



City of Richmond

Report to Committee

To Public Works & Transportation - Feb 18, 2009

To: Public Works & Transportation Committee
From: Dave Semple
Director of Parks and Public Works Operations

Date: February 11, 2009
File: 10-6125-00/Vol 01

Re: Corporate Use of Biodiesel and Other Alternative Fuels

Staff Recommendations

- 1. That the City's Green Fleet Policy 2020 be amended to expand on existing triple bottom line practices specifically in relation to the use of biofuels as an alternative fuel by adding the following to 'Item 1 - Acquisition' as an additional bullet:

"Biofuels will be evaluated by taking into account their effect on agriculture, environmental impact, cost, source location and energy balance. The highest blends available will be used subject to operational constraints."

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Dave Semple
Director of Parks and Public Works Operations
(604-233-3350)

Att. 2

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ROUTED TO: SUSTAINABILITY OFFICE CONCURRENTLY Y [checked] N [ ]
REVIEWED BY TAG YES [checked] NO [ ]
CONCURRENCE OF GENERAL MANAGER [signature]
REVIEWED BY CAO YES [checked] NO [ ]

**Staff Report**

**Origin**

At their October 22, 2008 meeting, Public Works & Transportation Committee requested that staff explore and report back on:

1. the feasibility of the continued use of biodiesel fuel, and
2. alternative fuel initiatives the City could use.

This report responds to that referral.

**Analysis**

**1. Feasibility of Continued Use of Biodiesel Fuel**

*An Overview of Biodiesel*

Biodiesel is a non-petroleum based biofuel made from vegetable oil or animal fat. It can be used in varying blends to replace conventional diesel, which is made from petroleum sources. Biodiesel generates less particulate matter, is made from renewable energy sources, generates less greenhouse gas emissions and provides opportunities for economic diversification in relation to local economies. Biodiesel is one type of biofuel. Additional information on other biofuels is addressed later in this report.

*Benefits and Concerns of Biodiesel Use*

Concerns have been raised about the potential adverse impacts of biofuels on agriculture, food prices and long-term food security. This concern arises from the fact that some biofuels are being produced on arable land that has been converted from producing crops-for-food to crops-for-fuel. Biodiesel can also be produced from waste material, including grease, rendered animal fats and agricultural vegetative waste material. As shown in the following table, not all biodiesel is produced from food crops. The table also summarizes use, source, affect on agriculture, environmental impact and energy balance (the amount of energy used in a fuel’s production versus the amount of fuel it provides).

**Table 1. Biodiesel Production and Use<sup>1,2</sup>**

<b>Fuel</b>	<b>Use</b>	<b>Source</b>	<b>Affect on agriculture</b>	<b>Environmental Impact</b>	<b>Energy Balance</b>
<i>Biodiesel</i>	<ul style="list-style-type: none"> <li>• used as an alternative or additive to petroleum diesel</li> </ul>	<ul style="list-style-type: none"> <li>• currently derived from sources such as oil seed crops (e.g. canola, soybean, palm oil) and waste food products (e.g. used cooking oil, animal fat renderings)</li> </ul>	<ul style="list-style-type: none"> <li>• waste food products: limited impact</li> <li>• Canola, main agricultural source of biodiesel in Western Canada: positive impact<sup>3</sup></li> </ul>	<ul style="list-style-type: none"> <li>• Canola typically grown as a low tillage crop, which results in less CO2 release</li> <li>• B5 reduces ghg emissions by 4% in comparison with 100% regular diesel</li> </ul>	<ul style="list-style-type: none"> <li>• 3 to 1 (canola based biodiesel)</li> </ul>

<sup>1</sup> Biodiesel Canada. 2007. Biodiesel Overview from Alberta Agriculture. [biodieselfcanada.blogspot.com/2007/02/biodiesel-overview-from-alberta.html](http://biodieselfcanada.blogspot.com/2007/02/biodiesel-overview-from-alberta.html). sourced Jan 2009.

<sup>2</sup> Food and Agriculture Organization of the United Nations. 2008. The State of Food and Agriculture 2008. Biofuels: Prospects, Risks and Opportunities.

<sup>3</sup> Canola is the main agricultural source for biodiesel in Western Canada. Biodiesel experts advise that each canola harvest can be used for multiple purposes. The canola meal, left over from oil production, can be used as livestock food. The oil can be graded into food and non-food grade streams based on factors such as acidity, clarity and water content. At this time, the majority of Canada’s canola-based biodiesel is exported to Europe.

*City Use of Biodiesel*

The City introduced a 5% biodiesel blend into most of its diesel fleet in April, 2005. The biodiesel used by the City is currently made from rendered animal fats supplied by a Lower Mainland company that obtains the fuel from the United States. This means that the biodiesel currently used by the City is not made from food crops. Use of biodiesel reduces the City's diesel fleet's greenhouse gas emissions by 4% when compared with the use of 100% regular diesel. When compared with the City's overall greenhouse gas emissions including that from buildings, solid waste, water/wastewater, lighting and the vehicle fleet, the use of biodiesel reduces overall City emissions by 0.5%.

The following table details greenhouse gas emission reductions based on the percentage of biodiesel used in fuel.

**Table 2. Emission Reductions from Biodiesel Use<sup>4</sup>**

Biodiesel Proportion	Consumption (Litres/Year)	GHG Emission Reduction (tonnes CO <sub>2</sub> e)	% reduction over regular diesel ghg emissions	% reduction of total City ghg emissions	Equivalent Turbo SUVs taken off the road
0%	0	0	0	0	0
5%	25,000	50	4	0.5	10
10%	40,000	100	8	1	20
20%	100,000	200	15	2	40

An increase in biodiesel use, therefore, would be beneficial in further reducing diesel as well as overall City greenhouse gas emissions. Higher biodiesel blends are subject to operational capacity, i.e. ability of vehicles to process higher proportions of biodiesel, warranty limitations, fuel storage capacity issues, etc.

*Summary*

The City's current use of biodiesel should be continued recognizing that the source of the biofuel is from rendered animal fats as opposed to food-based crops. It also represents a positive direction toward reducing emissions and dependency on fossil fuels. Higher blends of biodiesel should be incorporated as operational capacity permits. It is noted that the current source of City biodiesel is imported from the United States. A more sustainable approach would be to work to seek a regionally-supplied source. The City's fuel purchases, including biodiesel, are undertaken via a regional consortium. Staff will work through that consortium to advocate for a regionally-supplied source of biodiesel rendered from animal fats.

<sup>4</sup> biofleet.net carbon reduction calculator

**2. Alternative Fuel Initiatives**

*Ethanol*

Biofuel is a broad definition for fuel sources or additives derived from non-fossilized biological sources. It includes fuels such as ethanol and biodiesel. Biodiesel is one type of biofuel, an alternative to diesel fuel. Ethanol is another type of biofuel which can be used to replace gasoline. The City does not currently use ethanol. Unlike biodiesel, ethanol is not yet commercially viable from non-food based sources (e.g. agricultural vegetative waste materials high in cellulose; straw, corn stalks; woodwaste; algae; etc.). Food-based sources of ethanol also currently have a low energy balance. The following table summarizes ethanol production and use, similar to that provided previously for biodiesel.

**Table 3. Ethanol Production and Use<sup>2</sup>**

<b>Fuel</b>	<b>Use</b>	<b>Source</b>	<b>Affect on agriculture</b>	<b>Environmental Impact</b>	<b>Energy Balance</b>
<i>Ethanol</i>	<ul style="list-style-type: none"> <li>used as an additive to gasoline</li> </ul>	<ul style="list-style-type: none"> <li>currently derived from food based feedstocks high in sugar (e.g. sugar cane), or rich in starch (e.g. corn or wheat) or non-food based feedstocks high in cellulose (e.g. agricultural waste, wood waste)</li> </ul>	<ul style="list-style-type: none"> <li>typically Canadian commercially viable feedstock sources are from corn and wheat, which could be consumed as a food source</li> </ul>	<ul style="list-style-type: none"> <li>E10 reduces ghg emissions by 4% in comparison with 100% gasoline (corn or wheat based ethanol)</li> </ul>	<ul style="list-style-type: none"> <li>1.5 to 1 (corn or wheat based ethanol)</li> </ul>

It is not recommended that the City consider the use of ethanol until such time as it becomes available from non-food based sources. Any expansion of biofuels should take the above evaluation factors into consideration – use, source, affect on agriculture, environmental impact and energy balance.

*Other Alternative Fuels*

Alternative fuels refer to substances that can be used as a fuel other than conventional fuels which include conventional fossil fuels (petroleum, coal, propane and natural gas). Alternative fuels for use in fleets include:

- biofuels (e.g., biodiesel and ethanol);
- chemically stored electricity (e.g., batteries and fuel cells);
- hydrogen; and
- alternative fossil fuels, such as compressed natural gas, which are cleaner burning alternatives to conventional fossil fuels.

A cursory overview of different types of alternative fuels, including alternative fossil fuels, is provided in Attachment 1. It should be noted that not every fuel type is available for every use. Different alternatives are available for different types of uses and provide differing benefits and costs.

In addition to the use of biodiesel in its diesel fleet, the City uses other measures to meet high standards in fleet performance (e.g., reduced greenhouse gas emissions, reduced reliance on non-renewable resources, etc.). This corresponds with the City's Green Fleet Policy 2020, adopted by Council in December, 2006, Attachment 2. This policy integrates triple bottom line decision making into the City's overall fleet management approach. The policy is broad reaching and considers fleet management decision-making pertaining to acquisition, operation and education. Key policy directions include:

- minimizing the overall fleet size
- 'right-sizing' or using the smallest vehicle available to meet need
- using vehicles with the highest fuel efficiency and lowest ghg emissions.

In relation to alternative fuels, the policy states that the City will maximize the use of alternative fuels and technologies.

In our passenger fleet, the City has approximately 14% of 'right-sized' vehicles and approximately 32% using fuel use reduction technologies (hybrid-gas-electric units). In addition, the ice resurfacers used at City arenas are electric. This not only reduces fossil fuel consumption, but also contributes to improved air quality within those facilities. Staff are continually reviewing advancements in alternative fuels and new technologies as they become available for application within our vehicle/equipment fleet. The City should continue with its current alternative fuels and technologies initiatives, which include the use of biodiesel in the majority of City diesel applications, utilizing electric applications in warranted situations, and expanding the City's use of hybrid gas-electric technology and pursuing plug in electrics.

### 3. Senior Government Policy Trends

The City has made positive advancements toward incorporating innovation and leading-edge technology in the management of its fleet as outlined in the Green Fleet Policy. These practices, including the use of biodiesel, are in alignment with provincial and federal policy direction.

The City has made a commitment to be climate neutral by 2012 through the Provincial Climate Action Charter, approved by Council in 2008. Alternative fuel strategies play a role in addressing this commitment. At the provincial level under the BC Energy Plan, a 5% average renewable fuel standard for diesel fuel use in the province will be implemented by 2010. The Province has also invested in supporting British Columbia based production of biofuels with demonstrated low greenhouse gas emissions. These initiatives support the Province's goals to reduce the life-cycle greenhouse gas emissions from all transportation fuels by at least 10 percent by 2020 and to meet 50 per cent or more of B.C.'s renewable fuel requirements by 2020 with biofuels produced in B.C.

In addition to the above, the federal government has introduced requirements for average annual renewable fuel content to be at least 5% calculated based on the volume of gasoline by 2010 and a 2% renewable content in diesel fuel and heating oil by 2012. The Federal Government has also implemented incentives for biofuel production and for the development of next generation biofuels (e.g. biofuels from non-food sources).

These policy trends support the City's continued use of biodiesel and advancements in relation to alternative fuel technologies.

**Financial Impact**

None

**Conclusion**

The City of Richmond has a Green Fleet Policy to guide the overall management of the City's vehicle fleet, including the use of alternative fuels. A review of biofuels indicates that while some biofuels may be impacting the increase in agricultural commodity prices, other biofuel uses may have positive agricultural affects. Other factors influencing agricultural commodity prices may include global petroleum prices, drought and other climate impacts. Appropriate investment in biofuels which are evaluated based on their affect on agriculture, environmental impact, cost, source location and energy balance may help to revitalize agricultural sectors, support the local economy, decrease dependency on fossil fuels, and reduce exposure to global petroleum volatility.

The City's current use of biodiesel is produced from waste material, and therefore does not compete with food-based agriculture. It also represents a sound approach to minimizing emissions and reducing fossil fuel dependency. To ensure the integrity of this approach is maintained going forward, it is recommended that the City's Green Fleet Policy be amended to ensure the City's use of biofuels are appropriately evaluated as noted above. The policy should also reflect the City's commitment to use the highest blends available subject to operational constraints.

The City should also continue with other alternative fuels and technologies initiatives, including utilizing electric applications in warranted situations and expanding the City's use of hybrid gas-electric technology.



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### Attachment 1: Alternative Fuels Review<sup>5</sup>

Alternative Fuel	Description	Typical use	Emission Reduction	Challenges	City's current use	City's proposed use
Biodiesel	<ul style="list-style-type: none"> <li>Biodiesel is a renewable, refined alternative to diesel fuel that is currently derived from sources such as oil seed crops (e.g. canola, soybean, palm oil) and waste food products (e.g. used cooking oil, animal fat renderings).</li> </ul>	<ul style="list-style-type: none"> <li>blended in petroleum diesel for on and off road use</li> </ul>	<ul style="list-style-type: none"> <li>B100 (75-85%)</li> <li>B20 (15%)</li> <li>B5 (4%) emission reduction in comparison to 100% petroleum diesel</li> </ul>	<ul style="list-style-type: none"> <li>Appropriate sourcing</li> <li>Meeting established warranty standards</li> </ul>	<ul style="list-style-type: none"> <li>5% biodiesel in majority of City applications</li> </ul>	<ul style="list-style-type: none"> <li>Potential increase up to 20% biodiesel in majority of City applications</li> </ul>
Ethanol	<ul style="list-style-type: none"> <li>An additive to gasoline, typically manufactured from corn or wheat</li> </ul>	<ul style="list-style-type: none"> <li>most gas engines can run a gas blend of up to 10% ethanol</li> <li>some vehicles are specifically designed to be able to operate up to 85% ethanol</li> </ul>	<ul style="list-style-type: none"> <li>E10 from grain estimated to reduces ghg emissions by 4% in comparison to 100% gasoline</li> </ul>	<ul style="list-style-type: none"> <li>Use of E10 increases fuel consumption by 2%</li> <li>current ethanol sources are food based</li> </ul>	<ul style="list-style-type: none"> <li>Not currently used</li> </ul>	<ul style="list-style-type: none"> <li>Federal legislation to have annual average content of E5 in gasoline by 2010 in all provinces, Province will mandate E5 in all gasoline by 2010</li> <li>Further action not recommended until cellulosic ethanol is feasible</li> </ul>
Natural Gas	<ul style="list-style-type: none"> <li>Odourless, colourless fossil-fuel based gas that is made of 90% methane</li> </ul>	<ul style="list-style-type: none"> <li>gasoline alternative for high fuel use vehicles</li> </ul>	<ul style="list-style-type: none"> <li>20 to 25% fewer ghg emissions in comparison to gasoline</li> </ul>	<ul style="list-style-type: none"> <li>training requirements for filling</li> <li>requires conversion to dual fuel/added tank space</li> <li>no change to fossil fuel dependency</li> </ul>	<ul style="list-style-type: none"> <li>Limited use in auxiliary equipment only</li> </ul>	<ul style="list-style-type: none"> <li>Continue use in limited applications as operations require</li> <li>Not recommended for broader expansion</li> </ul>
Propane	<ul style="list-style-type: none"> <li>gaseous fossil-fuel based fuel that is pressurized and stored as a liquid</li> </ul>	<ul style="list-style-type: none"> <li>gasoline alternative for vehicles</li> <li>indoor applications due to 90% less carbon monoxide emissions than gasoline</li> </ul>	<ul style="list-style-type: none"> <li>up to 20% reduction in ghg emissions in comparison to gasoline</li> </ul>	<ul style="list-style-type: none"> <li>training requirements for filling dual fuel issues/tank sizing</li> <li>no change to fossil fuel dependency</li> </ul>	<ul style="list-style-type: none"> <li>Off road applications</li> </ul>	<ul style="list-style-type: none"> <li>Continue use in limited applications as operations require</li> <li>Not recommended for broader expansion</li> </ul>

<sup>5</sup> greenfleets.bc.com, hydrogenhighway.ca, and Coxworth, E. 2003. Saskatchewan Environmental Society and Climate Action Network. The Role of Renewable Liquid Transportation Fuels in Canada's Climate Action Plan.

**Attachment 1: Alternative Fuels Review (cont'd)**

Alternative Fuel	Description	Typical use	Emission Reduction	Challenges	City's current use	City's proposed use
Electric	<ul style="list-style-type: none"> <li>Typically a rechargeable battery pack in the vehicle runs an electric motor</li> </ul>	<ul style="list-style-type: none"> <li>small on road vehicles and off road applications</li> </ul>	<ul style="list-style-type: none"> <li>dependent on electricity source</li> </ul>	<ul style="list-style-type: none"> <li>capacity required for electricity storage</li> <li>environmental impact of electricity source</li> </ul>	<ul style="list-style-type: none"> <li>New City ice resurfacers are electric</li> </ul>	<ul style="list-style-type: none"> <li>Review and employ electric applications as available and appropriate</li> </ul>
Hybrid-Gas-Electric	<ul style="list-style-type: none"> <li>Combination of an internal combustion engine and electric motor powered by a battery recharged from either engine and/or energy captured by braking</li> </ul>	<ul style="list-style-type: none"> <li>on road vehicles</li> </ul>	<ul style="list-style-type: none"> <li>reduces fuel use by 25-50%</li> </ul>	<ul style="list-style-type: none"> <li>higher purchase cost compared with conventional gasoline engines</li> </ul>	<ul style="list-style-type: none"> <li>28 passenger vehicles in the City fleet</li> </ul>	<ul style="list-style-type: none"> <li>Review the use of other hybrid-gas-electric technology as it becomes available (e.g. Pickup Trucks)</li> </ul>
Hydrogen	<ul style="list-style-type: none"> <li>Natural gas is the typical current feedstock, although almost any other energy sources can be transformed into electricity and then by electrolysis into hydrogen</li> </ul>	<ul style="list-style-type: none"> <li>in combustion engine compressed hydrogen is injected into the engine and used similarly to other fuels</li> <li>in a fuel cell vehicle hydrogen reacts with oxygen which produces electricity to power an electric motor</li> </ul>	<ul style="list-style-type: none"> <li>dependent on electricity source</li> <li>no ghg emissions at tailpipe (only water)</li> </ul>	<ul style="list-style-type: none"> <li>infrastructure required</li> <li>technology cost prohibitive</li> <li>combustion is not efficient for transportation applications as much of energy is released in the form of heat, which is not useful for propelling vehicles</li> </ul>	<ul style="list-style-type: none"> <li>Not currently used</li> </ul>	<ul style="list-style-type: none"> <li>Not considered viable at this time (due to e.g. infrastructure availability, efficiency, etc.)</li> </ul>



**Attachment 2: Green Fleet Policy, December, 2006**



**City of Richmond**

**Policy Manual**

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**Policy :**

It is Council policy that:

*in recognition that the production, use and disposal of motor vehicles result in significant impacts to human health and environment, and pose a sizeable cost requirement for the City, the City of Richmond will seek to:*

- be a leader in incorporating innovation and leading-edge technology in the management of its fleet, and
- manage its corporate fleet according to the following Green Fleet objectives and performance standards.

**1. Acquisition**

Purchases of new vehicles will be conducted in accordance with the City's Environmental Purchasing Policy and specifically aimed at:

- minimizing overall fleet,
- using the smallest size vehicles available to meet assessed need
- using vehicles with highest fuel efficiency and cost effectiveness based on considerations of life-cycle costing and financial investment requirements
- maximizing the use of alternative fuels and technologies.

Efficiency performance standards will be incorporated into bid specifications.

**2. Operational Safety and Efficiency**

The City's fleet will be operated in a manner which:

- maintains high safety standards
- maximizes manufacturer recommended performance standards
- supports, implements and complies with current operations and emissions standards
- incorporates technologies to accurately measure individual vehicle emissions
- ensure optimal vehicle operations and minimize emissions and fuel consumption
- adopts new technologies, including retrofits, aimed at improving fuel efficiency and reducing emissions, wherever practicable and cost effective
- prevents non-purposeful idling of City vehicles
- supports alternative transportation programs for City employees.

The City's driver/operator training program will include education on:

- operational practices for maximizing fuel efficiency and reducing emissions (e.g., minimizing travel distances, anti-idling, etc.)
- increasing safety, and
- encouraging acceptance of alternate technologies and approaches.

**3. Education and Awareness**

The City will work in partnership with the Richmond community and other agencies to support community-wide green fleet initiatives, wherever practicable and cost effective.

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**Attachment 2: Green Fleet Policy, December 2006 (cont'd)**



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File Ref:

Green Fleet Policy

**4. Monitoring and Reporting**

Corporate fleet practices, including annual fuel consumption, will be monitored and reported on in the City's State of Environment reporting program.

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