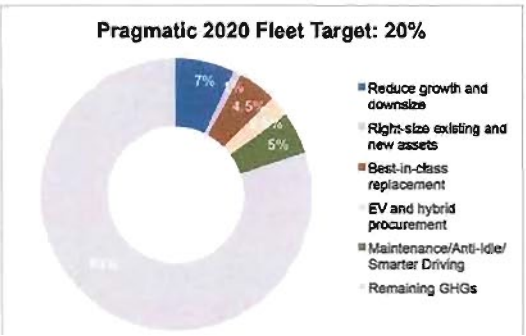
These actions, which are captured in the Green Fleet Action Plan, have led to a 3% reduction in emissions since 2007, despite an increase in fleet assets. Fuel costs have increased significantly -

- 28% from 2007 to 2010, and as a foreseeable trend, rising fuel costs alone serve as a key driver in pursuing green initiatives for both short and longer term fiscal prudence.

Proposed Target and Future Actions

The Plan identifies 24 actions which could be undertaken or considered by the City to reduce GHG emissions. These actions build on good practices to date and propose new strategies moving forward. A pragmatic emissions reduction objective of 20% by 2020 is recommended, with an ***annual reduction target of 2%.*** It is recommended this be an absolute target based on 2010 emissions. This is based on what is considered reasonably achievable given growth demands, and balances service level and operational requirements with anticipated market-ready technologies.

Proposed actions are captured in four key fleet management areas. Each area, along with principal action examples, are summarized below:



1. *Demand side management – 7%*
    - Reduce growth and downsize through demand-side management
    - Use technology to eliminate trips and improve route optimization
    - Encourage transit use and anti-idling behaviours

2. *Maintenance and management, monitoring and reporting – 6%*
    - Right size vehicles
    - Systematize preventive maintenance
    - Monitor and report
    - Join E3 Fleet Program

3. *Efficient resource use – 4.5%*
    - Best in class procurement
    - Reduce idling through technology improvements
    - Add GPS units to vehicle to aid in route optimization

4. *Alternative fuels – 2.5%*
    - Alternative fuel procurement such as electric vehicles
    - Monitor emerging technologies and employ when market-ready

Staff consider the demand side management target (7%) as aggressive, with recommendations to reduce growth and downsizing the fleet likely being the most challenging. Growth in the City and demand for vehicles and equipment to manage and maintain that growth could make the 7% recommended target in this area unattainable. However, staff feel greater gains may be possible through right-sizing and best in class procurement in order to meet the overall recommended target of 20%.

E3 Fleet Rating

The E3 Fleet Program is a third party rating program designed to foster green transportation and reduce greenhouse gas emissions from vehicle fleets. It is Canada's first and only national program dedicated to green performance by vehicle fleets. Launched and managed by the Fraser Basin Council, this program rates fleets at four performance levels (bronze, silver, gold, platinum). The rating program provides points for the successful completion of best practices and performance gains in the following areas: Green Fleet Action Plan, Training and Awareness, Idling Reduction, Vehicle Purchasing, Fuel Data Management, Operations and Maintenance, Trip & Route Planning, Asset Utilization, Fuel Efficiency, and Greenhouse Gas performance. Ratings must be renewed every two years to maintain and/or improve rating status.

The Green Fleet Action Plan is a key requirement the City must have for achieving a rating. A number of other measures within the focus areas noted are also required. The City is an E3 Fleet Program member and staff are working to collate existing information and develop program aspects needed to achieve an E3 rating status. A key current initiative is the implementation of a dedicated fleet software system which will enhance operations and maintenance performance as well as provide greater information for both short and long-term vehicle/equipment replacement planning. Future initiatives relating to trip planning and route optimization through the introduction of GPS units on vehicles will also be proposed.

Financial Impact

None.

Conclusion

The Green Fleet Action Plan presented with this report proposes an annual target of 2% reduction in corporate fleet emissions, and 20% reduction by 2020. If approved, the Green Fleet Action Plan will contribute toward the City's targeted greenhouse emission reduction targets and climate action commitments. In addition, the Green Fleet Action Plan is a requirement for achieving a rating as part of the E3 Fleet program.

If approved, information about the Green Fleet Action Plan will be posted on the City's website as part of communicating our targets to the community and demonstrating leadership in fleet emission reduction strategies.

Suzanne Bycraft
Manager, Fleet & Environmental Programs
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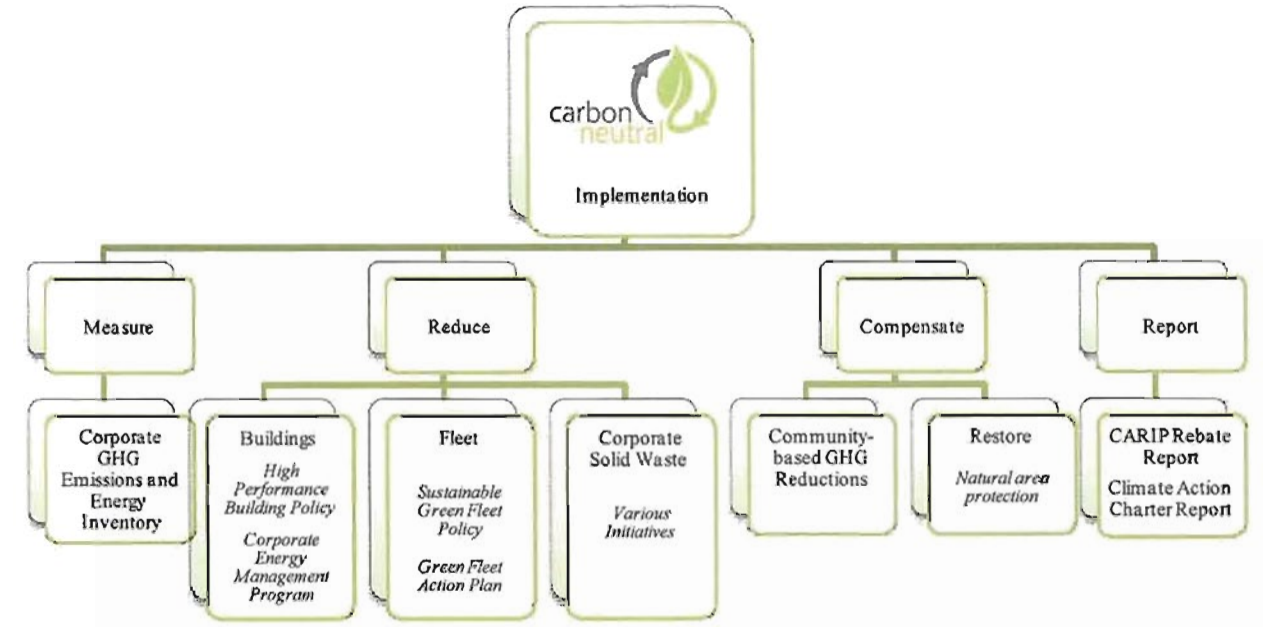
Attachment 1

Carbon Neutrality Implementation Summary



Fleet activities alignment in relation to carbon neutrality implementation summary

Attachment 2

Green Fleet Action Plan

Richmond Green Fleet Action Plan

Reducing corporate greenhouse gas emissions and advancing sustainable fleet management

Prepared for
Suzanne Bycraft, Manager Fleet Operations

Prepared by
Ellen Pond and Claire Beckstead
The Pembina Institute

August 2013

PEMBINA institute

Attachment 2

Green Fleet Action Plan (cont'd)

Disclaimer

This document is an independent report prepared exclusively as information for the City of Richmond. The views and opinions expressed in this report are those of the authors.

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About the Pembina Institute

PEMBINA institute *Leading Canada's transition to a clean energy future.*

The Pembina Institute is a national non-profit think tank that advances clean energy solutions through research, education, consulting and advocacy. It promotes environmental, social and economic sustainability in the public interest by developing practical solutions for communities, individuals, governments and businesses. The Pembina Institute provides policy research leadership and education on climate change, energy issues, green economics, energy efficiency and conservation, renewable energy, and environmental governance. For more information about the Pembina Institute, visit www.pembina.org.

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Pembina's Community Services group is a not-for profit consultancy on a mission to help communities advance sustainable energy solutions. Our staff's commitment and Pembina's mission create an innovative and unique approach to helping communities reduce greenhouse gas emissions, create energy plans that are sustainable and meet governance obligations. We strive to act as a bridge between a diverse set of stakeholders through identifying common solutions.

Acknowledgments

Pembina would like to acknowledge the City of Richmond's leadership and foresight in preparing this plan. Suzanne Bycraft (Plan Project Manager) and Margot Daykin (Manager – Sustainability) facilitated the Green Fleet Action Plan process. Special thanks to Jennifer Knbe for supplying fleet data. Thanks also to Chris McKenzie-Cook (Fleet Operations Supervisor) and the Works Yard staff for their input and feedback on past and future actions, and to all the Richmond staff who attended the Fleet Plan workshop. Their insight and ideas for future actions were invaluable to the development of this Plan.

Attachment 2

Green Fleet Action Plan (cont'd)

Richmond Green Fleet Action Plan

Reducing corporate greenhouse gas emissions

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Executive summary

Introduction

The City of Richmond's Green Fleet Action Plan is a component of the City's Corporate Energy and GHG Reduction program that will help Richmond meet its Climate Action commitments, and the City's sustainability goals of Sustainable Resource Use and a Climate-Prepared City. Green Fleet actions taken at the corporate level provide leadership to the broader community, demonstrating solutions that will advance community-based energy and greenhouse gas reduction actions.

The objective of the Green Fleet Action Plan is to identify and prioritize corporate actions that will reduce GHG emissions, improve fuel efficiency and reduce fuel costs, while continuing to provide enhanced city services and maintain service excellence. Specifically, the Plan:

- assesses Richmond's Green Fleet actions to date that reduce GHG emissions
- identifies ongoing and new opportunities to reduce energy use and greenhouse gas emissions
- recommends a pragmatic 2020 GHG reduction target for emissions from Richmond's fleet.

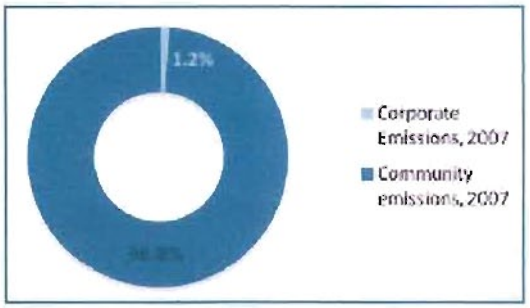

Figure ES- 1. Richmond's greenhouse gas emissions, broken out by corporate and community percentages

Richmond's Corporate emissions are just over 1% of the wider community emissions. Green Fleet actions taken at the corporate level are geared toward demonstrating Richmond's leadership as part of the collective momentum shift needed to achieve meaningful reductions in overall emissions in the community.

Richmond's 2007 Corporate inventory[1] provided a comprehensive analysis of the City's energy consumption levels, costs and direct GHG emissions corporate-wide. Richmond's fleet is the second-largest user of energy among corporate sectors in the municipality of Richmond, with fleet emissions accounting for approximately one-third of Richmond's corporate greenhouse gas emissions.

[1] Hyla Environmental Services, *Corporate GHG Emissions and Energy Inventory for 1995, 1999 and 2007* (June 2011), presented in City of Richmond Report to Committee re Reaching Carbon Neutrality, REDMS 308030 (June 1, 2011).

Attachment 2

Green Fleet Action Plan (cont'd)

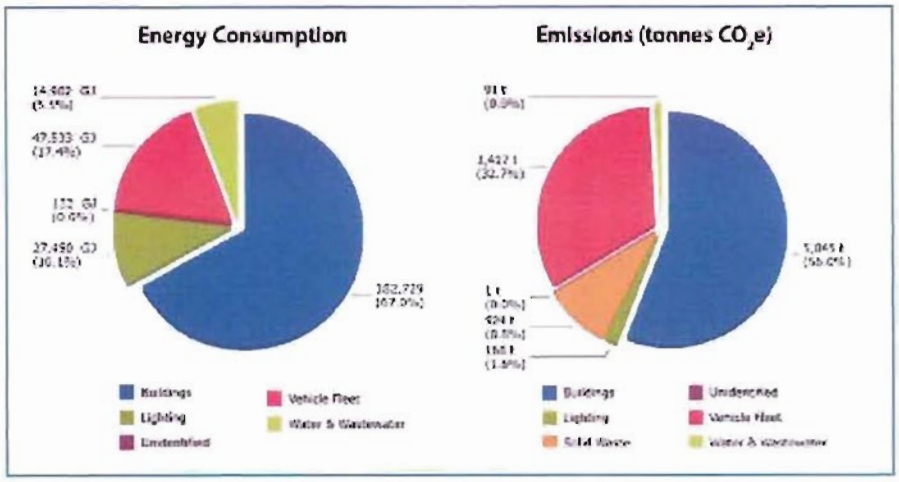

Figure ES-2. 2007 corporate energy consumption and GHG emissions

Fleet procures and maintains a wide range of vehicles and equipment, from mowers to snow plows. Many fleet vehicles and equipment provide more than simple mobility or transportation services for City staff to perform their work. For example, trucks have emergency lighting for public safety. A crewcab truck for the Parks board also acts as a mobile office for a foreman, and a lunchroom and place to warm up for Parks crews.

Energy use and greenhouse gas emissions from Richmond's fleet

Richmond's 2010 fleet fuel use totaled 1,249,957 litres of gasoline and diesel, at a cost of $1.27 million. Fleet emissions were 3,151 tonnes CO_2e.

Comparing the data from 1996 to 2010 shows that while the numbers of fleet assets (vehicles and equipment) have grown, the overall emissions and fuel use have remained relatively consistent. **2010 GHG emissions from Fleet are 6% below 1995 emissions and 3% below 2007 levels.** Richmond's population and service provision have grown significantly in this time period, and the City's actions taken to date have limited an overall increase of fuel use and emissions from fleet.

Fuel costs have increased by 28% in nominal dollars from 2007 to 2010 and more than doubled since 1999, providing a financial rationale for improving fleet efficiency. The litres of fuel saved in 2010 over 2007 also saved Fleet $64,650 in fuel costs.[2]

[2] Assuming an average cost price/litre of $1.02 for 2010.

Attachment 2

Green Fleet Action Plan (cont'd)

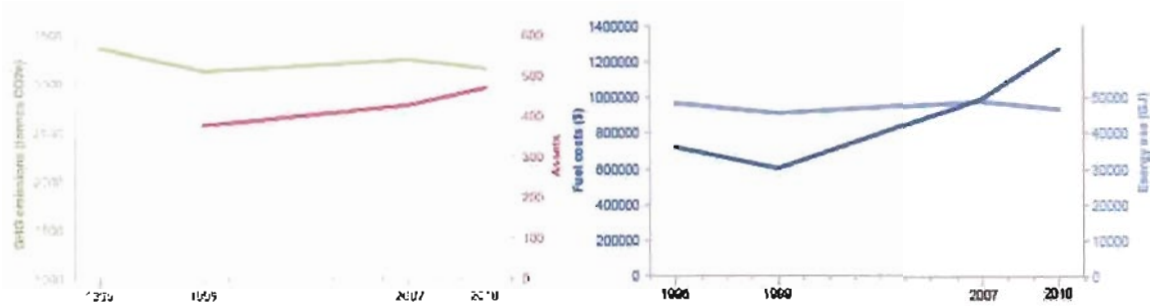

Figure ES-3. GHG emissions and asset counts over time; fuel costs and energy use over time

Passenger cars, which have been covered under Green Fleet procurement policies since 2006, account for 18% of Fleet assets, but only 7% of Fleet emissions. **By 2010, over 50% of Richmond's passenger cars were green fleet vehicles (hybrids or Smart Cars).** Trucks have a disproportionate share of emissions, due in part to diesel fuel use, a lack of green fleet vehicle options in the market, and the service requirements of many trucks that include idling.

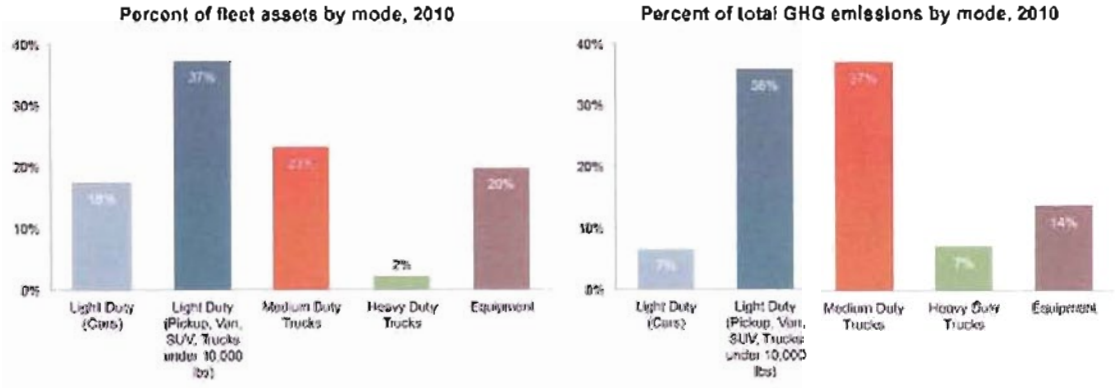

Figure ES-4. Percent of total fleet assets and GHG emissions by mode, 2010

Actions to date

Richmond has taken 15 actions to date across demand side management, maintenance and management, efficient resource use and alternative fuels, detailed in the table below.

In 2010, Richmond had 31 green fleet vehicles that saved 43 tonnes of GHGs between 2007 and 2010, a long-running employee carpool program, and departmental initiatives including route optimization. Fleet staff are converting truck lighting systems to low-energy LEDs with auxiliary batteries, and have installed solar panels to power Parks trailers. In 2012, Richmond purchased electric vehicles and installed charging stations.

New fleet management systems have been put in place, including the new fuelling system that ensures fuel security. These actions, taken together, have supported Richmond's fleet in delivering service excellence and ensuring worker safety while reducing fuel use and moving forward with Green Fleet policy initiatives.

Attachment 2

Green Fleet Action Plan (cont'd)

Actions to date

Demand Side Management
1. Anti-idling program at the Works yard, 2004; anti-idling bylaw, 2012.
2. Driver training: one-time driver training for all drivers using fleet vehicles; driver training on new equipment.
3. Reduce demand through operational practices: route optimization for bylaw, litter and tree routes; solar compactors at SkyTrain stations.
4. Pilot IT program to reduce the number of work-related vehicle trips taken by Richmond staff – Fire Halls and City Hall fifth floor connected.
5. Alternative transportation pilot: corporate bicycle share – program had low uptake and was discontinued.
6. Sustainable Commute: staff carpool program – almost 80 staff participate with a 70-person wait list.
Maintenance and Management Practices
7. Automated fuel management and dispensing system provides data and fuel security.
8. Preventive maintenance program for vehicles.
9. Fleet financial assessment and improved asset management systems.
Efficient Resource Use
10. Best-in-class procurement: purchasing Smart Cars and hybrids for passenger vehicles – 31 hybrids and 10 Smart Cars by 2010 – Green Fleet cars saved 43 tonnes of GHGs between 2007 and 2010.
11. Reduce idling through installation of LED lights for emergency lighting in trucks, and auxiliary batteries when appropriate: one-third of fleet vehicles converted.
12. Solar panel installation on Parks trailers to run safety/signal lights: two trailers converted.
13. Replace lower tier diesel equipment: four units replaced.
Alternative Fuels
14. Biodiesel 5 blend in diesel fuel prior to 2008. As of 2012, 4% biodiesel is the B.C. standard for diesel fuels, with a 5% ethanol blend in gasoline. 104 tonnes of Richmond's fleet emissions in 2010 were from renewable sources: biodiesel and ethanol.
15. Switch to low-carbon B.C. grid electricity. a) Richmond's five ice resurfacers are electric b) Four electric vehicle passenger cars procured in 2012 c) Eleven electric vehicle charging stations installed

Attachment 2

Green Fleet Action Plan (cont'd)

Priority new actions

Future actions build on Richmond's actions to date. While significant gains can be made with efficient resource use through technological innovation and alternative fuels such as electric vehicles, demand side management will also be key to achieving deeper GHG reductions and ensuring the fiscal sustainability of Fleet. Key actions include: down-sizing and right-sizing vehicles; continuing the best-in-class procurement policy, particularly for light-duty trucks; and, procurement and best use of electric vehicles and hybrids.

On-going and new actions

Demand Side Management
1. Reduce growth in assets and downsize vehicles through demand side actions. **Targeted GHG reduction of 7%, supported by other DSM actions.** Cost: Savings from reduced asset procurement and maintenance costs. Supports fiscal sustainability of the replacement reserve fund.
2. Consolidate and eliminate trips through information technology and route optimization. Report all route optimization programs in order to share learning. Cost: minimal.
3. Increase employee public transit use for off-site meetings, or pay for taxis or use personal staff vehicle (with mileage reimbursement) when a passenger car with low VKT has been downsized out of fleet. Cost: minimal to departments; net benefit when combined with downsizing vehicles.
4. Extend the Works Yard anti-idling program to City Hall – supports Richmond's community-wide anti-idling initiative and demonstrates leadership. Cost: net benefit.
5. Consider: Expand driver training to include anti-idling and smarter driver reminders.
6. Consider: Corporate car share program, e.g. with Modo.
7. Consider: Sustainable Commute: offer staff transit passes as an employee benefit.
Maintenance and Management, Monitoring and Reporting
8. Right-sizing: Align vehicles for best use on an annual basis, based on VKT, GPS data and vehicle use assessment. **Targeted GHG reduction of 1%.** Cost: net benefit.
9. Systematize preventive vehicle maintenance with the new Faster Asset management software. **Targeted GHG reduction of 5%, including anti-idling and smarter driving.** Cost: moderate outlay for long-term net benefits, will accrue savings over time through improved fleet performance.
10. Monitor and report on VKT annually for all vehicles. Consider tracking operating hours for

Attachment 2

Green Fleet Action Plan (cont'd)

equipment and truck idling. Mandatory for E3 Fleet review and rating. Cost: minimal once systems are in place.
11. Monitor and report on Sustainable Green Fleet actions, including an annual Green Fleet report. Demonstrates leadership and builds departmental support for Green Fleet actions and targets. Cost: moderate, requires dedicated human resource time.
12. Join the E3 Fleet Program, use the E3 Fleet Review to update the Green Fleet Action Plan, and obtain an E3 Rating.
13. Consider: Provide a monthly fuel use report to all departments using Fleet vehicles to support departments in managing their use of fleet assets. Cost: minimal.
14. Consider: Integrate GHG measurement tools with asset management software (in process).
15. Consider: Make fuel costs transparent to Departments in their leasing rates, providing an incentive for departments to reduce fuel use.
16. Consider: Provide additional human resources to Fleet during current critical renewal period.
Efficient Resource Use
17. Continue best-in-class fuel-efficient vehicle procurement, *with a focus on light-duty trucks*. Replace older passenger cars with best-in-class compact vehicles for low VKT users. **Targeted GHG reduction of 4.5%.** Cost: benefit, with no price premium on replacement vehicles and on-going fuel savings.
18. Reduce idling through better vehicle technology: continue the replacement of truck, van and SUV emergency lights with LEDs and auxiliary batteries; use solar panels where possible to run safety lights.
19. Add GPS units to vehicles to aid in route optimization, best use of vehicles, and data collection. Cost: moderate.
Alternative Fuels
20. Alternative fuel vehicle procurement: purchase EV passenger cars for high annual VKT use. Procure hybrid light-duty trucks when available; monitor price premiums and increase purchase of EVs and plug-in hybrids as price differential drops. **Targeted GHG reduction of 2.5%.** Cost: Moderate to significant. Upfront capital costs should have payback periods of less than 10 years if vehicles are best matched to use such as high VKT. Net benefit once payback has been achieved. Additional infrastructure costs: minimal to moderate as Level 2 charging stations already in place. Additional charging infrastructure may be required with additional vehicle acquisition.
21. Consider: Monitor emerging technologies in plug-in hybrid trucks, and adopt *plug-in hybrid* purchasing policies for light duty trucks as soon as the technology is market-ready.

Attachment 2

Green Fleet Action Plan (cont'd)

22.	Consider: Pursue procurement of diesel-electric hybrids for medium and heavy-duty trucks and buses as the technology matures and becomes market-ready.
23.	Consider: Monitor and assess emerging technologies, particularly compressed natural gas vehicles. Cost: Significant. Significant vehicle premiums and additional fuelling and vehicle maintenance infrastructure required. Public fueling infrastructure minimally available.
24.	Monitor the advances in biodiesel fuels and consider switching to a higher biodiesel blend when full life-cycle emissions reductions are assured.

Pragmatic target

Greenhouse gas reduction targets may be either pragmatic or "stretch." Richmond's fleet has an opportunity to set a pragmatic target that demonstrates attainable GHG reductions.

The Green Fleet Action Plan recommends a pragmatic 2020 target for the Richmond fleet of 20% below 2010 levels, with an annual reduction target of 2% per year. Reaching the target will require some organizational and behavioural change, improved fleet management practices, adoption of innovative technology and a shift to electricity as a fuel for some uses.

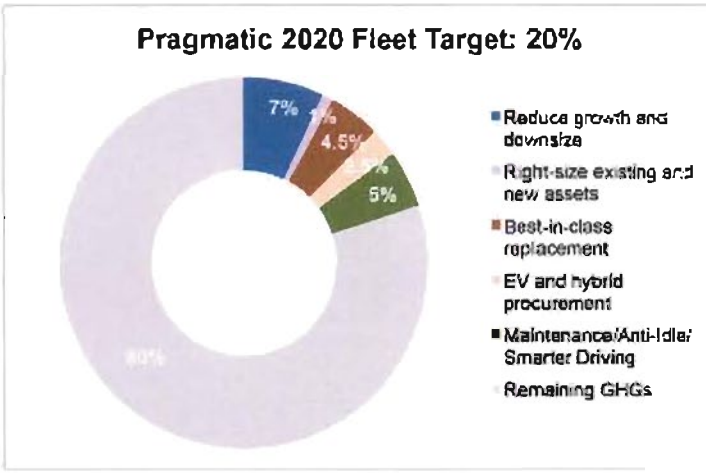

Figure ES-5. Pragmatic 2020 fleet target: 20% GHG reductions from 2010 baseline

This target should be achievable through the committed effort of Fleet, as well as City-wide departmental initiatives to reduce vehicle use. Three to five year trend data should be used to assess whether Richmond is on track to meet its 2020 target.

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Green Fleet Action Plan (cont'd)

Key recommendations

- Join the E3 Fleet Program.
- Improve process and data management to support Green Fleet goals, particularly improvements in VKT data.
- Adopt the 20% reduction target.
- Implement the priority actions with a focus on ensuring best-in-class procurement, especially for light-duty trucks, supporting demand side management across City departments, and making fuel use visible to departments.
- Recognize the human resource requirement associated with Fleet's significant renewal process now underway. Vehicles purchased now will still be in service in 2020; vehicle replacement provides an opportunity to build a long-term sustainable fleet through procurement of best-in-class vehicles. An additional human resource effort during renewal may help ensure that Fleet meets its fiscal and environmental objectives.

Attachment 2

Green Fleet Action Plan (cont'd)

1. Introduction

The City of Richmond's Green Fleet Action Plan is one of a number of tools that will help Richmond meet its Climate Action commitments and the City's sustainability goals of Sustainable Resource Use and a Climate-Prepared City. Green Fleet action also provides leadership to the broader community, demonstrating solutions that will advance community-based energy and greenhouse gas reduction actions.

In 2007, the Province of British Columbia passed the Greenhouse Gas Reduction Targets Act, which set a provincial target of 33% reductions in greenhouse gas emissions by 2020 and 80% by 2050, from 2007 levels. Local governments are required in turn to set targets, policies, and actions for GHG reductions in their Official Community Plans. Most B.C. municipalities, including Richmond, signed the Climate Action Charter, committing to also reduce their corporate greenhouse gas emissions.

The City of Richmond had introduced innovative fleet programs for action on climate change and local air pollutants prior to the provincial legislation. In 1997, Richmond began a Corporate Carpool Program using fleet vehicles that reduced personal vehicle and fuel use for employee commuting. In 2004, the Fleet Works Yard instituted an Anti-Idling program in the Works Yard for employees. In 2006, Richmond demonstrated municipal leadership by adopting a Green Fleet Policy that recognizes the environmental impacts of motor vehicles "on the environment, human health, and quality of life, including impacts on local air quality and the generation of greenhouse gases [GHGs] that contribute to global climate change."[3] Under this direction from Council, fleet began purchasing high fuel-efficient vehicles, such as Smart Cars and hybrids. The City also switched to using a 5% biodiesel blend. By 2007, when the province brought in the Greenhouse Gas Reduction Targets Act, Richmond had 12 hybrids and 11 Smart Cars in its fleet, representing 32% of Richmond's passenger cars at the time.

In 2008, Richmond signed the Climate Action Charter, committing to move towards carbon neutrality in its corporate operations. Richmond has been using an approach to reduce first and offset second.[4] Richmond commissioned a Corporate Emissions Inventory of its 2007 operations covering buildings, lighting, fleet, water/wastewater and solid waste, while the province has provided Community Energy and Emissions Inventories for 2007 and 2010.[5] These combined inventories show that Richmond's Corporate emissions are 1% of the wider community emissions. Therefore, actions taken at the corporate level are more geared toward demonstrating Richmond's leadership as part of the collective momentum shift needed to achieve meaningful reductions in overall emissions in the community. By leading through example, the City

[3] From background in the Staff Report to Council Re: Green Fleet Policy, December 5, 2006 (REDMS 2050547, 2034322).

[4] See Richmond's *Towards Carbon Neutrality – Progress Report 2012* for Richmond's approach. http://www.richmond.ca/__shared%/assets/Carbon_Neutral_CNCL_1126201234358.pdf

[5] Available through the Climate Action Secretariat's website, http://www.env.gov.bc.ca/cas/mitigation/ceei/RegionalDistricts/Metro-Vancouver/ceei_2010_richmond_city.pdf.

Attachment 2

Green Fleet Action Plan (cont'd)

demonstrates viable solutions and supports the emergence of a greener economy through procurement.

Richmond's fleet is the second-largest user of energy among corporate sectors in the municipality of Richmond, with fleet emissions accounting for approximately one-third of Richmond's corporate greenhouse gas emissions.[6] Richmond amended its Green Fleet Policy to the Sustainable Green Fleet Policy in 2012 in order to address the long-term financial sustainability of fleet. This Green Fleet Action Plan provides a framework for Richmond to continue to make progress on reducing greenhouse gas emissions from fleet.

The Green Fleet Action Plan quantifies the energy use and greenhouse gas emissions from Richmond's fleet, and measures the impact of emission reduction actions taken to date. The Plan recommends future actions to further reduce fuel use and costs as well as greenhouse gas emissions. Highlighting progress made to-date, the plan identifies a pragmatic GHG reduction target for Fleet.

Section 1 reviews the larger policy context for the Green Fleet Action Plan, including federal, provincial, and regional policies that impact fleet operations and emissions.

Fleet inventories and analysis are presented in Section 2. The Plan uses a 2010 inventory to measure reductions to date from 2007. The 2010 data, broken down by division, department, and vehicle type, provides a starting point for assessing ongoing and future actions.

Section 3 reviews past and current sustainable actions in Fleet across demand side management, maintenance and management, efficient resource use and alternative fuels, highlighting progress made to date. Richmond's fleet emissions decreased by 3% between 2007 and 2010.

Section 4 provides a priority list of future actions. While significant gains can be made with efficient resource use and alternative fuels, demand side management as well as fleet management practices will also be key to achieving deeper GHG reductions and ensuring the fiscal sustainability of Fleet.

Section 5 recommends a target for the Richmond fleet, proposing a 2020 GHG emissions target of 20% below 2010 levels, and an annual reduction target of 2% per year to achieve this. This target is a pragmatic target that includes maintenance and management practices by Fleet, as well as demand management across city departments and efficient vehicle procurement.

Lastly, Section 6 highlights key recommendations to continue progress under the Sustainable Green Fleet Policy.

Methodologies for the inventories and modelling are provided in Appendix A. Appendix B details recommendations for streamlining future GHG emissions inventories within fleet management practices.

[6] Hyla Environmental Services, *Corporate GHG Emissions and Energy Inventory for 1995, 1999 and 2007* (June 2011), presented in City of Richmond Report to Committee re Reaching Carbon Neutrality, (June 1, 2011), 22. REDMS 3086030

Attachment 2

Green Fleet Action Plan (cont'd)

1.1 Larger context of GHG regulation

1.1.1 Federal context – vehicle standards

The fuel economy of vehicles, which has a strong impact on the GHG emissions from fleets, is regulated by the federal government.[7] In 2010, the federal government announced new regulations and is gradually improving efficiency for light-duty vehicles (passenger cars and pickup trucks, SUVs and vans) for 2011-2016, particularly with respect to greenhouse gas emissions. They intend to bring in more stringent regulations as of 2017.[8]

Regulations for medium- and heavy-duty trucks and buses are proposed to start in 2014, with increased stringency to 2018. These should match U.S. regulations.[9] Off-road vehicles (which include Richmond's equipment) do not have regulations for greenhouse gas emissions, nor have any been announced.[10] Federal regulations for off-road equipment focus on improving local air quality due to restrictions on the emissions of local air contaminants, with standards from Tier 0 (no emissions controls) to Tier 4. Tier 4 will be required for new equipment as of 2014-2018.[11]

1.1.2 B.C. context – Greenhouse Gas Reductions Act

The release of greenhouse gas emissions is a significant contributor to human-caused climate change. Many B.C. communities are already feeling the effects of climate change, including increasingly frequent water shortages and extreme weather events, increased stress on fisheries and forests (including pine beetle infestations), and higher costs for insurance coverage. Sea level rise poses an increased risk of flooding for coastal communities.

In 2007, to address the challenge posed by climate change, the provincial government passed the Greenhouse Gas Reduction Act. This act set a province-wide target to reduce GHG emissions by at least 33% by 2020 and 80% by 2050, compared to 2007 levels. Under the Green Communities amendment to the Local Government Statutes Act, local governments were required to include targets, policies and actions to reduce their community's greenhouse gas emissions in their Official Community Plans. Local governments were not required to adopt the same targets as the provincial government; however, actions at the local level contribute to achieving B.C.'s overall GHG reduction target.

As part of the broader strategy to achieve B.C.'s reduction targets, the provincial government and the Union of B.C. Municipalities developed the Climate Action Charter to encourage local

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[7] The first regulatory framework was only set as of 2007, with the regulations coming into effect in 2011; prior to that, fuel consumption standards were set by voluntary agreements with automobile manufacturers. http://www.tc.gc.ca/eng/programs/environment-fcp-history-630.htm

[8] Office of the Auditor General, *2012 Spring Report of the Commissioner of the Environment and Sustainable Development*, Chapter 2—Meeting Canada's 2020 Climate Change Commitments, Exhibit 2.3—GHG regulations are in place in the transportation sector and proposed for the electricity sector. http://www.oag-bvg.gc.ca/internet/English/parl_cesd_201205_02_e_36774.html#ex3

[9] Ibid.

[10] They are referred to as "conceptual" in the Auditor General's report. ibid.

[11] Environment Canada, "Do you import or manufacture off-road diesel engines or machines?" http://ec.gc.ca/lcpe-cepa/default.asp?lang=En&n=5C98F8FB-1

Attachment 2

Green Fleet Action Plan (cont'd)

governments to work towards making their own operations carbon neutral by 2012, to measure and report on their community's emissions, and to work toward creating more compact, complete, energy-efficient communities. Richmond signed the Climate Action Charter in 2008, and has embedded their climate change leadership within a broader sustainability framework. As a signatory to the Climate Action Charter, Richmond is eligible for a rebate on the carbon taxes that they pay, under the Climate Action Revenue Incentive Program (CARIP)

B.C.'s low-carbon fuel standard regulates biofuels in gasoline and diesel, with 4% biodiesel and 5% ethanol in the provincial fuel mix as of 2012.[12]

1.1.3 Metro Vancouver equipment bylaw

Metro Vancouver has a bylaw to reduce local air quality emissions from non-road diesel engines (i.e. equipment).[13] This bylaw is designed to improve local air quality. The bylaw requires the registration and payment of a fee for equipment that does not meet specific standards for efficiency and air quality, and restricts idling to under five minutes. Although this bylaw does not directly address greenhouse gas emissions, improving the efficiency of equipment and restricting equipment idling may indirectly reduce GHGs from equipment.

1.1.4 Other municipal and green fleet plans

The Green Fleet program managed by the Fraser Basin Council has set a benchmark for green fleet practices. This program measures fleet performance and management across 10 areas of action, providing a comprehensive Rating System Checklist with optional and required actions.

In terms of greenhouse gas emissions, local governments in B.C. have focused on corporate emissions reduction plans, of which fleet is a component. Stand-alone fleet plans with specific emission reduction targets are less common. Prince George has a Green Fleet plan outlining a variety of actions, but does not have specific GHG reduction targets for fleet.[14]

In Ontario, Hamilton and Toronto have adopted specific and detailed fleet plans, which can be seen as an early benchmark for fleet planning in Canada. Toronto introduced its first plan in 2004 and its follow-up plan in 2008. Toronto's plans include estimates of GHG reductions over the period of the plan. For 2004-2007, the estimated potential reductions were 15 to 23%.[15] The 2008 plan estimates potential reductions of 11%.[16] Toronto's plan is to meet emission reduction targets adopted by Council of 6% of 1990 levels by 2012 (the "Kyoto target"), 30% by 2020, and 80% by 2050. Hamilton's Green Fleet Implementation Plan, introduced in 2005, provides

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[12] For FAQ on the Renewable & Low Carbon Fuel Standard, see http://www.empr.gov.bc.ca/RET/RLCFRR/FAQ/Pages/default.aspx

[13] Greater Vancouver Regional District Non-Road Diesel Engine Emission Regulation Bylaw No. 1161 (2012).

[14] *Towards a Greener Fleet: City of Prince George Green Fleet Corporate Plan*, December 2010. http://princegeorge.ca/infocentre/communications/Lists/Recent20News/Attachments/4/GreenFleetStrategicPlan.pdf

[15] Toronto Fleet Services, *2004-2007 Green Fleet Transition Plan*, 26. Not all of these reductions were realized: the 2004 Plan estimated reductions of 10,000 to 15,000 tonnes, while the 2008 Plan states that Green Fleet initiatives had reduced emissions by 5,000 tonnes during this time period.

[16] See the Executive Summary of the Toronto Fleet Services *Green Fleet Plan 2008-2011*. http://www1.toronto.ca/city_of_toronto/fleet_services/files/pdf/gfp.pdf

Attachment 2

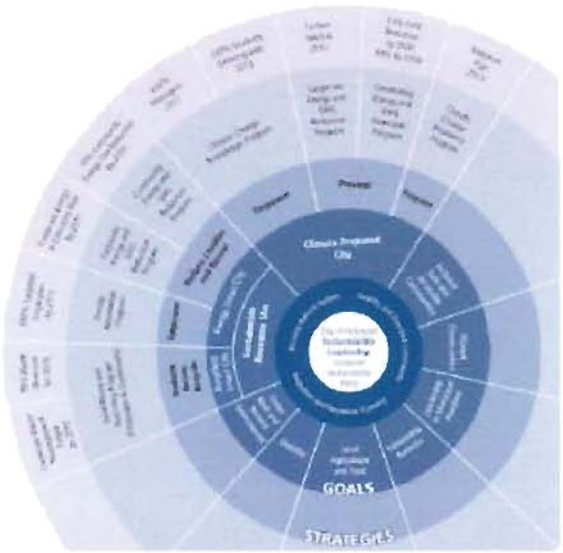
Green Fleet Action Plan (cont'd)

detailed implementation but did not explicitly contain GHG reduction targets;[17] however, the updated plan has a 2% reduction in GHGs/vehicle kilometre travelled.[18]

1.2 Richmond context – frameworks and policies

1.2.1 Sustainability Framework and climate change

Richmond is advancing its climate change work within an overall Sustainability Framework, as shown in Figure 1. The Sustainability Framework has established a strategic management program for the City's sustainability initiatives, and outlines core goals, strategies and performance targets.



The Sustainability Framework currently has two climate-related goals:

1. A Climate Prepared City 2020 *where climate change and its impacts are minimized and resiliency created to protect the environment, economy and community well-being.*
2. An EnergySmart City 2020 *where energy needs are met through wise energy practices exercised throughout the community and supported by an affordable, efficient, reliant and environmentally responsible energy system.*

Figure 1. Richmond's sustainability framework

Richmond's Climate Prepared City goal utilizes three strategies: Empower, Prevent, and Prepare. The Corporate and Community Energy and GHG Reduction Programs are located under Prevention.[19]

Richmond also adopted a community target of 33% GHG reductions by 2020 and 80% reductions by 2050, using a 2007 baseline. This target, when combined with the City's carbon neutral commitment, helps the City take a comprehensive approach to responding to climate

[17] City of Hamilton, *Green Fleet Implementation Plan* (2005). http://www.hamilton.ca/NR/rdonlyres/45DA2BA5-3877-4048-9535-4E3615E0F38E/0/GreenFleetImplementationPlan.pdf

[18] City of Hamilton, *Green Fleet Implementation Plan, Phase 2 2009-2011* (2009), 4.

[19] City of Richmond, *Climate Change Strategic Program*. http://www.richmond.ca/__shared/assets/Sustainability_GP_06211026740.pdf

Attachment 2

Green Fleet Action Plan (cont'd)

change. As shown in Figure 2, almost 99% of Richmond's overall emissions are from the community, and slightly more than 1% are from City corporate activities.

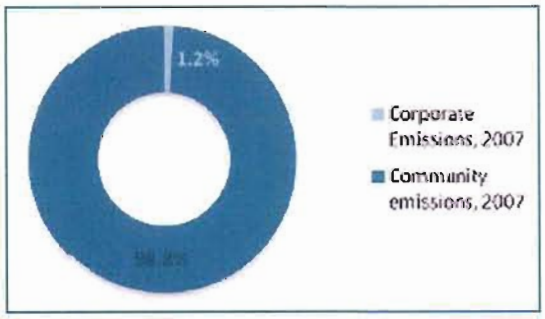


Figure 2. Richmond's greenhouse gas emissions, broken out by corporate and community percentages

1.2.2 Carbon neutrality implementation

The Green Fleet Action Plan is a component of the Corporate Energy and GHG Reduction Program that addresses emissions from City operations. An overview of key initiatives is provided in Figure 3. Measuring GHG emissions is the first step in implementing a program for reaching carbon neutrality. In 2010, the City completed its first comprehensive analysis of energy consumption levels, costs and direct GHG emissions corporate-wide. The analysis identified the need to focus action on reducing fossil fuel use in civic buildings and corporate fleet. Combined, these two activities account for the vast majority of GHG emissions currently being measured. The Green Fleet Action Plan also includes a comprehensive energy and emissions inventory for fleet vehicles providing critical trend data needed to better enable the City to advance strategic reduction actions.

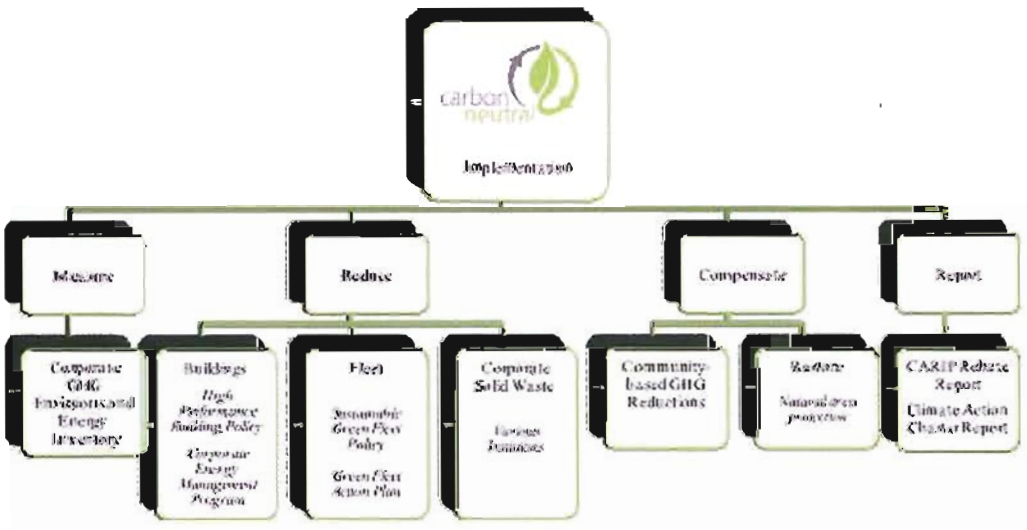


Figure 3: Carbon neutrality implementation summary

Attachment 2

Green Fleet Action Plan (cont'd)

Reducing internal corporate GHG emissions is the second step in implementation. Other reduction initiatives include the Corporate Energy Management Program and the corporate High Performance Building Policy which collectively include the development of LEED Gold buildings, installation of renewable energy systems into existing facilities and lighting and equipment retrofits. These initiatives have resulted in significant levels of avoided energy consumption, reduced GHG emissions as well as various other benefits.

With respect to fleet operations, Section 3 details 15 ways that Richmond has already taken action on emissions from fleet while Section 4 details the path forward for further reductions.

1.2.3 Sustainable Green Fleet policy

Richmond adopted a Green Fleet policy in 2006,[20] noting that the City's fleet represents a significant financial and natural resources investment. Concerns about vehicle impacts included greenhouse gas emissions, air quality and human health, and costs to the City. As of 2006, the City had already taken initiatives including:

- replacing compact fleet vehicles with hybrids or Smart Cars
- implementing an idle-free initiative
- using biodiesel as an alternative fuel
- instituting an employee carpool program

Under the Sustainable Green Fleet policy, Richmond seeks to be a leader in incorporating innovation and leading-edge technology and management practices. Fuel efficiency and emissions reductions are addressed through policy on acquisition, operational safety and efficiency, education and awareness, and monitoring. Actions under this policy are reviewed in Section 3.

In early 2012, Richmond amended its Green Fleet Policy to the Sustainable Green Fleet Policy.[21] The amendment addresses the financial viability of fleet replacement, given the aging vehicle stock and the possibility of depleting the replacement reserve fund.

1.3 Objectives of Richmond's Green Fleet Action Plan

The Green Fleet Action Plan provides specific actions under the direction set in the Sustainable Green Fleet Policy. The objective of the Green Fleet Action Plan is to identify and prioritize actions that will reduce GHG emissions, improve fuel efficiency and reduce fuel costs, while continuing to provide enhanced city services and maintain service excellence.

The Plan recommends actions in the areas of demand side management, maintenance and management, monitoring and reporting, efficient resource use, and alternative fuels. The actions

[20] City of Richmond, Report to Council re Green Fleet Policy, December 5, 2006. http://www.richmond.ca/__shared/assets/121106_item1615823.pdf (REDMS No. 2050547)

[21] City of Richmond, Report to Committee re Sustainable Green Fleet Policy 2020, February 3, 2012. http://www.richmond.ca/__shared/assets/SustainableGreenFleet_PWT_02221232306.pdf (REDMS No. 3358139, 2582744, 3462064)

Attachment 2

Green Fleet Action Plan (cont'd)

in the plan support Richmond in meeting and improving fleet's sustainable management practices of service excellence, worker safety and fiscal prudence.

Specifically, the Plan:

1. Evaluates the progress of past and current actions on GHG reductions from Richmond's fleet; reports on successes achieved to date
2. Identifies and prioritizes future actions that will provide ongoing GHG reductions, with quantification where possible
3. Recommends a reduction target for fleet GHG emissions
4. Recommends next steps on inventory data management, implementation, monitoring and reporting.

1.4 Fleet plan process

The Green Fleet Action Plan has been prepared using the following process:

- Review of existing inventory and development of 2010 inventory
- Review of sustainability and fleet policy
- Review of benchmark green fleet plans and E3 Fleet requirements
- Review meeting with Fleet staff to determine current actions and possible future actions
- Future modelling of projected 2020 fleet emissions, including modelling future action impacts where possible
- Workshop with Fleet and broader city staff (e.g. parks, roads, transportation planning, etc.) to review, add to, and prioritize future actions and discuss target-setting, with a particular focus on transportation demand management
- Final plan produced in consultation with Fleet and Sustainability managers

Attachment 2

Green Fleet Action Plan (cont'd)

2. Fleet inventories, 2007 and 2010

The purpose of the baseline and follow-up inventories is to measure and report emissions, assess success to date, and help plan for ongoing and future actions to improve the sustainability of fleet. The inventory is thus shown according to various breakdowns such as department and vehicle type or mode to help understand where Richmond fleet emissions come from in detail. The data should be used to support fleet planning.

2.1 Background

2.1.1 Where do fleet emissions come from?

Greenhouse gases (GHGs) are produced when fossil fuels, such as diesel, gasoline or natural gas, are burned to produce energy. For example, GHGs are produced when using gasoline to power a fleet vehicle, diesel fuel to power a bulldozer, or propane to power an ice resurfacer.

Both the type of vehicle or equipment used and the fuel type are important to consider when calculating greenhouse gas emissions. Different vehicle types (more technically referred to as vehicle modes) have different regulatory requirements for fuel efficiency. Cars and light-duty trucks have regulated fuel efficiency and GHG emissions standards that are improving every year.[22]

Fuel types impact GHG emissions because different fuels emit a different amount of greenhouse gases per unit of energy burned. For example, fossil fuels like diesel and gasoline produce more greenhouse gases per unit of energy produced than cleaner fuels like electricity.[23]

Greenhouse gas emissions include carbon dioxide, methane, and nitrous oxide.[24] Each of these has a different "global warming potential" and greenhouse gas emissions are therefore measured in tonnes of CO_2 equivalent (t CO_2e) for ease of comparison.

As well as the type of vehicle and fuel, driver behaviour, vehicle loads and vehicle maintenance all impact fuel use and GHG emissions. "Smarter Driver" techniques including smooth driving,

[22] The improvements are averages for each manufacturer across a vehicle class, so a vehicle that is beyond the standard such as a hybrid allows for other vehicles with lower standards to continue in production. As discussed in Section 1.1.1, heavy-duty vehicles will have regulated requirements as of 2014; equipment has no regulations regarding greenhouse gas emissions.

[23] In B.C., electricity is primarily produced from hydropower, which produces very few GHG emissions. Electricity is emerging as a fuel source for electric and hybrid vehicles, and for some specialty vehicles such as ice resurfacers. Switching to electricity in B.C. can significantly reduce the emissions from a fleet vehicle.

[24] These are the three measured in B.C. emissions inventories for mobile sources, i.e. transportation. Other greenhouse gases include water vapour and ozone.

Attachment 2

Green Fleet Action Plan (cont'd)

regular vehicle maintenance, lighter loads, minimal use of air-conditioning, and reduced idling may reduce fuel use by 5 to 33%.[25]

Figure 4 compares Richmond's corporate energy use and greenhouse gas emissions in 2007. While the vehicle fleet (red wedge) accounts for only 17% of the total energy use, the fleet's share of emissions is 33%. This is due in large part to the fact that buildings and lighting include electricity in their energy supply, while fleet does not. Consequently, the proportion of corporate emissions from fleet is higher than fleet's proportion of corporate energy use.

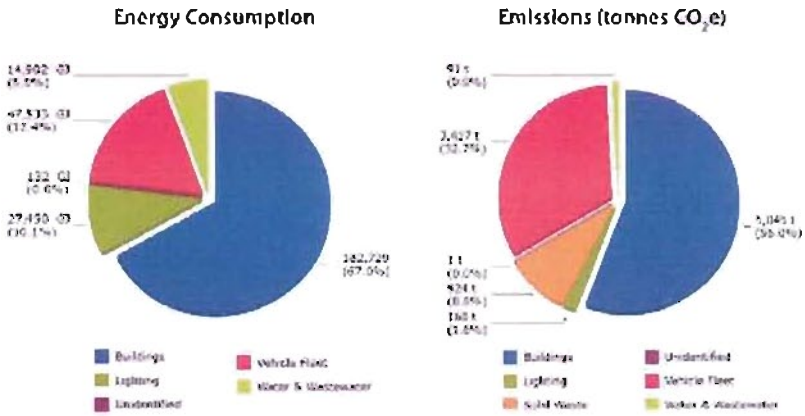


Figure 4. 2007 energy consumption and GHG emissions

Source: 2007 corporate emissions inventory[26]

2.1.2 Fleet Services

Richmond's fleet operations supports the delivery of a wide range of city services, including waste collection at parks and Skytrain stations, bylaw enforcement, building and maintaining roads, and providing water and sewer services. Residential garbage collection is contracted out and is not part of Fleet Services.[27]

The departmental breakdown in Appendix A.3 provides a good overview of all the city services that use vehicles and equipment maintained by Fleet Services. Fleet maintains over 500 assets[28]

[25] Cherise Burda, Katie Laufenberg, Alison Bailie and Graham Haines, *Behind the Wheel: Opportunities for Canadians to drive less, reduce pollution and save money* (Pembina Institute, 2012). http://www.pembina.org/pub/2379

[26] Hyla, Corporate GHG Emissions and Energy Inventory for 1995, 1999 and 2007, 22.(REDMS No. 3086030)

[27] Under current guidance on contracted emissions, the City is not obligated to report on contractor emissions for contracts signed prior to June 1, 2012; and, only contracts over $25,000 should be included in reporting. http://www.toolkit.bc.ca/sites/default/files/CNLG_Contracted%20Emissions_April%202012%20_FINAL.pdf. Richmond is reporting on direct emissions as part of its Carbon Responsible Strategy of 2011 (File no. 01-0370-01/2011-Vol01).

[28] *Sustainable Green Fleet Policy*, 2012 (REDMS No. 3358139, 2582744, 3462064) http://www.richmond.ca/__shared/assets/SustainableGreenFleet_PWT_02221232306.pdf

Attachment 2

Green Fleet Action Plan (cont'd)

consisting of vehicles and equipment. Vehicles include compact cars as well as tank trucks, crane trucks, and dump trucks (see

Table 1).

Figure 5. Fleet procures and maintains a wide range of equipment and vehicles
Source: City of Richmond

Many fleet vehicles and equipment provide more than simple mobility or transportation services in order for City staff to perform their work. Equipment requirements must meet the demands of the work as a principal requirement, using appropriate fuel technology to meet those power demands. For example, trucks have emergency lighting for public safety. A crewcab truck for the Parks board also acts as a mobile office for a foreman, and a lunchroom and place to warm up for Parks crews.

Figure 6. Fleet vehicles provide many services, including snow removal
Source: City of Richmond

Other trucks operate equipment, such as hydraulic equipment and air pressure tools like jackhammers. These services require a power source through vehicle idling or auxiliary means. Line painting equipment idles as part of the function it must perform. Therefore, fleet trucks serve as multi-purpose assets, meeting needs beyond staff mobility.

Attachment 2

Green Fleet Action Plan (cont'd)

Figure 7. Randy Jacimirski servicing equipment

Source: City of Richmond

2.1.3 Inventory scope

Under the Climate Action Charter and carbon neutral requirements, Richmond reports its energy and emissions use and, as of 2012, its emissions, to the B.C. government. Provincial carbon neutral reporting requires municipal governments to report on their emissions from buildings, infrastructure and other structures, and vehicles, equipment and machinery. Six traditional service areas are included: administration and governance; water and waste water; solid waste collection; roads and traffic operations; art, recreation and cultural services; and fire services. Police services are not included.

For Fleet, municipal government reporting to the B.C. government up to 2012 included only litres of fuel used in order to apply for the CARIP (carbon tax) rebate. As of 2012, carbon neutral reporting requires detailed inventories. Recommendations on carbon accounting and reporting are covered in Appendix B.

The Green Fleet Action Plan is based on 2007 and 2010 GHG inventory data calculated from Richmond fleet vehicles and equipment fuel use, and on modelling of possible future emissions under various actions. These inventories do not include contractor services and mobile A/C units.

Richmond reports out to the Mexico City Pact and plans to join the E3 Fleet program. Details on the scope of various reporting mechanisms are also in Appendix B.

Attachment 2

Green Fleet Action Plan (cont'd)

2.1.4 Inventory methodology

The 2007 fleet inventory followed standard GHG emissions accounting practices at the time for corporate greenhouse gas accounting.[29] The 2010 follow-up inventory followed standard B.C. government practices[30] (see Appendix A). In order to ensure methodological comparability, the 2007 inventory was re-calibrated with the 2010 methodology. Calculated reductions from 2007 to 2010 are therefore due to actual reductions in fuel use and concomitant greenhouse gas emissions. Recommended inventory methods starting in 2012 are provided in Appendix B.

The inventory is shown by division, department, and vehicle mode. Vehicle mode refers to the type of vehicle: light-duty cars, light-duty trucks (pickups, vans and SUVs under 10,000 lbs.), medium-duty trucks (includes buses in the Richmond fleet), heavy-duty trucks, and equipment.[31] Vehicle modes have different emissions factors for calculating GHGs (see Appendix A). Examples of each mode, as found in the Richmond fleet, are shown below.

Table 1. Examples of assets by mode in the Richmond fleet in 2010

Vehicle Mode	Examples found in the Richmond fleet
Light-duty cars	2001 Chevrolet Cavalier 2003 Honda Civic Sedan 2006 Smart Car
Light-duty trucks (pickups, vans, SUVs)	1995 Ford Econoline Van 1995 Ford Pickup Truck 2001 Ford Pickup Truck 2007 Dodge Ram Quad Cab ¾ Ton 2009 Dodge Dakota Club Cab
Medium-duty trucks	2000 Ford F550 Pickup Flat Deck 2001 Grumman Workhorse Van 2001 Ford F450 Crew Cab Dump 2005 International Single Axle Dump 2005 Ford F550 Crane Truck
Heavy-duty trucks	2002 IHC Tandem Dump Truck 2005 International Pumper 7400
Equipment	2003 John Deere Mower 2006 Cat 430E Backhoe 2007 Vermeer Brushcutter 2010 New Holland Tractor

[29] IPCC Guidelines and ISO Draft International Standards. Hyla, Corporate GHG Emissions and Energy Inventory for 1995, 1999 and 2007, Section 2.3: Inventory Methodology.(REDMS No. 3086030)

[30] B.C. Ministry of Environment 2012, *2012 B.C. Best Practices Methodology for Quantifying Greenhouse Gas Emissions*. http://www.env.gov.bc.ca/cas/mitigation/pdf/BC-Best-Practices-Methodology-for-Quantifying-Greenhouse-Gas-Emissions.pdf

[31] Fire Services are not broken down by vehicle mode for the 2007 and 2010 inventories.

Attachment 2

Green Fleet Action Plan (cont'd)

2.2 2007 fleet inventory

In 2007, fleet vehicles and equipment accounted for 17% of corporate energy use, and 33% of corporate emissions, as shown in Figure 4.
Fleet fuel use totaled 1,313,357 litres of gasoline and diesel fuel, at a cost of $992,020. Fleet emissions were 3,241 tCO_2e.[32] Fleet emissions for 2007, broken down by division, are shown below in

Table 2. Trends in emissions are discussed in Section 2.4.

Table 2. Fuel costs and GHG emissions by division, 2007

Division	Fuel cost	CO_2e emissions (tonnes)
Public Works	$ 663,342	2,196
Parks, Recreation, and Culture	$ 178,291	602
Law and Community Safety	$ 121,495	348
Miscellaneous	$ 16,155	53
Urban Development	$ 7,883	25
Finance and Corporate Services	$ 4,854	17
Total	**$ 992,020**	**3,241**

2.3 2010 fleet inventory

The purpose of the 2010 inventory is to provide a comparison to 2007, enable action tracking, and provide the basis for future strategy modelling and prioritization.

Fleet fuel use in 2010 totaled 1,249,957 litres of gasoline and diesel, at a cost of $1.27 million. Fleet emissions were 3,151 tCO_2e. This shows a reduction of 3% in GHGs from the 2007 inventory.

Figure 8 provides the breakdown of fleet assets by mode, and the percentage of GHG emissions for each mode. Passenger cars make up 18% of fleet assets, yet produce only 7% of emissions. This is due in part to the replacement of passenger cars with higher efficiency green fleet vehicles. In addition, passenger cars are unlikely to serve dual work purposes, whereas light-, medium- and heavy-duty trucks may idle to run equipment, keep workers warm during break periods, and provide other additional services. Light-duty trucks constitute the majority of fleet assets. Medium-duty vehicles (trucks and buses) account for the greatest percentage of emissions

[32] See Appendix A for inventory methodology; 2007 emission were re-calibrated using the 2010 methodology to enable 2007 to 2010 comparison.

Attachment 2

Green Fleet Action Plan (cont'd)

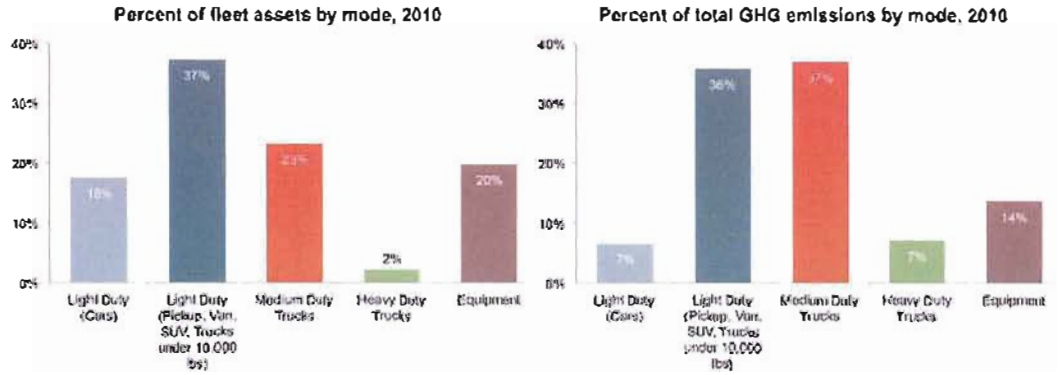


Figure 8. Percent of total fleet assets and GHG emissions by mode, 2010

Note: Data does not include Fire Service vehicles.

Table 3 shows fleet emissions and fuel costs broken down by division. The majority of emissions come from the Public Works division, which includes roads, water and wastewater, and fleet operations. Fire services are included in Law and Community Safety. Fuel costs show a similar breakdown: Public Works accounted for more than $800,000 in fuel costs in 2010.

Table 3. Fuel costs and GHG emissions by division, 2010

Division	Fuel cost	CO_2e emissions (tonnes)
Public Works	$ 854,411	2072
Parks, Recreation, and Culture	$ 215,435	549
Law and Community Safety	$ 166,712	432
Miscellaneous	$ 22,644	68
Urban Development	$ 5,554	13
Finance and Corporate Services	$ 7,031	18
Total	**$ 1,271,787**	**3151**

A more detailed breakdown of emissions by department is provided in Appendix A.3.

2.4 Analysis, 1995-2010

The 2007 inventory report included data from 1995 and 1999. When combined with the 2010 inventory, this allows comparison over a 15-year time period (Figure 9 and Figure 10,

Attachment 2

Green Fleet Action Plan (cont'd)

Table 4). With only three to four data points, it is difficult to identify concrete trends.[33] However, the data to date shows that per unit fuel use and emissions have decreased, while overall emissions and fuel use have remained relatively consistent. Richmond has grown significantly in this time period, and the actions taken to date have limited an overall increase of fuel use and emissions from fleet.

As shown in Figure 9, total greenhouse gas emissions have shown a slight downward trend from the mid-1990s, with variability around 3200 tonnes CO_2e since 1999. 2010 fleet emissions are 6% below 1995 emissions and 3% below 2007 fleet emissions.

At the same time, the total assets of fleet (vehicles and equipment) have continued to rise, with an increase of 24% between 1999 and 2010, reflecting the increased service level for a growing population. Richmond's population grew almost 30% between 1996 and 2011.[34]

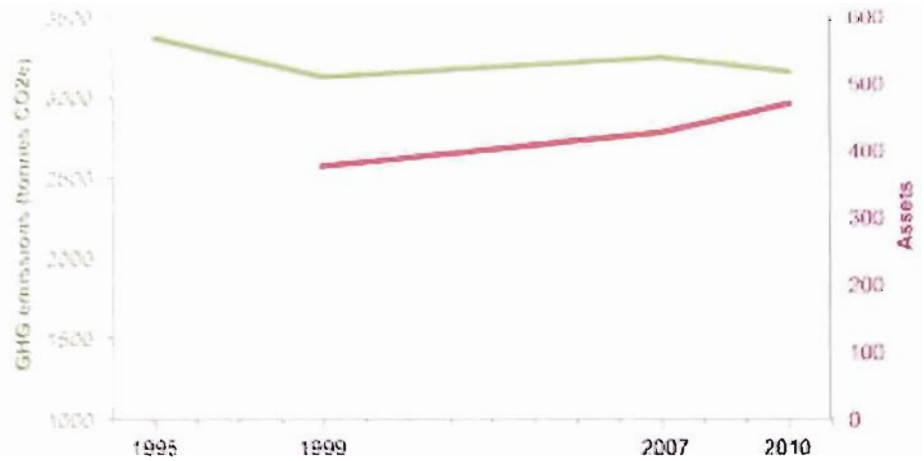


Figure 9. GHG emissions and asset counts over time[35]

The combined emissions trend and asset trend show that vehicles and equipment are becoming more efficient, and/or are being used more efficiently to provide services to the City.

[33] It is possible that differences are in part due to changing data methodologies.1995 and 1999 emissions numbers are taken directly from the 2007 Inventory Report. However, the 2007 and 2010 numbers have been calibrated for methodological differences in carbon accounting. Fuel management changes in 2009 may have impacted the fuel use numbers.

[34] Calculated from City of Richmond "Population Hot Facts"
http://www.richmond.ca/__shared/assets/Population_Hot_Facts6248.pdf

[35] The asset count for 1999 includes insured vehicles and equipment in 1999. The 2007 and 2010 numbers are based on a count of individual assets fuelling up at the Works Yard fuel station, as well as Fire Service vehicles.

Attachment 2

Green Fleet Action Plan (cont'd)

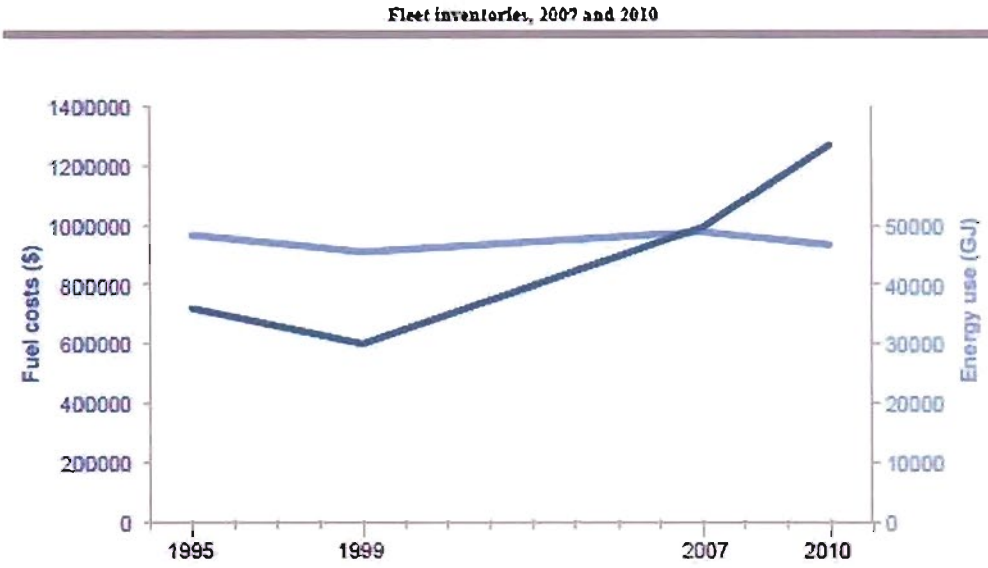


Figure 10. Fuel costs and energy use over time[36]

Figure 10 shows fuel use in GJ and fuel costs over time in unadjusted dollars. Fuel use has remained relatively stable. Fuel costs have increased by 28% in nominal dollars from 2007 to 2010, while energy use (and emissions, as shown in the previous graph) have remained about the same. Fuel costs in nominal dollars have more than doubled since 1999, providing a financial rationale for improving fleet efficiency.

The litres of fuel saved in 2010 over 2007 also saved Fleet $64,650 in fuel costs.[37] The upfront capital costs required to pay for some of the green fleet actions can be at least partially offset by operational savings. By reducing overall fuel use, Sustainable Green Fleet actions support fleet fiscal prudence as well.

Table 4. Asset, GHG, energy data 1995-2010

					Percent Change	
	1995	1999	2007	2010	1999-2010	2007-2010
Asset count		378	426	469	124%	110%
GHGs, tonnes CO_2e	3,368	3,124	3,241	3,151	101%	97%
Energy costs, $	720,131	602,521	992,020	1,271,616	211%	128%
Energy use, GJ	47,055	44,227	47,533	45,395	103%	96%
Energy use, L			1,313,357	1,249,957		95%

[36] 1995, 1999, and 2007 energy use and fuel cost numbers are taken directly from the 2007 Inventory Report. The 2010 numbers are based on 2010 fuel consumption cost data.

[37] Assuming average cost price/litre of $1.02 for 2010.

Attachment 2

Green Fleet Action Plan (cont'd)

3. Actions to date

Richmond began its innovative sustainable fleet work in the 1990s with the Employee Carpool Program. Richmond continued taking action on reducing fuel use and increasing the environmental sustainability of fleet with its Green Fleet Policy of 2006. Richmond's action to green its fleet and corporate transportation practices thus began prior to 2007, the baseline date for provincial GHG inventories, policies and action plans. This section summarizes key actions taken to date.

3.1 Action framework

In order to assess Green Fleet actions to date (and for future Green Fleet action planning), actions were divided into four key areas:

- demand side management
- maintenance and management
- efficient resource use
- alternative fuels

Demand side management covers a broad range of actions that reduce demand for fleet vehicles and equipment while maintaining worker safety and service excellence. These actions include reducing idling, changing driver behavior, and changing operational practices to reduce vehicle kilometres travelled (VKT). While demand side management actions may require broader organizational and behavioural shifts across municipal operations and departments, it is a fiscally prudent approach that generally does not require large capital outlays for Fleet. Responsibility for implementation rests with the corporation as a whole as well as Fleet Services.

Maintenance and management includes a sound vehicle maintenance program that maximizes vehicle efficiency, and accurate fuel management systems. Sound data collection and active data use can improve the performance of fleet overall. These practices are the responsibility of Fleet, although changes could impact other departments. Maintenance and management actions may require human resource and capital outlays to incorporate new practices (e.g. fuel dispensing systems), or they may improve upon on existing programs. They ensure worker safety, service excellence and fiscal prudence.

Efficient resource use includes new technology adoption such as moving to more efficient vehicles and upgrading vehicle technology to reduce fuel consumption.

Alternative fuels is the final area of action, whereby remaining energy demand may be met by a variety of low-carbon fuels. Some actions in both efficient resource use and fuels may require higher upfront capital cost outlays, as well as minor to significant fueling system changes. Alongside their environmental performance, consideration of operational cost savings is important to assess their financial feasibility.

Attachment 2

Green Fleet Action Plan (cont'd)

3.2 Actions to date

Richmond's actions to date are either completed, ongoing, or in pilot phases. They are summarized in Table 5, followed by details for each action in Section 3.3.

Specific current and ongoing actions have been measured where possible using quantitative indicators such as numbers of green fleet vehicles. Qualitative indicators of success have also been identified. For example, Richmond's exemplary carpool program, in operation since 1997, can be measured by number of staff participating; qualitative impacts include the demonstration of leadership and the enhancement of staff satisfaction.

Table 5. Sustainable Green Fleet actions to date

Action	Status	Impact
Demand side management		
1. Anti-idling program at the Works yard Anti-idling bylaw[38]	Completed	Richmond's fleet has had an idle-free program as of September, 2004 Community anti-idling bylaw provides opportunity for education and awareness, introduced July 2012
2. Driver training: One-time driver training for all drivers using fleet vehicles; driver training on new equipment	Ongoing	Driver behaviour, including idling, accounts for 5 to 33% of fuel use[39]
3. Reduce demand by changing operational practices a) Route optimization b) Reduced collection requirements	a) Completed for some departments b) Completed	Bylaw, litter and tree routes have been optimized. Solar compactors at SkyTrain stations.
4. Use IT to reduce the number of work-related vehicle trips taken by Richmond staff	Pilot	Fire Halls and City Hall fifth floor connected
5. Alternative transportation pilot: corporate bicycle share	Pilot	Program had very low uptake
6. Sustainable Commute: staff carpool program	Ongoing	Almost 80 staff participate, with a 70-person wait list Community GHGs are reduced; enhanced staff satisfaction; leadership. Does result in increased wear and tear on City vehicles and the need for accelerated vehicle replacement of carpool units.

[38] City of Richmond, Anti-Idling Initiatives & Regulation on Public Property, Adopted by Council June 25, 2012. http://www.richmond.ca/cityhall/council/agendas/council/2012/062512_minutes.htm (REDMS No. 2020978)

[39] *Behind the Wheel.*

Attachment 2

Green Fleet Action Plan (cont'd)

		Actions to date
Maintenance and Management Practices		
7. Automated fuel management and dispensing system	Completed	Ensures fuel use is monitored and tracked and provides for fuel security.
8. Preventive maintenance program for vehicles	Ongoing	Ensures vehicle safety and efficient vehicle performance for worker safety and best vehicle performance.
9. Fleet financial assessment; improved asset management systems	Completed; in process	Financial sustainability of Fleet; improved asset management including maintenance schedules and active data use for fuel savings.
Efficient Resource Use		
10. Best-in-class procurement: purchasing Smart Cars and hybrids for passenger vehicles	Ongoing	31 hybrids and 10 Smart Cars as of 2010. Green Fleet cars saved 43 tonnes of GHGs between 2007 and 2010. Demonstrates leadership.
11. Reduce idling through installation of LED lights for emergency lighting in trucks, and auxiliary batteries when appropriate.	Ongoing	One-third of fleet vehicles have been converted to LED lighting. As of 2012, all new trucks are spec'd with LED emergency lighting and dedicated auxiliary batteries where possible.
12. Solar panel installation on Parks trailers to run safety/signal lights.	In process	Two message board trailers have been converted to use solar panels for their safety/signal lighting.
13. Replace lower tier diesel equipment	In process	Four units replaced.
Alternative Fuels		
14. Biodiesel 5 blend in diesel fuel prior to 2008. As of 2012, 4% biodiesel is the B.C. standard for diesel fuels, with a 5% ethanol blend in gasoline.	Ongoing	104 tonnes of Richmond's fleet emissions in 2010 were from renewable sources: biodiesel and ethanol.
15. Switch to low-carbon B.C. grid electricity a) Electric ice resurfacers b) Electric vehicle passenger cars c) Electric vehicle charging station installations	a) Completed b) Ongoing c) Ongoing	a) All five ice resurfacers are electric b) Four electric cars procured in 2012 c) 11 electric vehicle charging stations installed

3.2.1 Overall impact

The overall indicator of success, from a carbon neutral standpoint, is the reduction of total emissions from fleet. Section 2 showed that there has been a 3% reduction in emissions from fleet vehicles and equipment between 2007 and 2010. Fleet emissions, when Fire Services are excluded, have decreased by 6% from 2007. Reductions were greatest in the light-duty truck category.

Attachment 2

Green Fleet Action Plan (cont'd)

Actions to date

Many factors impact the fuel economy of vehicles, annual vehicle kilometres travelled (VKT) and GHG emissions. These include weather/climate, level of service provision, driver behaviour, vehicle maintenance, and vehicle type and technology. Richmond's actions to date have addressed areas where Fleet Services can have an impact on using resources wisely.

Details on each action, as well as key actions that demonstrate the impacts of the Sustainable Green Fleet Policy, Richmond's leadership, and innovation by Fleet staff are provided below.

3.2.2 Demand side management

Richmond has several different programs and initiatives to reduce the demand for fleet vehicles and equipment. These actions demonstrate Richmond's corporate leadership on sustainability, dedication to sound fleet management practices, and innovation in the Fleet Yard. While difficult to quantify behavioural and organizational actions, demand side management plays a key role in reducing fuel use and GHG emissions, while ensuring the fiscal sustainability in fleet.

Action 1. Anti-idling corporate initiative (2004) and community-wide bylaw (2012)

Richmond has had an Fleet Operations Anti-idling Initiative since 2004. In 2006, the City partnered with School District #38 to pilot an Idle-Free program at two schools, which the School District has continued to expand. Preventing non-purposeful idling in City vehicles was included in the 2006 Green Fleet Policy. Non-purposeful idling is deemed to be idling not necessary for the safe operation of the vehicle, and therefore does not include idling to run safety lights or equipment.

Richmond has now expanded its anti-idling program, with a community-wide anti-idling policy adopted in 2012 that restricts non-purposeful idling to three minutes, with a $75 penalty.[40] The goal of the anti-idling bylaw is to promote voluntary compliance, engage people in dialogue about the impacts of idling, and promote community awareness. The three-minute limit is enforced by city bylaw officers as part of existing traffic and parking patrols.

Action 2. Driver training: "Smarter Driver"

Driver behaviour can account for 5% to 33% of fuel use, with a conservative estimate placing reductions of anti-idling, regular maintenance, and Smarter Driving at 10%.[41]

Driver training is critical to ensure that driver behaviour is supporting fuel reduction goals. Currently, drivers new to fleet vehicles undergo a training session for Fleet insurance purposes. The training is for all drivers who use fleet vehicles, including volunteer drivers for cultural services. The training focuses on safe driving practices, and includes smarter driving techniques such as slow acceleration and deceleration in order to improve the fuel efficiency of vehicles. Additional staff training is provided on new equipment.

Action 3. Reduce demand by changing operational practices

a. **Route optimization for service provision.** Bylaw, litter, and tree routes have been optimized to reduce total vehicle kilometres traveled (VKT). The Information

[40] City of Richmond. Anti-Idling Initiatives & Regulation on Public Property. (REDMS No. 3537567)

[41] *Behind the Wheel.*

Attachment 2

Green Fleet Action Plan (cont'd)

Actions to date

Technology department has divided the city into four quadrants to optimize services. These are department by department initiatives to streamline routes.

b. **Reduced collection requirements.** The garbage bin sizes at Gary Point Park have been increased using an in-ground container, so that they do not need to be emptied as frequently. Solar compactors for garbage at SkyTrain stations – the "Big Bellies" – reduce the frequency that staff need to empty garbage; however, injuries to workers may increase due to heavier lifting. Also, the stations still require litter clean-up, limiting the VKT reductions.

Action 4. Use Information Technology (IT) to reduce vehicle-related trips for meetings for Richmond staff. The IT Department has set up remote meetings for Fire Services, connecting City Hall and the fire stations with an optical communications system (OCS). A pilot at the Works Yard was not succesful due to poor lighting.

Action 5. Alternative transportation pilot – staff bicycle share program.

A fleet bicycle share was initiated for employees, as an alternative to taking vehicles to meetings. The program had poor uptake. Staff cite weather and limited awareness as potential reasons for its lack of success to date. Changing mindsets and cultural expectations were also given as reasons.

Action 6. Sustainable Commute: staff carpool program

Demonstrating Leadership

Initiated in 1997, Richmond's employee carpool program has almost 80 participants and more than 70 staff on the waitlist. The program uses 17 fleet vehicles that are based at either City Hall or the Works Yard and travel to Langley, Surrey, White Rock, Delta, Vancouver, and the Tri-Cities. Although the staff carpool does not directly reduce corporate GHG emissions, it does reduce community emissions, demonstrates leadership in transportation, and has been a model for other communities initiating staff carpool programs.

3.2.3 Maintenance and management practices

Action 7. Automated fuel management and dispensing system. Fleet operations installed a new fuel management system in mid-2009. This system tracks all fuel use by vehicle and equipment unit and ensures only authorizes vehicles can fuel up (i.e. provides fuel security).

Action 8. Fleet financial assessment and an improved asset management system. An independent financial assessment has provided strategies to support the financial well-being of fleet, particularly around replacement vehicles and the long-term stability of the Public Works/Corporate Vehicle and Equipment Reserve fund. Ensuring financial viability supports a progressive procurement policy that adopts new technologies, particularly around fuel efficiency.[42]

[42] The financial strategy is detailed in the February 7, 2012 Report to Committee on the Sustainable Green Fleet Policy amendments, REDMS 3537567.

Attachment 2

Green Fleet Action Plan (cont'd)

Actions to date

Fleet is also in the process of updating its asset management systems with new software that will enable better matching of vehicle to need, maintenance schedules, replacement calculations, and fuel tracking. The Faster Asset management software will support Fleet in providing service excellence while ensuring vehicle safety and fiscally-prudent decision-making about asset maintenance and replacement.

Action 9. Preventive maintenance program for vehicles

Richmond Fleet practices preventive maintenance by regularly servicing fleet vehicles. Regular maintenance reduces long-term and unexpected maintenance costs, ensuring that vehicles operate efficiently and safely.

Shawn Howe John Kovich
Source: City of Richmond

3.2.4 Efficient resource use

Action 10: Best-in-class vehicle procurement: purchasing Smart Cars and hybrids for passenger vehicles

Richmond has purchased fuel-efficient replacement vehicles, in keeping with the Sustainable Green Fleet Policy to use "vehicles with highest fuel efficiency and cost effectiveness based on considerations of life-cycle costing and financial investment requirements" and a Council resolution specifying procurement of Smart Cars and hybrids.[43]

The passenger car replacement policy is visible in the fleet inventory. Passenger vehicles purchased in the early 2000s included a mix of Honda Civics, Chevrolet Cavaliers, and Dodge sedans. Following the Council resolution to replace compact cars with hybrids or Smart Cars, new passenger cars in fleet were mainly Smart Cars and Honda Civic hybrids, with a few other vehicles (Chevrolet Malibu, Honda Accord, Saturn Vue). Numbers of hybrid vehicles and Smart Cars in Richmond's Green Fleet are shown in Table 6.

[43] City of Richmond, *Green Fleet Policy*. Adopted by Council December 11, 2006; amended by Council February 23, 2009 and February 7, 2012. (REDMS No. 3537567)

Attachment 2

Green Fleet Action Plan (cont'd)

Actions to date

Hybrid vehicles provide the best fuel economy within a vehicle class, aside from fully electric vehicles. In 2007, fleet had 12 hybrid vehicles, all passenger cars. In 2010, fleet had 31 hybrid vehicles: 30 hybrid passenger cars and one hybrid-diesel truck. Including Smart Cars, green fleet vehicles now represent over 50% of Richmond's passenger cars.

In 2010, green fleet passenger cars (hybrids and smart cars) operated more efficiently than non-green fleet passenger cars, using only 6.7 L/100km compared to 11.4 L/100 km for non-green fleet cars.[44] Richmond's green fleet cars (hybrids and Smart Cars) are 41% more fuel efficient than the other passenger cars in fleet.

From 2007 to 2010, the Green Fleet cars have saved almost 20,000 L of fuel and 43 tonnes of GHGs, as compared to conventional vehicle replacements. GHG emissions from passenger vehicles would have been 6% higher without the green fleet vehicles. Section 4 recommends actions to continue and improve on the savings from the green fleet vehicles.

Table 6. Numbers of Smart Cars and hybrid cars in fleet

Number of cars	2007	2010
Total number of cars	70	76
Smart Cars	11	10
Hybrid cars	12	30
Percent of passenger vehicles that are green fleet vehicles	33%	53%

For green fleet vehicles to be successful, they must also support service excellence, including staff satisfaction. For example, while fuel efficient, Smart Cars are seemingly less well liked by staff due to issues such as diesel odour, limited carrying space for materials/supplies and unease around vehicle safety due to size. They are also not effective for carpool use. One staff person simply stated that "people don't like to drive them." As service excellence and driver satisfaction are factored into vehicle procurement decisions also, Richmond has not continued to purchase Smart Cars, with 11 in the fleet in 2007 and 10 in 2010.

Piloting a diesel-electric truck

Richmond procured a diesel-hybrid truck as part of a pilot with five other municipalities. The truck chassis was outfitted as a Parks chipper vehicle for tree trimming. However, the electric drive for the bucket has a slow response time and considerable breakdowns, which has led to low utilization. As a pilot, the unit was new, with untested and unproven technology at acquisition. Fleet staff recommend that future hybrid-diesel vehicles be optimized for their use, i.e. used for overhead electrical work that does not require a rapid response time, as an example.

[44] Based on an assessment of 72% of passenger car VKT data for 2010.

Attachment 2

Green Fleet Action Plan (cont'd)

Actions to date

Action 11. Reduce idling through LED lights and auxiliary batteries.

Idling to run safety lights increases wear and tear on the engine and increases truck fuel use. Replacing lights with LEDs and including auxiliary batteries reduces idling time, saving fuel and maintenance costs. Results from the City of Hamilton measuring six trucks with auxiliary batteries showed an average fuel economy improvement of 6%.[45]

Richmond fleet staff are currently replacing vehicle emergency lights with LEDs, and auxiliary batteries where possible,[46] as vehicles come in for maintenance. Approximately one-third of eligible trucks have been re-fitted to reduce idling needs. New trucks are being ordered with LED lights and auxiliary batteries.

This action reduces the need to idle in order to run vehicle lights (e.g. safety lights), but does not reduce the need to idle for heating purposes in the winter, nor idling required to run equipment. For example, vehicles that serve as lunchrooms for outdoor crews will continue to idle for heating purposes. Also, short trip durations are not adequate for full auxiliary battery recharge. Work crews may need to charge batteries at a charging station at the yard as necessary.

Action 12. Solar panel installation on Parks trailer to run signal/safety lights.

Innovation

Fleet operations staff take advantage of opportunities to reduce fuel needs. They have installed two solar panels on Parks trailers to run the LED signal/safety lights. They note that this innovation is not likely transferable to many other fleet vehicles: individual opportunities are evaluated based on the energy draw required and available solar panel space.

Installing solar panels is an example of innovation in the Works Yard, meeting the Sustainable Green Fleet Policy to "adopt new technologies, including retrofits, aimed at improving fuel efficiency and reducing emissions."[47]

Action 13. Replacement of low-standard diesel equipment

Fleet has replaced four Tier 0 diesel units that were over 25 years old. This Sustainable Green Fleet action meets the human health and air quality policy goals in the Sustainable Green Fleet Policy, as well as Metro Vancouver's diesel equipment bylaw. Standards for equipment are geared towards standards for local air quality pollutants, and do not include standards for greenhouse gas emissions. However, some Tier 3 and Tier 4 equipment is more fuel-efficient[48] and may also improve fuel use and related greenhouse gas emissions.

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[45] Calculated from data provided in City of Hamilton *Appendix B: Green Fleet Implementation Plan, Phase 2 2009-2011* (2009), 17.

[46] Older vehicles are upgraded to LED lights, but not auxiliary batteries, as the conversion is not feasible.

[47] *Sustainable Green Fleet Policy*.

[48] By about 3-5% over the preceding tier, see, for example http://cumminsengines.com/fuel-duel.aspx, http://emissions.cardealer.com/system/resources/0000/0007/Tier_4_Customer_FAQ.pdf.

Attachment 2

Green Fleet Action Plan (cont'd)

3.2.5 Alternative Fuels

Action 14. Biodiesel

Richmond adopted the use of biodiesel 5 for fleet vehicles fueling at the fleet yard prior to 2008, ahead of provincial regulations that have now phased 4% biodiesel into the provincial diesel fuel mix.[49] B.C. has also regulated a 5% blend of ethanol in gasoline, as of 2010.[50]

Emission reductions from biodiesel are seen in the full life cycle of emissions from the fuel, rather than at the tailpipe. Life-cycle reductions from biodiesel 5 should be approximately 4%. As the biodiesel is from a renewable resource, some of these emissions will be re-captured by the crops for the next cycle of production.[51]

In 2010, 104 tonnes of Fleet's emissions were from biodiesel and ethanol blended in the diesel and gasoline fuels.

Action 15. Switch to low-carbon, B.C. grid electricity[52]

a) Richmond replaced its five propane-powered ice resurfacers with electric ice resurfacers. This improves indoor air quality at the ice arenas as well as reducing greenhouse gas emissions.

Figure 11. Richmond's ice arenas use electric ice resurfacers, eliminating fossil fuel use and improving indoor air quality

[49] 4% as of 2012. http://www.empr.gov.bc.ca/RET/RLCFRR/FAQ/Pages/default.aspx.

[50] Through the Cleaner Gasoline Regulation (CGR). http://www.env.gov.bc.ca/epd/codes/cera/index.htm

[51] The gains from biodiesel depend upon the fuel lifecycle including crop type and the methods of production. Second generation biodiesel is estimated to provide greater emissions gains than first generation biofuels, which have faced challenges including: large carbon inputs into production, displacement of food crops by fuel crops, etc.

[52] In B.C., electricity is primarily generated from hydroelectricity, and therefore the GHG emissions are very low. Richmond can use grid electricity and greatly reduce GHG emissions. Electricity in other jurisdictions may have much higher associated GHG emissions.

Attachment 2

Green Fleet Action Plan (cont'd)

Actions to date

b) In 2012, Richmond purchased one Nissan Leaf and three Chevy Volts. The Leaf is an all-electric vehicle (battery electric or BEV) with an electric motor that does not have a tailpipe, and hence no tailpipe emissions. It can drive over 100 km on a full charge, depending on local conditions and driver behaviour. The Volt is a plug-in hybrid vehicle (or PHEV) that can drive up to 80 km on a full charge; once the battery is depleted, it switches to using the gasoline engine.

Figure 12. Richmond's new all-electric Nissan Leaf and the new Chevy Volt plug-in hybrids

Electric vehicles provide fuel cost savings over the life of the vehicle. B.C. Hydro has estimated the savings from a BEV at $1200/year for B.C. owners.[53] Richmond's purchase of electric vehicles in 2012 has taken advantage of B.C. government rebates on electric vehicles. Payback periods depend on vehicle usage and are discussed in Section 4.

The purchase of electric vehicles demonstrates leadership in "incorporating innovation and leading-edge technology," a goal of the Sustainable Green Fleet Policy. Having electric vehicles in fleet can help profile EV's as a vehicle choice to Richmond citizens, supporting the community GHG targets.

c) Richmond has installed 11 electric vehicle charging stations in five locations. Eight are for public use (Steveston Community Centre, Thompson Community Centre, Cambie Community Centre, and Richmond City Hall). Two are for Fleet use at City Works Yard, with an additional station underground at City Hall for fleet use. In addition, the Richmond Olympic Oval installed two electric vehicle charging stations.

These installations have been funded in part by the B.C. government, making the installation more financially feasible for the municipality and enabling the transition to low-carbon electricity as an alternative fuel for some Richmond fleet vehicles.

The installation of publically-accessible charging stations also supports uptake of electric vehicles by community members. In the community as a whole, passenger vehicles account for more than 40% of total GHG emissions. Up to 25% of the community's passenger vehicle emissions could be reduced by 2035, along with air quality particulates, with a high EV adoption

[53] Assuming an average annual driving distance in BC of 16,700 km/year, 2 kwh/km and $ litres/100km., Alec Tsang, BC Hydro, "Identifying PEV Early Adopters and Their Needs," presented at Electric Mobility Canada Conference 2009. http://www.emc-mec.ca/phev/en/Proceedings.html

Attachment 2

Green Fleet Action Plan (cont'd)

Actions to date

rate in the community.[54] High visibility of the fleet's electric vehicles, as well as the supporting charging infrastructure that has been installed, will therefore also help to address Richmond's community emissions.

[54] Based on BC Hydro estimates and Pembina Institute modelling. In Alison Bailey, *Potential impacts of additional electric vehicles in City of Campbell River, the Peace River Region and City of Richmond* (Pembina Institute, 2013).

Attachment 2

Green Fleet Action Plan (cont'd)

4. Action plan for the future

Richmond has made progress towards reducing greenhouse gas emissions from fleet while continuing service excellence. New actions are needed to ensure that overall emissions continue to reduce emissions and support Richmond's larger climate action goals.

This section begins by presenting an estimate of fleet emissions in 2020 assuming no further actions are implemented, beyond improving vehicle emissions standards due to federal fuel regulations, as vehicles are replaced in the fleet. Fleet emissions, with on-going asset growth, are projected to increase by 3% by 2020. Using this as the baseline, the impact of potential future actions has been modeled where possible, or estimated based on a literature review, and the actions have been prioritized.

Moving forward with a sustainable green fleet will require action on several fronts. demand side management puts forward the broader organizational and behavioural changes that should be the starting point for Green Fleet action, including downsizing vehicles. Maintenance and management, alongside monitoring and reporting, puts the right systems in place to support service excellence, fiscal prudence and best use of vehicles for fuel savings. Monitoring and reporting also supports departments in managing their use of fleet assets and will help celebrate the successes of individuals, departments and Fleet in reducing VKT, fuel use and emissions, supporting broader institutional change.

The efficient use of resources shows that procuring best-in-class fuel-efficient vehicles is necessary to reduce emissions and also fiscally prudent. Fuel switching (e.g. to electricity) will also provide benefits. For both of these, best use of existing and new assets is critical to maximize the fuel cost savings that accrue directly to Fleet or ensure payback periods where price differentials exist (such as for EV's). Emissions from passenger cars can be very significantly reduced; an emphasis on dealing with the emissions from light-duty trucks is also critical.

This section emphasizes the importance of planning actions together and provides the basis for the recommended targets in Section 5. In several cases, technology and behavioural change support each other. For example, using LED lights and auxiliary batteries to reduce truck idling supports anti-idling behaviour by vehicle operators. Additional driver training to reinforce anti-idling can make this behavioural shift a reality. Systematized vehicle maintenance bundled with smarter driving and anti-idling can provide significant emissions reductions.

Making and keeping demand management choices requires the buy-in and support of the multiple departments and staff who use fleet vehicles. Part of the challenge is in changing cultural norms and behaviour. Staff at the workshop had numerous suggestions for how to engage staff across the City, including an annual Sustainable Green Fleet Report and holding an inter-departmental competition for emissions reductions.

Attachment 2

Green Fleet Action Plan (cont'd)

4.1 Assessing new actions

4.1.1 2020 projected fleet emissions, base case

Fleet emissions for 2020 were calculated using the 2010 inventory as a baseline, and are expressed as a percentage relative to the 2010 emissions.[55] Emissions were calculated for the existing fleet (vehicles and equipment, not including Fire Services), with replacement rates by mode based on historic and projected trends.[56] The modelling assumes a 2% growth in assets annually with total assets increasing 22% by 2020, and accounts for federal fuel economy regulations.

Total emissions in the 2020 base case are projected to increase by 3% over the 2010 emissions, as shown in Figure 13. Emissions only increase by 3%, compared to the 22% increase in assets, due to the replacement of older, inefficient vehicles by new more fuel-efficient vehicles.

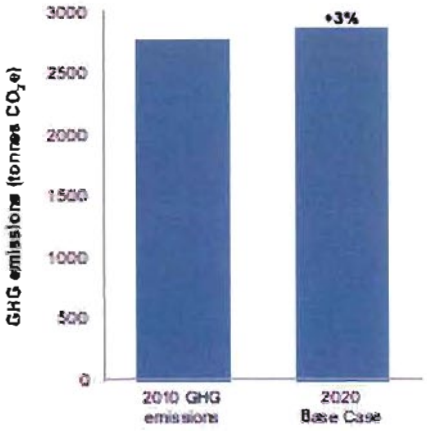

Figure 13. Base case emissions in 2020 compared to 2010 emissions

The base case emissions projection assumes that Richmond fleet procures conventional light-duty cars and light-duty trucks, vans, and SUVs, rather than hybrids and electric vehicles. Therefore, the base case model assumes that Richmond Fleet procures equivalent replacements like the Chevrolet Cruze.[57] In light trucks, the modelling assumes that Richmond's pickups are replaced by similar vehicles with some minor gains in fuel efficiency.[58]

[55] 2010 was chosen as the baseline because the new fuel dispensing system was in place. In addition, 2010 provides more up-to-date data from which to base future actions.

[56] See Appendix A.4 for a detailed breakdown of the future projections modelling methodology.

[57] Best-in-class conventional vehicles, hybrids and EVs were modelled separately under specific actions, in order to understand the gains made by specific choices in vehicle procurement. The base case modelling may underestimate some of Richmond's potential gains in passenger cars, given the recent shift in 2012 to purchasing pilot EVs.

[58] A 2003 Ford F150 is assumed to be replaced by a 2012 Dodge Ram 1500 with a 6% improvement in fuel economy. Additional gains are assumed annually due to changes in fuel standards for light trucks.

Attachment 2

Green Fleet Action Plan (cont'd)

Without new asset growth, emissions from current fleet assets and their replacements are actually projected to decline by 13%, reflecting improvements in vehicle fuel economy due to federal regulations and fleet replacement. The 2020 base case modelling suggests that, with continued growth in assets, Richmond will continue its current trend of annual variability in CO_2e emissions, rather than building on the 6% reductions that Fleet, not including Fires Services, achieved between 2007 and 2010 to continue a downward trend. If asset growth continues, and without sustained Green Fleet actions, emissions may rise in the future.

What actions can Richmond expand and add to its green fleet actions so as to continue — and accelerate — the reduction in fleet emissions? How can Richmond continue to lead on Green Fleet actions in B.C. and across Canada while maintaining its record of service excellence and ensuring fiscal sustainability?

4.1.2 Impact of new actions

The overall indicator of success, from a carbon neutral standpoint, is a reduction in total GHG emissions from fleet. Sections 2 and 3 showed that there has already been a 6% reduction in Fleet emissions between 2007 and 2010 (not including Fire Services). Projected impacts on GHG emissions by 2020 have been modelled for key actions. Other quantitative measures of success, as well as qualitative indicators, have also been identified in order to provide measurable objectives for specific actions. Section 5 sets a pragmatic 2020 and annual GHG reduction target for Fleet, built from pragmatic GHG targets for key action areas.

4.1.3 Process for action prioritization

Future actions were developed and prioritized through a process that included a review of best practices in other fleet plans and resources[59] and a preliminary meeting with Fleet staff to discuss actions. Fleet staff made recommendations about Efficient Resource Use and Fuels actions. Modelling was used to quantify the GHG impact of some of these.

Demand side management actions, particularly those that are reliant on organizational or behavioural change, are also important, although they are less easily quantified. A workshop held on November 29, 2012 with staff from several city departments provided critical feedback and input on these actions. Follow-up with staff helped to clarify feasibility of implementation. Service excellence and fiscal prudence have been used as part of the prioritization criteria in choosing actions and setting targeted GHG reductions.

A note on the cost assessments: the generalized costs are provided to help determine overall strategic trade-offs, not specific business decisions on a per asset basis. "Minimal" is used when the main outlay is in staff time. "Moderate" refers to situations that may require some additional capital costs, such as the purchase and installation of GPS units, or a price differential in

[59] Including: City of Hamilton (2005). *Green Fleet Implementation Plan*; City of Hamilton (2009) *Green Fleet Implementation Plan Phase 2: Appendix B*; Stantec (2011). *City of Surrey Corporate Emissions Action Plan*; Fleet Challenge Ontario (2011). *Best Practices Manual, 2nd Edition: Municipal Green Fleet Management in Ontario*; FCM/PCP (2010). *Enviro-fleets: reducing emissions from municipal heavy-duty vehicles*; Toronto Fleet Services (2004). *Toronto Green Fleet Transition Plan 2004-2007*; Toronto Fleet Services (2008). *Toronto Green Fleet Plan 2008-2011*; US DOE (2011). *Comprehensive Fleet Management Handbook*; City of Vancouver, http://vancouver.ca/green-vancouver/green-fleets.aspx

Attachment 2

Green Fleet Action Plan (cont'd)

purchasing an electric vehicle. "Significant" refers to large capital outlays. Several actions save costs, such as retiring under-utilized vehicles from fleet or ensuring best use of existing assets. Most of the actions have net benefits, as improvements in fuel economy and reductions in VKT and vehicle demand save Fleet operating and fuel costs over time.

4.2 Prioritized new actions

Table 7 below lists 24 sustainable fleet actions to reduce emissions. Details on each action including feasibility of implementation[60] follow the table. The actions are categorized into demand side management, maintenance and management practices including monitoring and reporting, efficient resource use, and alternative fuels. The order of these categories is such that the "low-hanging" fruit from a fiscal prudence perspective are covered first (reducing demand, management practices), followed by actions that could require higher capital outlays, including new fueling infrastructure.

Priority actions are those actions that have a high feasibility of implementation from an organizational perspective, provide significant greenhouse gas reduction benefits and other positive impacts, and are implementable in the short-term. Actions to Consider can provide benefits, but may require more time to implement, face organizational or other barriers, or require further fiscal sustainability considerations such as substantial new fueling infrastructure.

The Impacts are provided to show how actions could be measured and reported on. Some actions have GHG impacts that can be modeled and the potential reduction in GHG emissions for 2020 is provided were that action to be aggressively pursued. Other actions' GHG reductions are taken from the literature. **Targeted GHG reductions** are the pragmatic, achievable GHG reductions that together build an overall reduction target for the fleet, explained in Section 5.

Table 7. Prioritized new fleet actions

New Action	Status	Impact
Demand Side Management		
1. Reduce growth in assets and downsize vehicles through demand side actions.	Priority	Eliminating new growth in assets could provide up to 16% reductions in fleet emissions, 2010 to 2020. Potential to reduce overall number of assets in some areas such as passenger cars.[61] **Targeted overall GHG reduction of 7%, supported by other DSM actions.** Cost: Savings from reduced asset procurement and maintenance costs. Supports fiscal sustainability of the replacement reserve fund.

[60] Feasibility of implementation provides a general measure of the ease of implementation from an organizational perspective. Specific financial feasibility of each action has not been assessed.

[61] Based on 2010 data, up to 30% of passenger cars have low-VKT and should be assessed for replacement by Actions 2, 3, and 4.

Attachment 2

Green Fleet Action Plan (cont'd)

Action plan for the future

2. Consolidate and eliminate trips through information technology and route optimization. Report all route optimization programs in order to share learning.	Priority	Reduces VKT. Cost: minimal.
3. Increase employee public transit use for off-site meetings, or pay for taxis or use personal staff vehicle (with mileage reimbursement) when a passenger car with low VKT has been downsized out of fleet.	Priority	Supportive action for downsizing low use passenger vehicles. Cost: minimal to departments; net benefit when combined with downsizing vehicles.
4. Extend the Works Yard anti-idling program to City Hall.	Priority	Supports Richmond's community-wide anti-idling initiative, demonstrating leadership. Cost: net benefit.
5. Expand driver training to include anti-idling and smarter driver reminders.	Consider	Up to a 10% reduction in emissions[62] from driving when combined with anti-idling and maintenance. Cost: Additional staff training time; benefit in the fuel savings from improved fuel economy in vehicles.
6. Corporate car share program, e.g. with Modo.	Consider	Reduces the need for passenger cars in Fleet, enabling downsizing and freeing resources for other service provision. Cost: Net benefit in reduced replacement costs, fuel and maintenance savings.
7. Sustainable Commute: offer staff transit passes as an employee benefit	Consider	Demonstrates leadership, reduces community GHG emissions, and enhances employee satisfaction.
Maintenance and Management, Monitoring and Reporting		
8. Right-sizing: Align vehicles for best use on an annual basis, based on VKT, GPS data and vehicle use assessment.	Priority	Fuel cost savings are maximized when higher capital green fleet vehicles are assigned to users with the highest VKT. Passenger car fuel savings of up to 18% may be possible, with a targeted overall GHG reduction of 1%. Cost: net benefit.
9. Systematize preventive vehicle maintenance with the new Faster Asset management software.	Priority	Regularly scheduled vehicle maintenance saves fuel, ensures worker safety and prolongs vehicle life. Use of the Faster Asset software will ensure reduce vehicle downtime and ensure continued service excellence. **Targeted GHG reduction of 5%, including anti-idling and smarter driving.**

[62] 10% is a conservative estimate, based on the 5%-33% range of potential reductions.

Attachment 2

Green Fleet Action Plan (cont'd)

Action plan for the future

		Cost: moderate outlay for long-term net benefits, will accrue savings over time through improved fleet performance.
10. Monitor and report on VKT annually for all vehicles. Consider tracking operating hours for equipment and truck idling.	Priority	Supports right-sizing and downsizing of existing assets. Mandatory requirement for E3 Fleet review and rating. Cost: minimal once systems are in place.
11. Monitor and report on Sustainable Green Fleet actions, including an annual Green Fleet report on number of Green Fleet assets, overall fleet emissions, and other successes such as solar panel installs, EV kilometres, etc.	Priority	Demonstrates leadership and builds departmental support for Green Fleet actions and targets. Cost: moderate, with need for dedicated human resource time.
12. Join the E3 Fleet Program, use the E3 Fleet Review to update the Green Fleet Action Plan, and obtain an E3 Rating.	Priority	Use the E3 Review to update Fleet actions; improve overall fleet efficiency; obtain an E3 Fleet Rating.
13. Provide a monthly fuel use report to all departments using fleet vehicles.	Consider	Supports departments in managing their use of fleet assets.
14. Integrate GHG measurement tools with asset management software.	In process	Assures monitoring and reporting on Fleet emissions performance. Cost: minimal.
15. Make fuel costs transparent to Departments in their leasing rates.	Consider	Provides an incentive for departments to reduce fuel use.
16. Provide additional human resources to Fleet during current critical renewal period.	Consider	Ensure implementation of sustainable actions during current renewal cycle. Cost: moderate outlay for long-term net benefits.
Efficient Resource Use		
17. Continue best-in-class fuel-efficient vehicle procurement, *with a focus on light-duty trucks*. Replace older passenger cars with best-in-class compact vehicles for low VKT users.	Priority	**Targeted overall GHG reduction of 4.5%.** Cost: benefit, with no price premium on replacement vehicles and on-going fuel savings.
18. Reduce idling through better vehicle technology: continue the replacement of truck, van and SUV emergency lights with LEDs and auxiliary batteries; use solar panels where possible to run safety lights.	Priority	Supports anti-idling program. By 2020, 100% of vehicles that idle to run emergency lights should be outfitted with LED lights and auxiliary batteries. Older trucks that cannot convert to auxiliary batteries will be retired. Cost: minimal to moderate.
19. Add GPS units to vehicles to aid in route optimization, best use of	Priority	GPS units support improved fleet management and demand side management,

Attachment 2

Green Fleet Action Plan (cont'd)

vehicles, and data collection.		ensuring fuel and GHG reductions from other actions. Cost: moderate.
Alternative Fuels		
20. Alternative fuel vehicle procurement: purchase EV passenger cars for high annual VKT use. Procure hybrid light-duty trucks for uses not met by best-in-class conventional. Monitor price premiums and increase purchase of EVs and plug-in hybrids as price differential drops.	Priority	Fully battery electric vehicles have zero tailpipe emissions. Up to 5% additional modeled reductions in fleet emissions with high rates of EV and hybrid adoption in light-duty vehicles including trucks. **Targeted overall GHG reduction of 2.5%.** Cost: Moderate to significant. Upfront capital costs should have payback periods of less than 10 years if vehicles are best matched to use such as high VKT.[63] Net benefit once payback has been achieved.[64] Additional infrastructure costs: minimal to moderate as Level 2 charging stations are in place. Additional charging infrastructure may be required with additional vehicle acquisition.
21. Monitor emerging technologies in plug-in hybrid trucks, and adopt *plug-in hybrid* purchasing policies for light duty trucks as soon as the technology is market-ready.	Consider	Aim to have 10% of light-duty truck procurements plug-in hybrid or EV by 2017. Cost: Price differential for EV trucks means that they should be assigned to high usage to ensure payback through fuel cost savings.
22. Pursue procurement of diesel-electric hybrids for medium and heavy-duty trucks and buses as the technology matures and becomes market-ready.	Consider	No cost to monitor and assess.
23. Monitor and assess emerging technologies, particularly compressed natural gas vehicles. Depending on trends, pursue a feasibility study for establishing an alternative vehicles program that would shift medium and heavy-duty vehicles to compressed natural gas (CNG).	Consider	GHG reductions from NG vehicles may be as high as 25%, but depend on vehicle type and driving cycle. Full life cycle emissions are also impacted by upstream production and distribution emissions. Cost: Significant. Significant vehicle premiums and additional fuelling and vehicle maintenance infrastructure required. Public fueling infrastructure minimally available.

[63] Note that these costs will change over time, and should be re-assessed as the price differential between conventional and hybrid/EV vehicles changes and fuel prices change.

[64] EV fuelling costs are estimated at 10% of gasoline/diesel. Fraser Basin Council, E3 Fleet, *The Business Case for Reducing Your Carbon Footprint*, presented at Truxpo, September 21, 2012. http://www.e3fleet.com/_Library/docs/E3_Fleet_-_Truxpo_Workshop_Sept_2012.pdf

Attachment 2

Green Fleet Action Plan (cont'd)

24. Monitor the advances in biodiesel fuels and consider switching to a higher biodiesel blend when full life-cycle emissions reductions are assured.	Consider	The GHG benefit of biodiesel is in the full life-cycle of the fuel, with estimated savings of 18% for biodiesel20.[65] Cost: significant incremental fuel costs.[66]

4.2.1 Demand side management

Demand side management generally provides low-cost fuel and GHG savings through sustainable operational and behavioural choices that reduce the need for VKT or hours of operation. Demand side actions can reduce the need to increase the number of assets and enable downsizing of some vehicles out of fleet. DSM offers some of the most cost-effective ways to reduce fuel use.

Priority	1. Reduce growth in assets and downsize vehicles through management practices and as a result of additional demand side actions.[67]

This action has two components: reducing growth in assets and downsizing under-utilized vehicles. This action is possible with a commitment to demand side management actions, including Actions 2, 3 and 6 such as car share, trip elimination, taxis and transit tickets.

Feasibility of implementation: medium to high

As shown in Figure 14, projected emissions for 2020 include an increase of 16% over 2010 from the growth in assets (shown in light blue), assuming a 2% growth in assets per year.

Reducing or eliminating the demand for additional vehicles and equipment could therefore save fuel costs and greenhouse gas emissions. Reducing the demand for new assets also saves procurement and maintenance costs to fleet and departments. These monies could be re-allocated for other uses, such as ongoing purchase of best-in-class technology for replacement vehicles and equipment.

[65] Ibid. Note that current B.C. government methodologies include biodiesel emissions in the inventory for reporting.

[66] Ibid.

[67] Downsizing is the process of removing under-utilized vehicles and equipment from service.

Attachment 2

Green Fleet Action Plan (cont'd)

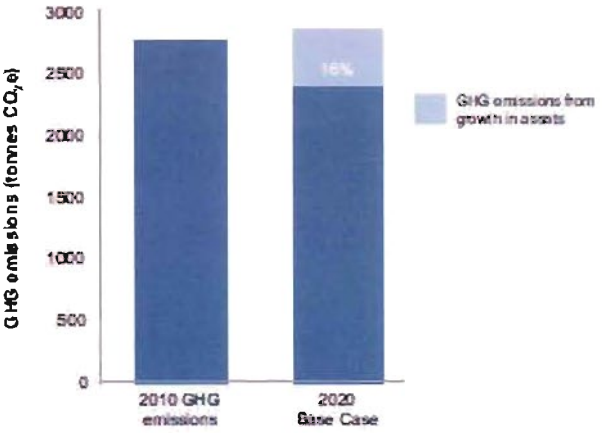

Figure 14. Projected 2020 emissions showing increase from new asset growth

Note: Shown as a percentage of 2010 emissions

As well as reducing growth in assets, a downsizing assessment should be included as part of vehicle replacement assessment, based on annual VKT and user needs. Downsizing could also be instituted on an annual basis, with an annual review of VKT and fuel use to monitor and re-assign or down-size vehicles with low usage. These vehicles represent assets that cost money to maintain.

Specifically consider downsizing passenger cars that have under 5000 km of use per year: in 2010, up to 30% of passenger cars drove fewer than 5000km. These could be replaced by car share vehicles (Action 6), using public transit, taxis, and eliminating trips with IT (Actions 2 and 3). Downsizing saves on replacement costs and removes the maintenance management of these assets from Fleet.

The number of vehicles/equipment removed from service without replacement should be tracked and reported as part of the annual Green Fleet report.

Pragmatic GHG target: 7.0% from reducing growth and down-sizing, supported by other DSM actions.

Given that Richmond is a growing city, and that some vehicles may have low VKT yet serve necessary functions, the recommended pragmatic target from reducing assets and down-sizing is 7.0%. This can be achieved by holding growth in assets to 1% annually and downsizing some under-utilized vehicles. The other demand side management actions also support reaching the 7% DSM target.

Cost implications: net benefit. This action reduces the future load on the Vehicle Replacement Reserve Fund as well as maintenance demands. It will help to ensure the long-term viability of the replacement reserve, as well as reduce overall GHGs. This action frees Fleet resources from under-utilized assets to better provide other services.

Attachment 2

Green Fleet Action Plan (cont'd)

Priority	2. Consolidate and eliminate trips by employees across the departments.

Consolidate and eliminate trips by employees across the departments through:

- Information Technology (IT) for meetings. Expand the virtual meeting network (OCS or optical communication system) to connect the Works Yard and City Hall. Provide instant messaging, virtual whiteboards, and possibly an avatar system or "bridge technology"
- Use of IT to assess sites for planning and development. Some site assessment could be done virtually, e.g. using Streetview.
- Continued route optimization. Consider requiring a route optimization plan with any new vehicle request, and when vehicles are being replaced, if applicable.

Feasibility of implementation: high

Pilot programs have already been instituted for virtual meetings; route optimization has been undertaken by several departments.

Priority	3. Increase employee public transit use for off-site meetings.

Reduce the number of trips taken in fleet vehicles by encouraging employee use of public transit for meetings by providing bus tickets. For example, the Transportation Division currently has one- and two-zone FareSaver tickets available for staff to use, which is particularly convenient for off-site meetings at YVR or TransLink (Metrotown).

Feasibility of implementation: high

Cost: Each division would set aside funding within its budget.

Priority	4. Extend the Works Yard anti-idling program.

This action would extend the Works Yard anti-idling program to City Hall. It would demonstrate leadership on the new community-wide anti-idling Bylaw. Staff have suggested that more anti-idling signs in vehicles would support the current and expanded anti-idling programs.

Feasibility of implementation: high

Cost: net benefit. In addition to increased fuel use, idling increases wear and tear on vehicles, leading to increased maintenance costs.[68]

Consider	5. Expand the driver-training program to include "smart air conditioning", anti-idling and smarter-driver reminders.

Current driver training reaches new Fleet drivers. This Action proposes to develop short Smarter Driver training modules for existing Fleet drivers on an annual or bi-annual basis. Having follow-up training will help to reinforce the smarter techniques and anti-idling initiatives. Driver

[68] Increased maintenance can be as high as $2000/year/vehicle, according to the American Trucking Association. In City of Hamilton, *Green Fleet Implementation Plan, Phase 2, Appendix B* (2009), 23.

Attachment 2

Green Fleet Action Plan (cont'd)

training could also include introductions to new technology such as LED lights and auxiliary batteries.

Estimates of smarter driving fuel reductions range from 5-33%, with conservative estimates of 5-10%.[69] As Richmond already has these programs in place, additional gains are likely to be at the lower end. This action has been bundled with anti-idling and preventive maintenance for a pragmatic target of 5%.

Feasibility of implementation: medium

Other Departments have a role to play as well. For anti-idling and smarter driving, staff suggested that peer-to-peer learning and sharing within departments in order to encourage anti-idling and smarter driver uptake should be undertaken.

Priority	6. Corporate car share program, e.g. with Modo.

Replace low-use passenger vehicles at the City Hall location with car share vehicles that are owned and operated by a car share company. The vehicles would be available for staff use during the day, and public use during evenings and on weekends.

Feasibility of implementation: medium

The City of Vancouver has a car share program with the car-share Modo.[70] Modo is currently expanding its services to Richmond. A potential barrier to be aware of is that some people may not want to relinquish their cars and switch to Modo, even if their actual vehicle utilization is low.

Consider	7. Sustainable Commute: offer staff transit passes as employee benefit

In addition to the carpool program, consider enrolling the City in TransLink's Employer Pass Program, which provides a 15% discount on monthly transit passes, and increasing the discount to staff as part of their benefits package.

Feasibility of implementation: medium

TransLink currently requires a minimum of 25 participants to commit for one full year. To date, the City has not been able to sign up enough staff. However, TransLink is considering modifying the enrollment policies following the implementation of its Compass card in Fall 2013.

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[69] 33% - Shell Canada, "Smarter Driver Challenge." http://www.shell.ca/home/content/can-en/environment_society/driving_challenge/; 30% - Fleet Challenge Ontario, *Municipal Green Fleet Management in Ontario Best Practices Manual* (2008). http://www.fleetchallenge.ca/pdfnew/FCOntario_MuncipalBestPracticesManual2008.pdf; 5-10% - City of Hamilton, *Green Fleet Implementation Plan Phase 2*, Report to Public Works Committee, April 14, 2009. http://www.hamilton.ca/NR/rdonlyres/BB12D808-A593-47F5-BB56-E197D3A1EB4F/0/May04PW03147c.pdf

[70] Modo is a car-share co-operative based in Vancouver, part of the provincial network of car sharing cooperatives. http://www.modo.coop/

Attachment 2

Green Fleet Action Plan (cont'd)

4.2.2 Maintenance and management, monitoring and reporting

Priority	8. Right-size and best use: align vehicles for best use on an annual basis, based on VKT, GPS data and vehicle use assessment.

Right-sizing is the process of evaluating vehicles and equipment uses, and matching the vehicles to the duties performed. Right-sizing needs to occur at the time of replacement so that the replacement vehicle fits the job. Right-sizing should also be assessed as on an on-going basis for existing assets.

Feasibility of implementation: high

Right-sizing continues Fleet's current practice of matching vehicle and user needs at time of replacement. Best use of vehicles includes assigning the appropriate vehicles by VKT in order to maximize fuel savings. This practice is particularly important with the addition of a variety of vehicle fuel types, including the conventional, best-in-class, hybrid and electric vehicles that now make up Fleet assets.

For example, in passenger cars, it saves money to match the vehicle use (VKT) to the vehicle efficiency. Of three passenger cars driving over 30,000 km in 2010, one was a hybrid that used 1849 litres of fuel. Two older vehicles each used over 3150 litres of fuel to drive fewer kilometres. The cost savings in using hybrids to drive those kilometres would have been $2600:[71] lower economy vehicles should be re-assigned to low-VKT users. Re-assigning passenger cars based on best use could provide fuel savings of up to 18% of total passenger car fuel use.[72] This would result in a 0.5% reduction in overall fleet emissions.

Actively using data in fleet management, such as annual VKT and vehicle fuel economy, supports the best use of existing vehicles that can provide significant fuel savings. This action will require re-assigning passenger cars and light-duty trucks, so it may need buy-in from vehicle users.

Pragmatic GHG target: 1.0% of overall fleet emissions from right-sizing

Cost implications: There is a net benefit to this action through fuel savings.

Priority	9. Systematize preventive vehicle maintenance with the new Faster Asset management software.

Feasibility of implementation: high

Regular maintenance reduces long-term and unexpected maintenance costs, improves fuel efficiency and reduces tailpipe emissions of both greenhouse gases and local air pollutants. Reliable vehicles also ensure worker safety and service excellence. The new Faster Asset management system will improve preventive maintenance scheduling for fleet vehicles.

[71] At $1.02/litre, the average cost of fuel in 2010 for Richmond fleet.

[72] Based on an assessment of available 2010 VKT data for passenger cars.

Attachment 2

Green Fleet Action Plan (cont'd)

Pragmatic GHG target: 5.0% from a combination of anti-idling, smarter driving, and systematic preventive maintenance

Cost implications: this action has a net benefit as it prevents breakdowns and reduces fuel costs by maintaining fuel economy standards.

Priority	10. Monitor/track and report on vehicle kilometres travelled (VKT) for all fleet vehicles. Consider tracking hours in operation.

Sound vehicle performance data supports fleet management, including identifying under-utilized vehicles and poorly performing vehicles.[73] It can also help identify areas where driver behaviour could be a factor in vehicle performance, and it is essential to maximizing the benefits of fuel-efficient vehicles such as EV's.

Tracking VKT is required for E3 Fleet review and rating, and will improve future monitoring and measuring of green fleet actions. In addition to collecting VKT and fuel use, Richmond should consider tracking hours of operation for equipment and vehicles that idle for work purposes.

Feasibility of implementation: high

Cost implications: Fleet is implementing an improved VKT tracking system, using the current fuel management hardware and software. Measuring hours of operation for equipment could require additional staff resources in order to implement.

Priority	11. Monitor and report on Sustainable Green Fleet actions and showcase these actions with an annual web report.

This action proposes to report on actions on an annual basis, including the Green Fleet Asset inventory, with the number of hybrid vehicles, plug-in hybrids and electric vehicles by mode; number of trucks with LED lights and auxiliary batteries; and other innovations such as the solar-powered trailers.

A Green Fleet report on the Fleet website showcasing Green Fleet actions annually could also highlight demand side management actions, and celebrate actions taken by specific departments and individuals.

Feasibility of implementation: medium to high

Priority	12. Join the E3 Fleet Program, use the E3 Fleet Review to update the Green Fleet Action Plan, and obtain an E3 Rating.

The Fraser Basin Council's E3 Fleet review and rating program provides action recommendations based on a Fleet review and data analysis. The program also gives Green Fleet

[73] Fraser Basin Council, *The Business Case for Reducing Your Carbon Footprint.*

Attachment 2

Green Fleet Action Plan (cont'd)

ratings. Richmond requires at least one year of complete VKT data for all on-road vehicles in order to join the program. Rating requires two comparable years of data that show an overall efficiency improvement in the fleet.

Feasibility of implementation: high

The Green Fleet Action Plan should provide Richmond with actions that improve the overall efficiency of its vehicles. Richmond is currently collecting VKT data for all vehicles in order to join the E3 Fleet program. The E3 Fleet Review will provide additional actions or action prioritization in order to achieve an overall efficiency improvement in Fleet vehicles.

Consider	13. Provide a monthly fuel use report to all departments using Fleet vehicles.

Departments could use the reports to monitor fuel use and implement departmental actions to save fuel and costs. The current fuel management system can email automated fuel use reports by vehicle to Departmental managers.

Feasibility of implementation: high

In process	14. Implement the recommendations on embedding GHG emissions tracking within fleet management systems.

The recommendations are detailed in Appendix B. This Action is currently in progress, and will allow Fleet to monitor and report on its GHG emissions in future years through reports from the Faster Asset Management software system. This should make monitoring and reporting cost-effective with minimal staff time required. It will enable Fleet to generate its own reports as needed to support Sustainable Green Fleet actions.

Feasibility of implementation: high

Consider	15. Make fuel costs transparent to Departments in their leasing rates.

This action would support departments in being more directly responsible and accountable for their fuel use. Currently, fuel costs are paid by Fleet, and included as a component of the monthly vehicle rate charged to departments. Monthly rates are calculated on an annual basis, and include purchase and salvage values, vehicle life expectancy, overhead, annual maintenance, annual fuel use (based on the previous year), and annual insurance. Fuel use is therefore only one of several factors that go into the monthly leasing rate formula, and is not visibly reflected in the monthly rate in a transparent manner.

This action proposes to include the percent of the monthly rate charge that is based on fuel. Departments that reduce their fuel use on an annual basis would see a reduction in the fuel component of the monthly rate when calculated for the following year.

This action would provide a financial incentive for departments to reduce fuel usage. Action 13– providing fuel use reports on a monthly basis to Departments – would allow them to monitor fuel use and take corrective action as needed throughout the year.

Attachment 2

Green Fleet Action Plan (cont'd)

Feasibility of implementation: medium

This action requires a change in practice not only within Fleet, but also across Departments. It should be considered as part of a longer-term change in Fleet and Departmental management practices to actively reduce costs.

Consider	16. Provide additional human resources to Fleet during current critical renewal period.

Provide additional resources to fleet for the implementation and ongoing use of the asset management software and support for green fleet policy during the current cycle of fleet renewal and the preparation of annual action tracking reports.

Feasibility of implementation: high

4.2.3 Efficient resource use

Priority	17. Continue to purchase best-in-class fuel-efficient conventional vehicles as per the Sustainable Green Fleet policy, *with a focus on light-duty trucks and vans*. Replace older passenger cars with best-in-class compact vehicles for low VKT users.

This action ensures that vehicles purchased now have the best possible fuel economy for their class, as they will still be in service in 2020.

There are two key areas for this action: the extension to light-duty trucks, and the replacement of low-VKT passenger cars with best-in-class compact vehicles (when not downsized). Light-duty trucks, SUVs and vans represent over one-third of fleet emissions, with over 150 vehicles in use. Reducing their emissions through fuel-efficient procurement is a key part of a sustainable green fleet.

Low-VKT vehicles (under 10,000km/year) represent over 50% of passenger cars. Their low annual fuel use does not justify the higher premium required for a hybrid or electric car. Fuel-efficient compact cars have low purchase costs and straightforward maintenance. Replacing the low-VKT passenger cars with fuel efficient, compact vehicles could save up to 15% of passenger car fuel annually,[74] provided the fuel economy of the new vehicles is under 8L/100km for city driving.

The number of vehicles replaced by smaller, more efficient vehicles should be tracked and reported as part of annual Green Fleet reporting. Note that current hybrids in Fleet should be replaced with hybrids or equivalent vehicles that meet or exceed their efficiency.

Feasibility of implementation: medium to high

Fleet is in a major replacement cycle, with over 50% of fleet assets due for replacement between 2012 and 2016. Fleet renewal presents a significant opportunity to take advantage of new

[74] Based on an assessment of 2010 passenger car VKT.

Attachment 2

Green Fleet Action Plan (cont'd)

technological innovations in fuel economy through the purchase of best-in-class vehicles. Fuel economy should be included in tender specifications.[75]

Implementation challenges include:

- Requires a cultural shift for workers accustomed to larger light-duty trucks or larger passenger cars.
- Not all trucks may be able to be switched out due to performance requirements.
- Not all dealerships respond to tenders, so that securing the best-in-class vehicles is not always possible.
- There may be a cost premium for some fuel-efficient vehicles, although best-in-class compact passenger vehicles have comparatively low purchase costs.
- Operational requirements dictate need, including outfitting requirements and auxiliary equipment.

Modelling shows that up to a 9% reduction in GHGs can be achieved by best-in-class replacement by 2020 (Appendix A.4). However, achieving the full reduction assumes that all passenger cars replacements are best-in-class: a Chevy Cavalier would be replaced by a vehicle such as a Ford Focus or a Mazda 3, with a 20–30% fuel economy improvement over the older vehicles in fleet.[76] All light-duty truck replacements as well as new vehicles would be best-in-class light-duty trucks (e.g. Toyota Tacoma or the Ford Transit Connect van). Procurement of medium-duty trucks and buses, heavy-duty trucks, and equipment would remain the same as for the base case.

Given that not all light-duty vehicles can be replaced by compact, best-in-class trucks and passenger cars due to operational requirements, the targeted GHG reduction from this action is 4.5%.

Pragmatic GHG reduction from best-in-class: 4.5% GHG reduction

Cost implications. This action should result in a net benefit, as compact, fuel-efficient vehicles tend to have lower purchase costs than larger vehicles and they have standard maintenance requirements.

[75] NRCAN's fuel economy ratings for vehicles can be found at http://oee.nrcan.gc.ca/transportation/tools/fuelratings/ratings-search.cfm.

[76] A 2001 Chevy Cavalier replaced by a Mazda 3 in 2011 has a 20% improvement, while the same replacement in 2012 provides a 31% improvement. Annual improvements after that are reduced, because these efficiency gains have already captured in the gains projected by new standards. There are a number of internal combustion engine vehicles available in 2013 that have similar fuel economy (under 8L/100km for city and under 6L/100km for highway), such as the Ford Focus, the Honda Fit and Civic, the Toyota Yaris, the Chevrolet Sonic and the Chevrolet Cruze Eco.

Attachment 2

Green Fleet Action Plan (cont'd)

Transit Connect as a best-in-class option

The Transit Connect is a good example of Efficient Resource Use in action. The Ford Transit Connect Van is an ecoEnergy 2012 and 2013 winner in the Large Van category,[77] with a combined fuel economy of 8.9L/100km. Average fuel economy in Natural Resources Large Van category is 17.7L/100km.[78] In Richmond, the Transit Connect vans provide service excellence – they are in demand by departments – and they provide excellent carrying and storage capacity. Their purchase costs are competitive, supporting fiscal prudence. On-going maintenance is straightforward.

Priority	18. Reduce idling through better vehicle technology: continue the replacement of truck, van and SUV emergency lights with LEDs and auxiliary batteries; use solar panels where possible to run safety lights.

This action continues the Works Yard program of LED light replacement and auxiliary battery installs. It also recommends continuing innovation in the Fleet Yard, such as solar panels for safety lights on trailers. These actions should be included in annual Green Fleet reports.

Feasibility of implementation: high

Implementation challenges are more likely to involve the user. They include:

- Short trip durations are not adequate for full auxiliary battery recharge. Work crews may need to charge batteries at a charging station at the yard as necessary.
- Drivers do not trust the LEDs and auxiliary batteries to not deplete their main battery, so may continue to idle vehicles. A supporting action would be to include information about LEDs, auxiliary batteries, idling, and battery charging as part of driver training. In addition, a sticker saying that the truck has an auxiliary battery to run the lights could be added to truck dashboards, alongside the anti-idling program material.
- In addition, there may be additional maintenance costs as the continued start/stop of vehicles can impact the starters.

Priority	19. Add GPS units to vehicles to aid in route optimization, best use of vehicles, and data collection.

GPS units support improved fleet management and demand side management, ensuring fuel and GHG reductions from other actions. Specifically, GPS units support efficient dispatching of vehicles and improved response times, reducing VKT and ensuring service excellence. They support staff safety and also provide data for liability claims.

Feasibility of implementation: high

[77] Natural Resources Canada, "2013 ecoENERGY for Vehicles Awards," Backgrounder, February 14, 2013. http://www.nrcan.gc.ca/media-room/news-release/2013/6844http://www.nrcan.gc.ca/media-room/news-release/2013/6844

[78] Based on 2013 fuel economy data for Large Vans: http://oee.nrcan.gc.ca/transportation/tools/fuelratings/ratings-search.cfm.

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Green Fleet Action Plan (cont'd)

Fleet is currently planning to pilot GPS units in route-driving vehicles such as bylaw cars and vans and litter pickup trucks, as well as dump trucks, snow response units, and Recreation vans and buses.

4.2.4 Alternative fuels

Priority	20. Alternative fuel vehicle procurement: purchase EV passenger cars for high annual VKT use. Procure hybrid light-duty trucks for uses not met by best-in-class conventional.

This action substitutes low-carbon B.C. grid electricity for gas and diesel as part of Fleet's fuel mix. Fuel, cost and GHG savings are maximized when green fleet vehicles, e.g. electric, hybrid and Smart Car vehicles drive the most kilometres: vehicles need to be assigned to high annual VKT users whose daily use patterns bests match the range of the vehicle.

Fleet has purchased hybrid cars for several years, and has also begun to purchase electric cars. This action proposes a continuation of Fleet's commitment to hybrid and EV purchases, with the addition of a gradual increase in hybrid and electric light-duty truck procurement.

For light-duty trucks, hybrid options should be considered when conventional best-in-class trucks and vans do not meet specific needs. For example, the 2013 Chevy Silverado hybrid has similar fuel economy to the best-in-class Toyota Tacoma or Ford Transit Connect, and may meet other user requirements. More hybrids will be available in the light-duty truck category in the coming years.

Feasibility of implementation: medium to high

Pragmatic GHG target: 2.5% reduction from EV and plug-in hybrids.

Replacing conventional vehicles with EV's and hybrids for Fleet's passenger cars and light-duty trucks could achieve a modeled 5% GHG reduction over the best-in-class scenario. The modelling assumes a "best case" scenario with high rates of car and truck hybrid and EV procurement, particularly after 2016 when it is assumed that light-duty hybrids and electric trucks will be widely market-ready.[79] Medium and heavy-duty truck procurement would remain the same as for the base case scenario, as would equipment procurement.

The targeted GHG reduction for this action is set at half the modeled potential, or 2.5% for fleet overall. This is a realistic target considering the market-readiness of EV and plug-in hybrid light-duty trucks, that EV's are not suited for all operational needs, and the current price differential.

Should the price differential between EV's and conventional vehicles drop, EV's would be a better choice for more vehicles, saving Fleet more in fuel costs and additional GHGs. Particularly as more light-duty electric or plug-in hybrid trucks become available, the pragmatic target could be revised upwards.

[79] See Appendix A.4 for details on the vehicle mix for this scenario.

Attachment 2

Green Fleet Action Plan (cont'd)

Role in Fleet

Given the price differential (see cost assessments and payback periods, below), electric vehicles (including fully electric and plug-in hybrid) have two specific roles to play within fleet. First, they should be used for higher VKT uses that ensure a payback and provide the greatest GHG reductions, with best-in-class conventional passenger cars assigned to lower VKT uses.

Second, and as noted under Current Actions, the leadership demonstrated by Richmond's electric vehicles should not be under-stated. Vehicle emissions are a significant proportion of community GHGs, and electric vehicles are one important strategy to reduce them. Ensuring high visibility of Richmond's EV's and charging stations will support plug-in and fully electric vehicle adoption rates in the broader community.

Cost assessments and payback periods

At this time, hybrid and electric vehicles carry a higher one-time acquisition cost, currently about $20,000 per vehicle,[80] even though they provide operational savings in fuel consumption. BC Hydro has estimated this at $1200/year for average BC annual driving distances.[81] Including lifetime fuel costs to determine the best purchase from a financial perspective is important.

However, annual fuel savings will depend on vehicle utilization rates. With fully electric vehicles (battery electric vehicles, or BEVs), the higher the daily utilization, the greater the savings and the shorter the payback period. For plug-in hybrids (PHEVs), maximum returns on investment through fuel savings are achieved by maximizing the electric driving.[82] The new GPS units on some vehicles will enable better matching of vehicle to daily use patterns.

In the meantime, as a general rule-of-thumb, plug-in hybrids or PHEV's, with a lower electric range than fully battery-electric EVs, should be assigned to vehicles driving at least 10,000km/year. Vehicles driving 10,000-15,000km/year are good candidates for replacement by the Volt, which should be able to provide most of the daily driving on electricity alone.[83] BEV's, with a larger range, should be assigned to higher mileage uses, with hybrids or Smart Cars reserved for the highest annual VKT users.

In 2010, six of Fleet's passenger cars drove 15,000 to 25,000 km, accounting for approximately 25% of the fuel used by passenger cars.[84] These vehicles are good candidates for electric replacement, depending on daily use pattern.[85] If these six vehicles were replaced by EV's, the

[80] Based on procurement costing data from Richmond for the Nissan Leaf, Chevy Volt, and conventional Chevrolet 200 sedan.

[81] Tsang, "Identifying PEV Early Adopters and Their Needs."

[82] Fleet Carma webinar, "How to get the most out of plugging in," April 2013. http://www.fleetcarma.com/en/Resources/Webinars

[83] These numbers are provided for general reference only, and need to be compared to actual daily use distances, as well as measured vehicle performance once it is in use. For EVs, heating and cooling as well as driver behaviour affect the distance available on a single-charge.

[84] Based on assessment of 72% of passenger car VKT data for 2010.

[85] Based on 254 working days a year, a car driving 25,000 km/year would drive an average of 98 km/day, which is within the range of the Leaf.

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Green Fleet Action Plan (cont'd)

fuel savings would be on the order of 15,000L per year.[86] Vehicles driving over 25,000 km year are good candidates for fuel efficient hybrids.[87]

Actual driving distances and fuel savings should be monitored in the EV's as payback periods for electric vehicles will become clearer as more vehicles are in use and monitored. One study estimates the payback period to be 2.6 years, with 40 km of daily driving, a price premium of $10,000 and an incentive of $7500[88] (note that B.C. incentives are available at $2500 to $5000 per vehicle). After this period, the fuel savings accrue to fleet, provided that utilization rates remain high over the life of the vehicle.

Implementation challenges

- Hybrid and electric vehicle maintenance is handled by the dealership while the vehicle is under warranty. Afterwards, maintenance becomes the responsibility of Fleet, and in-depth training programs on hybrid and EV technology are not currently available to non-dealership mechanics locally.[89]
- Hybrid and electric vehicles are not best suited to all tasks and work demands. While a rough guide has been provided here based on annual VKT, consider using emerging hardware/software systems such as Fleet Carma to monitor current vehicle use and match specific EV, hybrid, or fuel-efficient combustion engine to daily driving patterns, in addition to the new GPS systems.[90]
- Range anxiety may result in less EV utilization, and users may forget to plug in at the end of the day.
- If more vehicles are purchased, and to ensure full charges for daily driving, more charging stations may need to be installed in the future. These carry a moderate infrastructure cost (generally under $20,000/station).

Consider	21. Monitor emerging technologies in plug-in hybrid trucks, and adopt *plug-in hybrid* purchasing policies for light-duty trucks as soon as the technology is market-ready.

Feasibility of implementation: medium

This action relies on market-readiness of emerging technologies.

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[86] And a cost savings of approximately $10,000, assuming a cost savings of 7.2 cents/L, based on electricity at 6.8 cents/kWh and gasoline at $1.09/L (Tsang, "Identifying PEV Early Adopters and Their Needs.").

[87] If daily usage is occasionally very high and sometimes low, then a standard hybrid would be a better choice. If daily use falls within the EV range, the Leaf is a good choice; for daily use that marginally exceeds range, an EV can still be used if a top-up charge during the day can be scheduled.

[88] Additional assumptions: electricity rate of 10c/kWh and gas price of $1.36. (Fleet Carma webinar, "How to get the most out of plugging in.")

[89] The City of Hamilton has provided hybrid maintenance training to other municipal fleets in the past. Hamilton Information Update. August 15, 2006. Green Fleet Implementation Program, 2.

[90] For an example, see the Fleet Carma system http://www.fleetcarma.com/.

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Green Fleet Action Plan (cont'd)

Consider	22. Pursue procurement of diesel-electric hybrids for medium and heavy-duty trucks and buses as the technology matures and becomes market-ready.

Medium and heavy-duty trucks currently represent over a third of fleet's emissions. Moving to a low-carbon fuel source would help reduce emissions.

Feasibility of implementation: medium

This action relies on market-readiness of emerging technologies.

Consider	23. Monitor and assess emerging alternative fuel vehicles, particularly compressed natural gas vehicles and, depending on trends, pursue a feasibility study for establishing an alternative vehicles program that would shift medium and heavy-duty vehicles to compressed natural gas (CNG).

This action does not recommend switching to CNG vehicles at this time. Rather it proposes to first monitor results from Toronto, Vancouver, Surrey,[91] and others who have adopted natural gas vehicles in order to assess performance, operational issues, GHG savings and fuel savings. Second, collect comprehensive VKT and operating hours data on medium and heavy-duty fleet vehicles in Richmond to provide full inventory data and aid in a feasibility assessment. Third, depending on trends and available data, conduct a feasibility assessment on the transition to CNG vehicles, including specific infrastructure requirements (both fuelling and maintenance), payback potential, and assessing fleet inventory for NG vehicle potential.

CNG vehicles are not appropriate for all uses. Currently, CNG vehicles are most commonly used in three main fleet applications: buses,[92] couriers/delivery, and garbage trucks/waste haulers.[93] Richmond contracts out its waste management services, so the largest potential group of fleet vehicles is not directly under corporate control. Richmond could discuss the option of conversion to CNG with its waste management contractors and include this in the feasibility study.

Potential GHG Reduction

Compressed natural gas vehicles may provide tailpipe GHG savings of approximately 25%,[94] although vehicle type and driving cycles may significantly impact emissions, reducing the

[91] The City of Surrey's curbside waste collection fleet is using CNG trucks with a plan to power them using biogas from a new organic waste biogas facility; assuming the CNG trucks have 24% fewer GHG emissions than diesel trucks, the renewable gas will reduce 100% of waste collection emissions and offset the City's corporate emissions. "City of Surrey Approach to a Fully Integrated Organic Waste Management System." PCP National Measures Report, webinar, June 27, 2013. http://www.fcm.ca/Documents/presentations/2012/webinars/PCP_City_of_Surrey_Approach_to_a_Fully_Integrated_Organic_Waste_Management_System_EN.pdf.

[92] Although CNG buses are in decline across Canada, in part due to technical challenges (Conference Board of Canada, *Cheap Enough? Making the Switch from Diesel to Natural Gas* (2012), ii)

[93] MIT Energy Initiative, *The Future of Natural Gas: an interdisciplinary MIT study* (2010). http://web.mit.edu/mitei/research/studies/report-natural-gas.pdf; Fortis BC NG vehicle program: http://www.fortisbc.com/MediaCentre/NewsReleases/2013/Pages/Over-150-new-compressed-natural-gas-vehicles-to-hit-the-streets-across-BC.aspx.

[94] MIT Energy Initiative, *The Future of Natural Gas*, 50, 121.

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tailpipe benefits.[95] As well, full life-cycle savings are reduced due to methane leakage in production and distribution.[96]

Cost implications

Natural gas vehicles have 25%-50% lower fuel costs than conventional vehicles.[97] Reduced fuel costs depend on the price spread between natural gas and gasoline/diesel, as well as VKT and hours of operation. The expected payback could be 1.8 to 11.7 years.[98] Natural gas vehicles thus have an attractive payback for high mileage use, or short-range, low-mileage/gallon vehicles.[99] For example, fuel savings have been 32% for company in Ottawa, compared to gasoline, with delivery vehicles driving an average of 170km/day. Unlike Richmond, the company has a public compressed NG station across the street so they did not need to install any infrastructure.[100]

The two major barriers to CNG vehicles are vehicle price premiums and infrastructure availability and the requirement to upgrade maintenance repair shops to repair CNG vehicles. Moving to natural gas would require substantial investment in additional Works Yard infrastructure: unlike the relatively low-cost of a Level 2 EV charging station. CNG fuelling stations entail a large up-front capital cost.

In addition, vehicle price premiums (e.g. $6,000 to $50,000[101]) would need to be offset by reduced fuelling costs. In 2010, Richmond's 109 medium and heavy-duty vehicles used almost 480,000 L of fuel per year at a cost of nearly $500,000.[102] The potential cost savings of 25% suggests that CNG might have a net benefit.

However, in 2010, only four of the medium and heavy-duty vehicles used over $10,000 of fuel in one year, suggesting that the combination of vehicle price premiums and required fueling infrastructure would not have a payback within the service life of the vehicles.

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[95] D.-W. Lee, et al., "Characterization of on-road emissions of compressed natural gas and diesel refuse trucks". *Journal of the Transportation Research Board* (2011); C. Davies et al., *Assessment of GHG emissions benefits of Heavy Duty Natural Gas vehicles in the United States*. (U.S. Department of Transportation, 2005).

[96] See Ramon Alvarez et al., "Greater focus needed on methane leakage from natural gas infrastructure." *Proceedings from the National Academy of Sciences* 109 (2012)..

[97] Fraser Basin Council, *The Business Case for Reducing Your Carbon Footprint.*

[98] MIT Energy Initiative *The Future of Natural Gas*, 122.

[99] Ibid.

[100] Transport Canada, Modern Dry Cleaners - Ottawa, Ontario. *FleetSmart Profiles: Pickups, Vans and SUVs.* http://fleetsmart.nrcan.gc.ca/index.cfm?fuseaction=docs.view&id=pickup-vans-modern

[101] Price premium estimates vary. For example, an additional 60-80% is assumed for heavy-duty LNG trucks (calculated from the Conference Board of Canada. 2012. *Cheap Enough? Making the Switch from Diesel to Natural Gas*, 4.) A second study puts the cost at $50,000 per heavy-duty truck: $10,000 for the engine and $40,000 for the integration costs, including tanks (Marbek. 2010. *Study of the Opportunities for Natural Gas in the Transportation Sector*. For Natural Resources Canada).

[102] Based on 2010 fuelling data.

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Green Fleet Action Plan (cont'd)

Additional challenges include a lack of public infrastructure. The City of Hamilton, whose natural gas fleet is primarily city buses, notes that they do not have public filling station options as a back-up when there have been problems with city fuelling stations.[103]

Funding opportunity

Fortis BC has an incentive funding program that covers 75% of the incremental cost of vehicles for the next four years, should the results of monitoring and assessment suggest that there are net benefits in moving to NG vehicles in Richmond's context.[104]

Consider	24. Monitor the advances in biodiesel fuels and consider switching to a higher biodiesel blend if full life cycle GHG reductions in the fuel are assured.

This action would monitor the advances in biodiesel fuels and consider switching to a higher biodiesel blend (Biodiesel 20) when transparent reductions in the full life cycle of the fuel are certified.[105] Note that using Biodiesel 20 was not considered a high priority by staff, and one staff person voted against using Biodiesel 20 at the staff workshop. Warranty and performance/maintenance issues would need to be resolved prior to using Biodiesel 20.

The City of Toronto Green Fleet Plan notes that: *Biofuels are an important component in greening fleet operations, but cannot compare to the environmental benefits of actually reducing fuel consumption.*[106]

[103] City of Hamilton *Appendix B. Green Fleet Implementation Plan*, 36.

[104] FortisBC, "Over 150 new compressed natural gas vehicles to hit the streets across B.C.," media release, March 1, 2013. http://www.fortisbc.com/MediaCentre/NewsReleases/2013/Pages/Over-150-new-compressed-natural-gas-vehicles-to-hit-the-streets-across-BC.aspx

[105] The emissions reductions from biodiesel come from the full life cycle of the fuel, rather than the tailpipe emissions.

[106] Toronto, *Green Fleet Plan 2008-2011*, 19.

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Green Fleet Action Plan (cont'd)

5. Recommended reduction target

A variety of targets can be set for GHG reductions. Targets are generally set for a future year in comparison to a chosen baseline. They may be absolute or intensity-based. For example, the Mexico City Pact allows cities to provide CO_2e reduction targets, and/or carbon intensity, renewable energy, and energy efficiency targets.

Absolute targets can be challenging to achieve under growth conditions. However, due to increasing regulation and technological innovation, vehicle fleets can continue to grow service levels — for example, VKT or hours of operation — while still reducing fuel use and GHGs. This is shown by the historic trajectory of Richmond's growth in fleet assets, while fuel use and emissions have been held relatively constant. The challenge now is to achieve and continue a downward trend in overall fleet fuel use and emissions.

Targets may be either pragmatic or "stretch." Richmond's fleet has an opportunity to set a pragmatic target that demonstrates attainable GHG reductions. Reaching the target will require some organizational and behavioural change, improved fleet management practices, adoption of innovative technology and a shift to electricity as a fuel for some uses.

The recommended target for Richmond Fleet is a 20% reduction in absolute GHG emissions from fleet by 2020, with an annual reduction target of 2%.

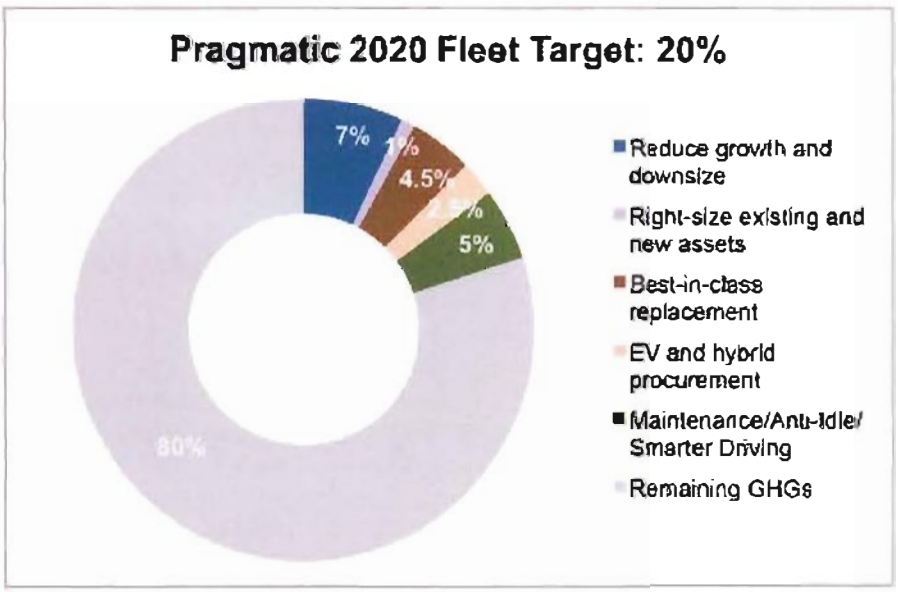

Figure 15. Pragmatic 2020 fleet target: 20% GHG reductions from 2010 baseline

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Green Fleet Action Plan (cont'd)

This target can be met through the actions outlined in Section 4. Each key area of the Green Fleet Action Plan has a quantifiable target, as shown in Table 8. These targets are supported by the full suite of priority actions outlined in Section 4.

Table 8. Summary of actions and pragmatic targets

Area	Action	GHG savings
DSM	Reduce growth and downsize	7.0%
Management	Right-size and best use	1.0%
Efficient Technology	Best-in-class replacement	4.5%
Alternative Fuels	EV procurement	2.5%
DSM+	Anti-Idle/Smart Driving/Maintenance	5.0%
Total		20.0%

For DSM, reducing growth in assets and downsizing existing vehicles saves procurement costs and fuel, and provides significant reduction in GHG emissions. These actions support fiscal prudence in fleet by reducing the financial demands on the Replacement Reserve Fund. The actions must be managed carefully in order to continue to provide service excellence, and require action on the other demand side management actions across departments, such as providing transit tickets, optimizing routes, etc.

Improvements in management practices will enhance vehicle longevity and performance. Right-sizing replacement vehicles and ensuring best use of existing passenger vehicles – and using data actively such as annual VKT – should improve overall fleet performance in fuel use and GHG emissions, reducing emissions by 1%.

Best-in-class replacement takes advantage of the new federal fuel standards for passenger cars and light-duty trucks, replacing existing assets as they age with conventional vehicles that have best-in-class fuel economy. By 2020, best-in-class vehicles should save 4.5% of Fleet's emissions.

Hybrid and electric vehicles have a role to play in Fleet as well, particularly for high VKT uses where the fuel and cost savings can be maximized. Replacing hybrids with hybrids, procuring hybrid light-duty trucks, and adding electric vehicles to the passenger vehicle mix should reduce overall GHG emissions by an additional 2.5%.

Lastly, the combination of anti-idling programs, Smarter Driving, and systematized preventive vehicle maintenance reduces fuel use and should save 5% of Fleet's overall emissions.

These actions, when supported by the larger set of actions outlined in Section 4, mean that Fleet should be able to achieve an overall target of 20% reductions in emissions by 2020. Using a baseline of 2010, this translates into an approximate reduction of 2% in GHG emissions annually. This is equivalent to the reduction in fleet emissions between 2007 and 2010, without Fire Services included.

One challenge with an annual target is the variability in fleet service requirements, such as winter with snowfall. It is therefore recommended that the annual target of 2% be tracked and reported,

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Green Fleet Action Plan (cont'd)

and a trend line established. Using three to five year trends should provide a stronger sense of overall reductions. For example, Fleet could assess its 2012 emissions, then track them annually and look for a trend in 2015. This will allow time for pathway correction if the annual targets are not being met.

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6. Recommendations

Richmond has a strong Sustainable Green Fleet Policy, and has already undertaken actions to reduce fuel consumption and conserve material and financial resources. The following recommendations will assist Richmond in continuing to make progress on reducing emissions while supporting service excellence and fiscal prudence.

Process and data management

- **Ensure systematic data tracking and reporting, particularly VKT.** Richmond has taken important steps towards systematic data tracking, including its new fuel dispensing system and its Faster Asset management software. Vehicle kilometres travelled are critical to measuring service level changes and individual vehicle and overall fleet efficiency. They will enable improved management of fleet assets that save money and make sure resources are effectively allocated.
- **Ensure tracking and reporting on Green Fleet actions and assets.** Many of the current actions are undertaken on an ad hoc basis by individual staff or departments. Increased monitoring and reporting on Green Fleet actions on an annual basis will enable ongoing measurement of success, shared learning across departments, continued green fleet achievements, and a demonstration of Richmond's leadership.
- **Ensure that GHGs are tracked and reported within Richmond's fleet management system.** Integrating GHGs into Richmond's fleet management software will facilitate ongoing assessment of the fleet, as well as facilitate the accessment and update of the Green Fleet Action Plan.
- **Reassess the fleet inventory and priority actions annually.** Revisiting the inventory and the priority actions annually will help to assess the success of the Plan, as well as help to identify new actions to reduce emissions. This assessment should include the Fleet Manager, the Sustainability Manager and fleet staff. A review of DSM actions should include appropriate Departments also.
- **Ensure that data collection, monitoring and reporting aligns with the protocols the City has chosen to report under.** The City has chosen to report its emissions under the Climate Action Charter, CARIP, the Mexico Pact, and may choose to participate in the E3 Fleet program. Each reporting protocol has different data and reporting requirements. The fleet inventories compiled for the Green Fleet Action Plan align with the current reporting protocols; however, it will be important to continually monitor the data requirements to ensure Richmond is collecting the correct data.

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Action implementation

- **Work to implement the priority actions,** with a focus on ensuring best-in-class procurement, supporting demand side management, and making fuel use visible to departments.
- **Assess the actions for consideration** to identify additional actions for implementation. Over time, new strategies may emerge as key priority actions. The E3 Fleet Review will provide an opportunity for re-assessment.
- **Consider providing additional human resources** for Fleet's significant renewal process now underway. Vehicles purchased now will still be in service in 2020; vehicle replacement provides an opportunity to build a long-term sustainable fleet through procurement of best-in-class vehicles. Additional human resources may help ensure that Fleet meets its fiscal and environmental objectives.

Target setting

- **Adopt a pragmatic target of 20% reduction in absolute GHG emissions from fleet by 2020,** based on the 2010 baseline, and a **2% annual reduction in GHGs from Fleet.** This target will motivate action and provide a way to measure progress over time.

Richmond has shown leadership in adopting new technologies such as hybrid cars and led the way in programs such as the employee carpool program. Richmond's corporate fleet has seen increased service levels since the mid-1990s in terms of the numbers of vehicles on the road, with minimal or reduced fuel use and greenhouse gas emissions, although fuel costs continue to rise. With a Green Fleet Action Plan in place, Richmond's fleet can provide ongoing, significant GHG reductions in the municipality while maintaining service excellence and ensuring fiscal prudence.

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Appendix A. Methodology and detailed data

A.1 Inventory methodology and emission factors

The emissions inventories for fleet vehicles and equipment followed the practices outlined in the B.C. Government's Methodology for Reporting B.C. Public Sector Greenhouse Gas Emissions.[107]

Emissions inventories are based on fuel use data, to which are applied various greenhouse gas emissions factors depending on the vehicle mode. For the 2010 inventory, vehicles were classified by mode and fuel type for modelling (Appendix B, Table 12 and Table 13). Vehicle fuel use was provided from Richmond's fuel management system. Fuels include gasoline, diesel from the fleet yard (biodiesel 5), and conventional diesel (i.e. Fire Services fuelling up at stations other than the Works Yard). GHG emissions were calculated using the emissions factors shown in Table 9.[108]

Emissions factors from the BC Government methodology are shown below. Methane (CH4) and nitrous oxide (N2O) are multiplied by their global warming factors of 21 and 310 respectively in order to determine the total CO_2 equivalent emissions in kg/L.

Table 9. Greenhouse gas emission factors for vehicle modes and fuels.

Vehicle Mode[109]	Fuels	Emissions factors, kg/L[110]				Totals, kg/L
		$bioCO_2$	CO_2	CH_4	N_2O	tCO_2e
Light-duty vehicles	gasoline	0.0747	2.175	0.00023	0.00047	2.40023
	diesel	0.098	2.556	0.000051	0.00022	2.723271
Light-duty trucks, vans and SUVs	gasoline	0.0747	2.175	0.00024	0.00058	2.43454
	diesel	0.098	2.556	0.000068	0.00022	2.723628
Heavy-duty (over 8500 lbs.)	gasoline	0.0747	2.175	0.000068	0.0002	2.313128
	diesel	0.098	2.556	0.00011	0.000151	2.70312
Off-road vehicles and equipment	gasoline	0.0747	2.175	0.0027	0.00005	2.3219
	diesel	0.098	2.556	0.00015	0.0011	2.99815

[107] These practices are updated periodically, including the emissions factors. Electric vehicles have not been included in the methodology to date. (*2012 B.C. Best Practices Methodology for Quantifying Greenhouse Gas Emissions*)

[108] The B.C. government biodiesel factor assumes a 4% biodiesel blend; Richmond uses a 5% blend. We also calculated emissions using a derived 5% biodiesel emissions factor, and the result was only 1.3 tonnes less overall. Therefore, we used the current B.C. government methodology and emissions factors to calculate the 2010 inventory.

[109] See Appendix C for the vehicle mode classification.

[110] From the *2012 B.C. Best Practices Methodology for Quantifying Greenhouse Gas Emissions*, 21.

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Green Fleet Action Plan (cont'd)

As inventory methodologies continue to be updated, and in order to compare the 2007 and 2010 inventories, the 2007 fuel use numbers were re-calibrated with the 2010 methodology. Of an initial six percent reduction in GHGs from 2007 to 2010, three percent could be accounted for due to the adjustments in methodology. The methodological difference is likely due to differences in biodiesel fuel methodology, vehicle classification, and the resulting application of various emissions factors.

A.2 Service level methodology – accounting for the emissions reduction

Fleet service levels can be calculated using vehicle kilometres travelled (VKT), hours in operation, or asset counts. Complete VKT data was not available for 2007 or 2010 as Richmond is in the process of updating its VKT tracking.

Service level comparisons were thus done at a gross level using asset counts. This follows the 2007 inventory that compared 1999 to 2007 asset numbers. For the Green Fleet Action Plan, 1999 asset numbers are taken directly from the 2007 Inventory report. 2007 and 2010 asset numbers were calculated by counting assets with fueling records. This provides a count of vehicles and equipment in regular use during the year, but under-counts the assets that do not fuel up directly.

Changes in fuel use are due to an interaction of several factors, including vehicle efficiencies, changes in vehicle use patterns, weather, driver behaviour and vehicle maintenance. VKT data will aid Richmond in tracking and managing fleet asset use, vehicle efficiency and overall fleet efficiency.

Contracting out also affects annual fleet service levels. When not reporting on contractor services, "leakage" could occur were Richmond to contract out more of its services. Any increases in contracting out should be noted in the annual Green Fleet report.

A.3 2010 Inventory data by department

Table 10 shows the breakdown of Richmond's divisions that use fleet vehicles by department.

Figure 16 and Figure 17 show the breakdown of emissions and fuel costs by department. The Public Works division — the largest division in terms of emissions— is comprised of 16 departments, several with a relatively large share of emissions, e.g. Roads, Water, Sanitary Sewers, Fleet Operations. The Parks, Recreation and Culture Division has seven departments, of which one (Parks Administration) is responsible for the majority of departmental emissions.

Fleet Services provides vehicles and equipment to the City in two principle ways: as monthly rental vehicles to departments for which a monthly fee is charged, and as hourly or daily rentals to departments. The monthly rentals are included in the departmental inventories, while hourly or daily vehicles are included in the Fleet Operations inventory, although they are performing work for many departments across the City.

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Table 10. Richmond divisions and departments using Fleet assets

Division	Department
Parks, Recreation, and Culture	Minoru Arenas Ice Centre Community Centre Ops (Seniors) Cultural Centre - Art Gallery Recreation Administration Parks Administration Library Administration
Finance and Corporate Services	Business Liaison and Development Stores Information Technology
Human Resources Division	Human Resources
Public Works Division	Roads Storm Drainage Drainage Pump Stations Facility Operations Facility Planning Fleet Operations Fleet - Hourly Equip Sanitation and Recycling Garbage Operations Water Sanitary Sewers San/Sewer Pump Stations Engineering Admin Engineering Inspections Engineering Design and Construction PW Communications (Eng.)
Urban Development Division	Traffic Operations Traffic Signals Building Approvals Building Approvals - Tree Bylaw
Law and Community Safety Division	Emergency and Environmental Services Community Bylaws Parking Enforcement Fire Services

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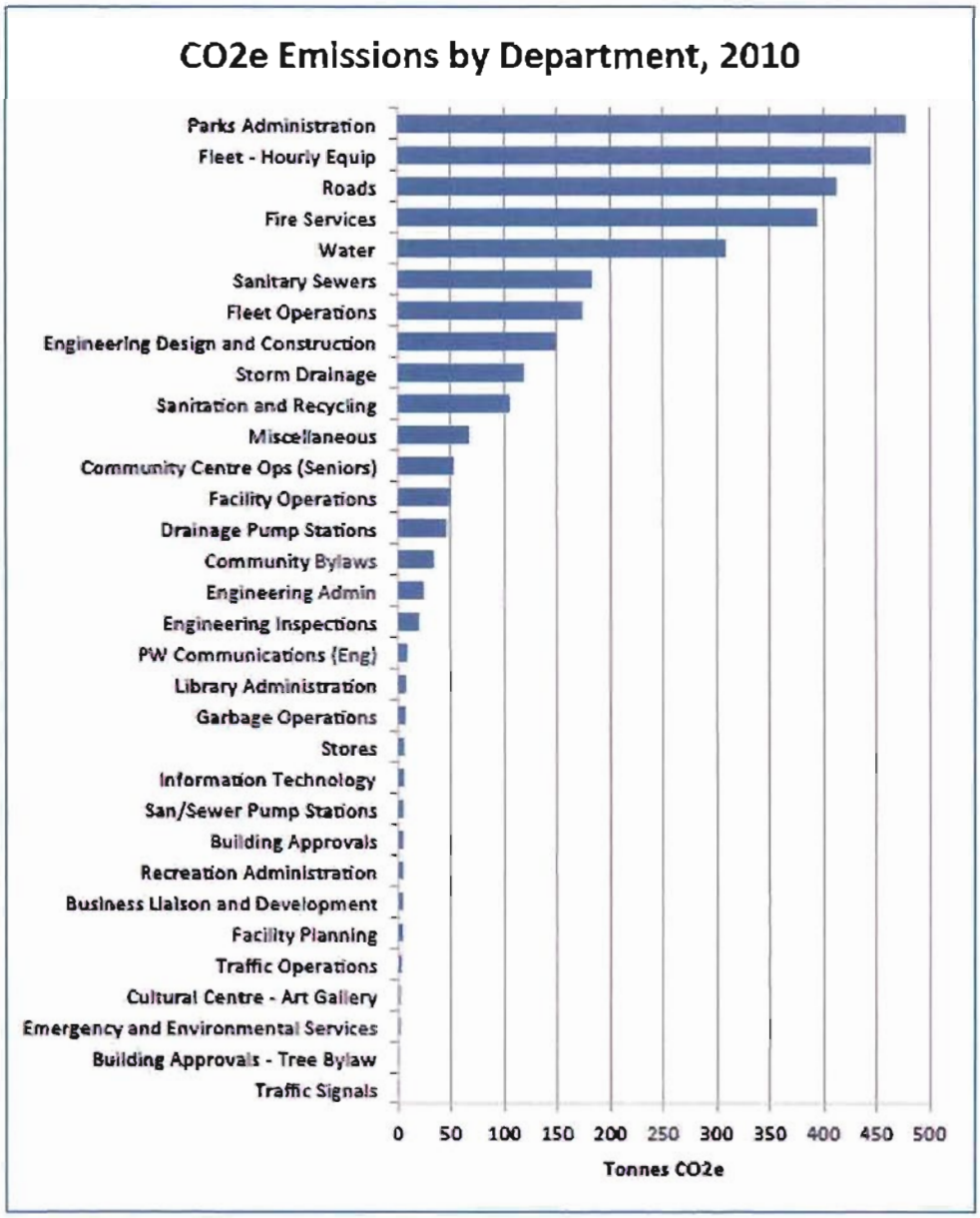

Figure 18. GHG emissions by department, 2010

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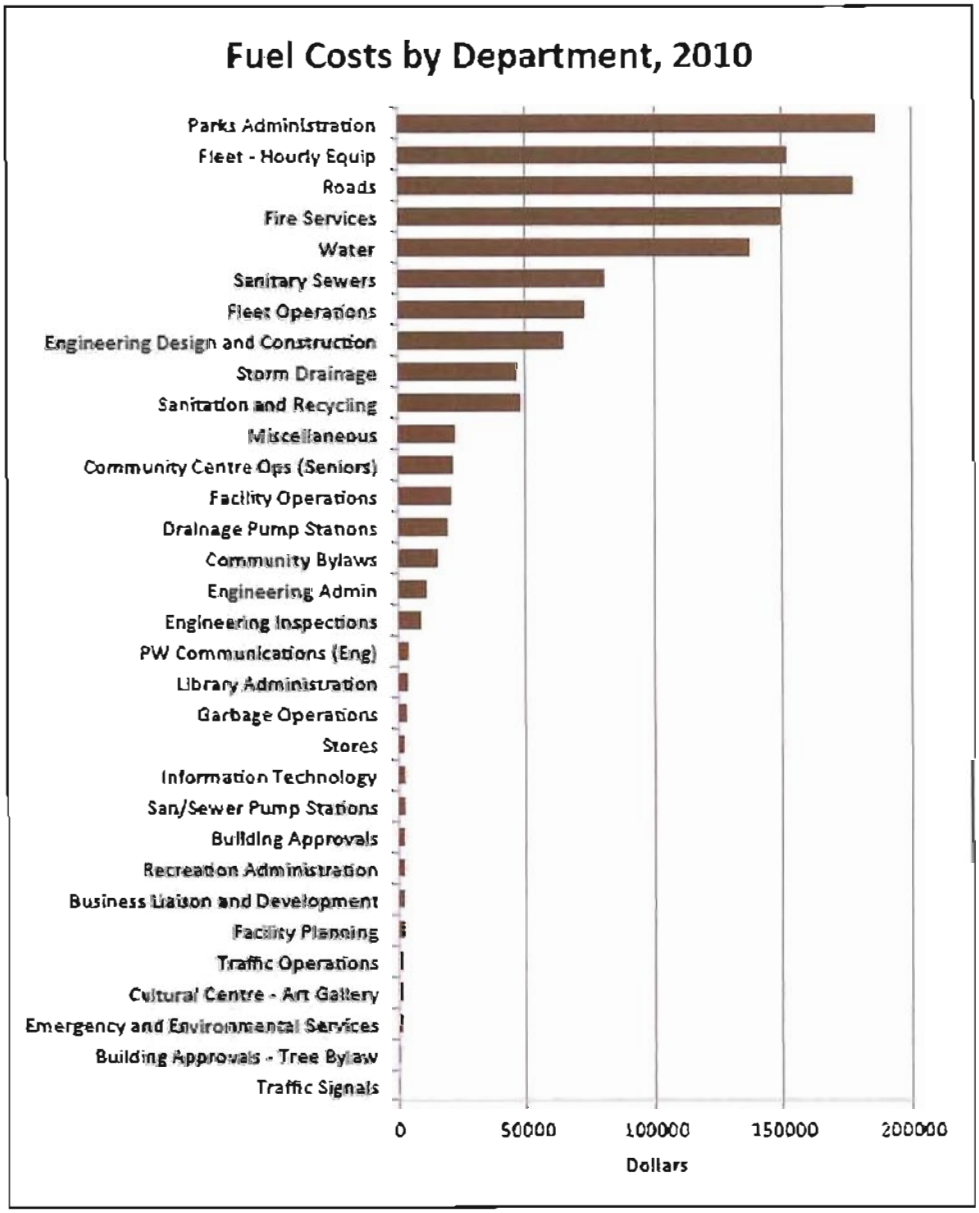

Figure 17. Fuel costs by department, 2010

A.4 Business as usual and future actions modelling

Modelling future emissions for fleet required assumptions for growth rates, replacement rates for vehicles and equipment, assumptions about efficiency improvements and assumptions about the fuel mix.

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Green Fleet Action Plan (cont'd)

Growth rates were assumed to be 2% per year, compounding annually, across all vehicle and equipment modes (22% total growth 2010 to 2020). This is lower than the high growth in assets between 1999 and 2007, reflecting the more recent trend from 2007 to 2010. The 2% growth rate was used for all future cases.

Replacement rates, shown in Table 11, were based on 2007, 2010 and the most recently available 2012 vehicle inventories and the 2013-2017 replacement schedule. They do not include Fire Services, schools, or RCMP.

The replacement rates for 2011-2016 are in line with the Sustainable Green Fleet Policy 2020 Report to Committee (February 7, 2012), which notes that the current fleet is "relatively old given daily usage patterns and operational wear and tear – the average age of vehicles in the fleet is 9.8 years." The fleet is currently undergoing significant renewal: approximately 76 units (~14% of fleet vehicles and equipment) were slated for replacement in 2012, while the 5-year plan (2012-2016) projects replacement of 265 units, representing over 50% of fleet vehicles and equipment.[111]

The 2017-2020 replacement rate assumption was more conservative. At these replacement rates, Richmond's fleet will essentially turn over in approximately 10 years.

Table 11. Annual replacement rate for modelling, 2010 baseline

Mode	2011-2012	2013-2016	2017-2020
Equipment	19%	19%	15%
Cars	7%	7%	5%
Light Duty	13%	13%	8%
Medium Duty	12%	12%	7%
Heavy Duty	0%	23%	0%

The 2020 cases used varying assumptions about vehicle efficiency to reflect the various procurement actions modelled. Efficiency assumptions were based on comparisons of fuel economy for typical vehicle models found in the Richmond fleet to currently available models. Assumptions ranged from equivalent replacement (e.g. 2012 Chevrolet Cruze, 2012 Dodge Ram 1500) for the base case, to best-in-class (e.g. 2012 Mazda 3, 2012 Toyota Tacoma) for the best-in-class conventional case, to hybrid (e.g. Toyota Prius) for the hybrid and EV case.

Data on fuel economy was taken from NRCan's Fuel Consumption Ratings tables for each typical vehicle.[112] Tailpipe emissions from electric vehicles were assumed to be zero (i.e. fully battery electric; plug-in hybrids are included in the hybrid category). Modest efficiency improvements of 9% and 4% were assumed for medium- and heavy-duty trucks respectively for 2011 and 2012, as compared to the older vehicles they would be replacing, across all the cases.

[111] February 7, 2012. Richmond City Report to Committee. Sustainable Green Fleet Policy.

[112] Natural Resources Canada. "Fuel Consumption Ratings."
http://oee.nrcan.gc.ca/transportation/tools/fuelratings/ratings-search.cfm

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Green Fleet Action Plan (cont'd)

Efficiency improvements for all vehicles beyond 2012 were based on Federal regulations[113] and an in-house model.

While the base and best-in-class conventional vehicles cases assumed 100% replacement by the same vehicles, the hybrid-EV case assumed a mixed replacement. For light cars, the model assumes a 60/10/30 mix of hybrid/EV/best-in-class conventional for 2012-2016 and a 40/60 hybrid/EV mix for 2017-2020. *No conventional passenger cars would be purchased after 2016 in this case.* Light-duty trucks would be replaced by best-in-class conventional vehicles for 2012-2016, and by a 50/10/40 hybrid/EV/best-in-class conventional mix for 2017-2020. The hybrid/EV scenario thus demonstrates additional savings to the best-in-class of 5%.

The 2010 fuel mix between diesel and gasoline was applied to the 2020 modelled fuel use in order to calculate emissions. The emissions factors used to calculate the emissions for 2020 were the same as for 2010.

Modelling Results (Figure 18) demonstrate that significant reductions are possible through replacement by more efficient vehicles and electric/hybrid vehicles. When new growth is not included, reductions are even higher: for example, 2020 emissions could be 27% lower than 2010 for the Hybrid + EV scenario, provided no new assets are added to Richmond's Fleet. Note that the hybrid/EV scenario only represents a 5% improvement over the best-in-class scenario.

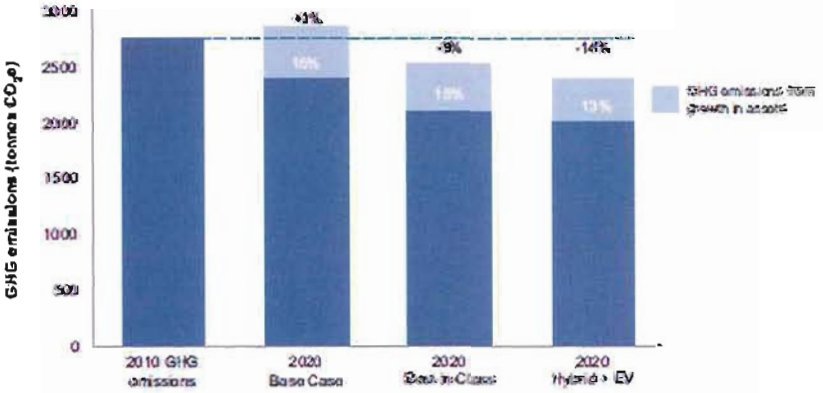

Figure 18. Modeled emissions reductions for best case scenarios

However, given that growth in assets will continue and that operational requirements cannot currently be met for all light-duty vehicles with either best-in-class or hybrid/EV units, pragmatic targets were set lower than the modeled results, shown in Figure 19. The DSM target assumed that some growth could be curtailed, and that some growth would be offset by changes in current practices: 7% was chosen as the DSM target. For best-in-class, the pragmatic target was set at 4.5%, half of the 9% modeled reductions. Hybrids and EV's, which build on best-in-class, could provide up to a 5% additional reduction: the pragmatic target was set at 2.5%. The pragmatic target based on the modeling was thus 14%.

[113] See the Auditor-General's condensed version of the regulation procedure, http://www.oag-bvg.gc.ca/internet/English/parl_cesd_201205_02_e_36774.html .

Attachment 2

Green Fleet Action Plan (cont'd)

In addition, a right-sizing target was set at 1%, based on analysis of passenger car VKT data. The anti-idling, smarter driving and maintenance target was conservatively set at 5%, based on a literature review, because Richmond has already done work in these areas.

The total pragmatic target was thus set at 20% overall, from a 2010 baseline.

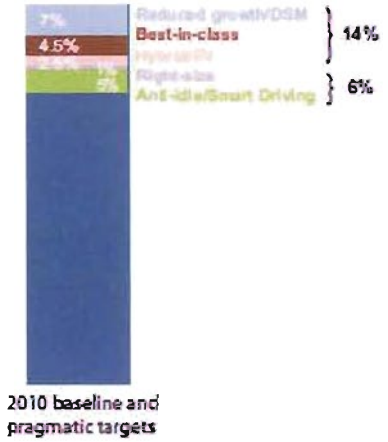

Figure 19. Pragmatic GHG targets compared to 2010 baseline

Attachment 2

Green Fleet Action Plan (cont'd)

Appendix B. Fleet management practices recommendations

B.1 Emissions measuring and reporting

Recommendations for future emissions measuring include:

- Use a method that will allow for reporting out to E3, B.C. Government, and the Mexico Pact, including the detailed mode vehicle classification system in Table 12
- Include air/conditioning (vehicles with/without), for future B.C. reporting
- Consider including contractor services' fuel use in future to prevent "leakage" of GHG emissions accounting
- Build a GHG calculator into the Faster Asset management software reporting tools. The advantages are that in-house tracking at an individual asset level is available; the con is that this will require staff time and annual refinement to check for emissions factor updates.
- In order to more accurately measure service level changes and overall fleet efficiency, manage assets for right-sizing and best use, include VKT and/or hours of operation. VKT is required for E3 Fleet Rating
- Evaluate feasibility of separating rideshare fuel use from corporate fuel use for future emissions reporting

B.2 Fleet classification for GHG emissions tracking and reporting

Fleet vehicles and equipment require classification for greenhouse gas emissions measuring and reporting. This plan piloted an inventory methodology that Richmond could use in its new fleet management software system for future emissions and green fleet reporting.

Richmond will report out to the E3 Fleet certification program run by the Fraser Basin Council, the Province of B.C. to meet Richmond's Climate Action Charter obligations, and the Mexico City Pact,[114] an international agreement with signatory cities reporting on commitments, performance and actions.

Richmond currently tracks all vehicles by a vehicle ID number. In order to prepare the 2010 inventory, Richmond classified all vehicles that fuelled up in 2010 by detailed mode, as shown in Table 12. The classification system enables reporting out to the three scopes above.

[114] The Pact was launched in November 2010 at the World Mayor's Summit in Mexico City. It sets voluntary commitments for mitigation and adaptation action. http://www.mexicocitypact.org/en/the-mexico-city-pact-2/

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The detailed mode is based on the E3 fleet requirements, with the addition of a T0 category. E3 sets the light-duty truck categories at 10,000 lbs., while federal and provincial emissions and fuel efficiency regulations set the light-duty to medium-duty cut-off at 8,500 lbs. T0 vehicles can be reported out as P vehicles for E3, yet classified as medium-duty for the purposes of calculating greenhouse gas emissions for the Province of B.C. Note that for greenhouse gas modelling purposes, equipment is treated as one category (i.e. the same emissions factors for E1, E2, and E3).

The vehicle modes as developed for this plan are shown below.

Table 12. Vehicle classification by detailed mode, based on E3

Green Fleet Action Plan Mode	Detailed Mode	Description
Light duty (cars)	C	Cars
Light duty (pickup, van, SUV, trucks under 10,000 lbs.)	P	Pickups
	V	Van, up to 8500 lbs (3900 kg) GVWR
	S	SUV
	T0	Trucks, Vans: 8500-10,000 lbs. GVWR
Medium duty	T1	Truck, 10,000-17,000 lbs GVWR
	T2	Truck 17,001-35,000 lbs GVWR
	T3	Truck 35,001-60,000 lbs GVWR
	B	Bus/Coach
Heavy duty	T4	Truck 60,001-110,000 lbs GVWR
	T5	Truck 110,000 lbs & greater GVWR
Equipment	E1	Small Equipment (e.g. Small trailer)
	E2	Medium Equipment (i.e. medium-sized forklift)
	E3	Large Equipment (e.g. backhoe)

Richmond's current fuel management software tracks fuel use by gas, diesel, or marked diesel (1, 2, 3). Given the addition of hybrid and electric vehicles, Pembina recommends an additional set of fuel type categories, shown below in Table 13. These will allow Richmond to easily measure and report on its electric and hybrid vehicles, i.e. its green fleet assets. In addition, as EV charging infrastructure becomes available, Richmond may choose to also measure and report on its vehicle electrical use.

Table 13. Fuel classes

FUEL CLASS		Notes
g	Gasoline	As of 2010, provincial gas includes 5% ethanol.
d	Diesel (biodiesel 5%)	As of 2012, provincial diesel includes 4% bio-diesel; Richmond started using 5% bio-diesel prior to 2008.
e	Electricity	Unless charging stations are billed separately from

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Green Fleet Action Plan (cont'd)

		buildings, fleet vehicles' charging will be counted under building energy use.
h-g-e	Gasoline/electricity - plug-in or pump	See note above – plug-in hybrid vehicles are treated as g fuel vehicles, unless charging station data is available.
h-g	Gasoline, no plug-in	These vehicles are treated as gasoline vehicles for modelling purposes
h-d	Diesel, no plug-in	These vehicles are treated as diesel vehicles for modelling purposes
p	Propane	Only 2 forklifts run on propane; for 2012 reporting onwards, they should either be included in the inventory, or excluded using the 1% decision tree rationale.
Future, as needed		
B20	Bio-diesel 20% blend	

B.3 Reporting out scope and method

Richmond plans to report out on fuel use and emissions for three different purposes: B.C. government requirements for municipal carbon neutrality under the Climate Action Charter; E3 Fleet through the Fraser Basin Council; and, the Mexico City Pact. Table 14 details the requirements for each.

Pembina recommends that Richmond use the B.C. government SmartTool for B.C. government reporting. SmartTool will take the fuel use spreadsheet from Richmond's fuel management software, and convert it to data for input into SmartTool.[115] The classification by detailed mode outlined above will allow for simple reporting to E3 fleet, and calculation of emissions for the Mexico City Pact.

Table 14. Reporting scope for Carbon Neutral, E3 Fleet, and Mexico Pact

Carbon Neutral/B.C. Gov.	E3 Fleet	Mexico Pact[116]
Reporting out mechanism is an additional sheet in the CARIP Public Reports, with data from SmartTool or equivalent measurement tool	VKT (required) and hours of operation (optional)	
All six "traditional service" areas are included:[117] 1. Administration and	C, P, T, V, S, B (see Table 12) T1–T5 (see Table 12) E1–E3 (see Table 12)	2 categories only: 1. Transit (incl. passenger cars) 2. Non-transit (e.g. cranes)

[115] It should be noted that SmartTool is an energy and emissions reporting tool, and should not be relied on as an energy management tool.

[116] http://citiesclimateregistry.org/fileadmin/user_upload/carbonn/User_Manual/carbonn_cCCR_User_Manual_v3.0_June2012.pdf

[117] Fire services will need to provide its fuel use data by vehicle, with vehicle classifications by detailed mode.

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Green Fleet Action Plan (cont'd)

Fleet management practices recommendations

governance 2. Drinking, storm, and wastewater 3. Solid waste collection, transportation, and diversion 4. Roads and traffic operations 5. Arts, recreation, parks, and cultural services 6. Fire protection		
Police are NOT included. Biofuels must be calculated and reported out separately. Air conditioning must be reported, by number of vehicles.[118] Contractor services are included for work in the traditional service areas.		Cities may also report on actions.
Sources		
Union of BC Municipalities. *The Workbook: Helping Governments Understand How to be Carbon Neutral in their Corporate Operations. Version* 2. 3/9/2012.	E3 Fleet. *Fuel Usage Summary.* 2006. Fraser Basin Council. FBC. *E3 Master Input Form w/Equipment.* Current excel spreadsheet.	Carbon Cities Climate Registry. *User Manual: Guidance for Local Government Representatives in Carbon and Cities Climate Registry.* Version 3.0, June 2012. ICLEI-Local Governments for Sustainability. www.climatecitiesregistry.org www.carbonn.org

[118] By number of vehicles with air conditioning, if more detailed data does not exist.