

# Use Of Bio-Diesel At TTC

Meeting Date: August 27, 2008

Subject: Use Of Bio-Diesel At TTC

## **Recommendation**

It is recommended that the Commission:

1. Accept this report for information in response to a request by the Commission at its meeting of July 10, 2008 to report on the use of Bio-Diesel at TTC;
2. Note that while there are environmental benefits to the continued use of bio-diesel for a portion of our fleet for the next 2 to 3 years, given the serious financial issues facing the Commission, that approval be given to discontinue the use of bio-diesel in 2009.

## **Funding**

Based on the most current information regarding anticipated consumption of B5 for 2009, we expect to incur a premium cost of approximately \$1,500,000 with the use of bio-diesel fuel in 2009.

## **Background**

In 2006, an evaluation program was introduced by staff to determine the effects of using bio-diesel fuel in TTC's diesel buses.

Arrangements were made with Suncor and Canada Clean fuels to provide a 5% Bio-Diesel blend for the winter months, and a 20% blend during the summer, of soya-based bio-fuel with #1 diesel fuel to the Queensway Garage for fuelling of buses at this division.

After successfully completing almost a year of testing, it was recommended by staff that bio-diesel be used in all TTC diesel-powered vehicles and equipment to take advantage of the benefits of the blended fuel product. It was recommended at the time that a blend ratio of only 5% bio-fuel be used as it is known that the soya-based ester oil product derived from soya bean oil used in higher blend ratios can cause deterioration of seals and gaskets in older equipment. Based on testing by various groups in North America, it was confirmed that a lower blend ratio is not detrimental to older equipment while still providing an opportunity to reduce the emissions of unburned hydro-carbons and particulate matter in diesel exhausts while at the same time reducing our dependence on non-renewable energy sources and foreign oil supplies.

At this time, all TTC diesel equipment is fuelled with bio-diesel based on a blend of 5% soya-based bio-fuel and 95% ultra low sulphur #1 diesel fuel. This includes all buses, diesel powered non-revenue vehicles, subway work cars, and many types of construction equipment including welders and compressors.

### **Discussion**

The use of B5 bio-diesel has been very successful at TTC over the last two and a half years, but this has been done at additional cost as the bio-fuel portion is provided by Suncor at a premium cost compared to ultra low sulphur #1 diesel fuel. As previously mentioned, the identifiable benefits in the use of bio-fuel are based on the fact that the introduction of soya bean ester oil to the blended fuel provides additional oxygen for combustion. This serves to improve the combustion process thereby reducing unburned components in the exhaust emissions. Effectively this reduces the amount of black soot that can be seen emitting from diesel exhausts as well as unburned particulate matter that is claimed to be carcinogenic as well as the cause of many human respiratory problems. The use of bio-diesel can reduce the global generation of carbon dioxide, thereby reducing global warming, when the total process of bio-fuel generation and combustion as fuel is considered as a “well to wheel” process.

Other benefits in the use of bio-fuel, in addition to reducing our dependency on non-renewable energy resources and foreign oil, are a reduction in sulphur dioxide emissions and possible improvement in diesel engine life due to the lubrication qualities of the bio-fuel portion of the fuel blend.

Additionally, the use of bio-fuel improves the fuel cetane number which results in improved diesel engine cold start up characteristics and a reduction in exhaust emissions as the engine warms up.

It should be noted, on the negative side, that the energy content of bio-fuel is not as high as diesel fuel. This reduces the power developed and increases fuel usage. However, at the 5/95% blend ratio, this characteristic has a minimal effect and is not noticeable to operators.

At TTC, the greatest effects of bio-diesel are realized in the exhaust emissions from our older buses using 2-cycle engines such as our General Motors buses and our 1991 Orion V's. These buses use Detroit Diesel 6V71 and 6V92 engines respectively. It is expected that in the next 2 or 3 years, these buses will be retired.

While it is difficult to quantify the environmental benefits to the use of bio-diesel in 2 cycle engines, it is known that this type of engine is not as fuel efficient as our clean diesel 4 cycle engines, and in fact, TTC's experience is that approximately 13% more fuel is used in 2 cycle engines.

The bio-fuel content in the extra fuel used has a direct relationship to the reduction in harmful

emissions as some of the combustion products that might pass through a 2 cycle engine in an unburned state are burned, or oxidized, due to the presence of the bio portion of the fuel.

Middle aged buses in our fleet, such as 1996 Orion V's, and Nova Bus RTS's as well as our low floor New Flyer buses, use 4-cycle engines fitted with very rudimentary engine exhaust after-treatment. Engine exhaust emissions from the older 4 cycle and 2 cycle engines can be reduced by the use of bio-diesel to improve the combustion process. Our latest Orion VII and Orion VII Next Generation Low Floor buses, including our hybrid fleet, are fitted with much cleaner engines with the latest engine exhaust after-treatment systems such as diesel oxidizing catalysts and particulate traps that have a greater affect on engine exhaust emission than does the use of bio-diesel. In the case of those buses fitted with particulate traps, the emissions of unburned particulates have been reduced by approximately 99% as compared to diesel engines without traps.

Bio-diesel has such a minimal effect on these new engines, in regard to reducing harmful exhaust emissions, that once the older GM's and Orion V buses are retired in 2 to 3 years, the use of bio-diesel will have little positive impact on emissions from Commission buses.

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