Bio-Diesel Pilot

Project Plan
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Introduction

The Bio-Diesel Pilot Project is an endeavor to test and validate the applicability of a bio-diesel fuel blend in a controlled group of District vehicles. Bio-diesel fuel is a clean burning alternative fuel produced from domestic, renewable resources, such as vegetable oils and animal fats. The introduction of a bio-diesel fuel blend into the District’s fleet provides a unique opportunity to leverage a green technology that requires limited capital investment. Further, the Transportation Branch anticipates the pilot will have a minimal impact on District services.

The selection of pilot vehicles is based on three main factors: the ability to isolate a test group of vehicles, the absence of on-site fueling facilities, and the potential for reductions in “deadhead” time and fuel consumption. Given these factors, the vehicles selected will potentially most benefit from the pilot.

The timing of the pilot is strategically tied to the expiration date of the current fuel contract. The fuel provider dispatches tanker trucks to District locations to fuel vehicles while they are parked (wet-line fueling). The Transportation and Materiel Management Branches are using this opportunity to incorporate bio-diesel fuel service into the current wet-line fueling contract. The contract will be amended to include bio-diesel fuel, and will be presented for Board approval in October 2008. This will ensure uninterrupted fuel service for District vehicles.

The Branch anticipates a minimal impact on overall fuel consumption due to similar miles per gallon for both conventional petroleum diesel fuel (petro-diesel) and bio-diesel. Also, pilot vehicles represent a relatively small portion of the District’s overall heavy duty fleet. Further, bio-diesel fuel is a direct replacement for petro-diesel, thereby any increase in bio-diesel consumption will result in a proportional decrease of petro-diesel consumption.

After the initial pilot evaluation period, the Branch will explore three options: expansion of the pilot incorporating additional vehicles and/or locations, continuation of the pilot in its current state for further evaluation, or termination of the pilot due to significant impacts to maintenance costs and operational readiness. The timeline below illustrates projected pilot milestones.

Diagram 1 – Bio-Diesel Pilot Project Timeline
Background

The Transportation Branch is responsible for the maintenance service of approximately 3,400 vehicles and power equipment items, which includes the procuring and dispensing of fuel. The current escalating costs of fuel have direct affects on support services such as pupil transportation, material distribution, and maintenance and operations support. To ensure the effective and efficient use of fuel resources, the Branch aggressively manages and monitors fuel costs, consumption, and trends.

Over the past few years, fuel costs have risen precipitously. The increases to petro-diesel fuel have had the greatest impact on District operations. The vast majority of the District’s heavy duty fleet is diesel-powered. Since the 2003-04 fiscal year, the District’s average unit price for a gallon of petro-diesel fuel has increased by 107%. However, petro-diesel fuel consumption has remained steady throughout the same period, although a declining trend is expected as the District transitions from petro-diesel fuel to alternative cleaner burning fuels.

Over the last few years, the Branch has aggressively pursued funding to replace diesel school buses with alternative fueled buses including Compressed Natural Gas (CNG) and Ultra Low Emission Vehicles (ULEV). Although these efforts continue, replacement will still take a few years to accomplish. This also does not take into account the District’s fleet of heavy duty diesel trucks that will continue to operate for many years to come. As such, other options must be considered to reduce the reliance on petro-diesel, while introducing cleaner emission fuels to the District’s fleet.
**Bio-Diesel Fuel**

The most common and readily available sources of bio-diesel are soybean oil and used vegetable cooking oil. Bio-diesel fuel can be blended at different percentages with petro-diesel to create a bio-diesel blend. Blends are noted as BXX, where the XX represents the percentage of bio-diesel in the mixture compared to petro-diesel. The pilot will utilize a blend consisting of 20% bio-diesel and 80% petro-diesel known as “B20.” The B20 blend is the most widely used blend of bio-diesel, and contains the highest content of bio-diesel that may be used with diesel engines with limited or no modifications to fueling infrastructure.

Within the last few years, bio-diesel fuel has become a viable alternative to petro-diesel fuel. Many local government agencies have already taken advantage of the increased availability of bio-diesel. The cities of Ventura, El Segundo, and Inglewood have recently introduced bio-diesel to their respective heavy duty fleets.

Last year the Transportation Branch contracted with an outside firm to conduct a study to evaluate the viability of using bio-diesel fuel for the District’s heavy duty fleet. The analysis included a review of the risks, costs, and benefits associated with utilizing bio-diesel. Based on this analysis, the Branch is implementing a 6-month pilot that will include both yellow (school buses) and white (trucks) fleet vehicles.

Any amount of bio-diesel helps lower most emissions. According to the U.S. Environmental Protection Agency, the use of a B20 blend in a conventional heavy duty diesel engine results in reductions of particulate matter, hydrocarbons, and carbon monoxide compared to emissions from regular petro-diesel fuel (Table 1). In addition, the exhaust emissions of sulfur oxides and sulfates (major components of acid rain) from bio-diesel are also reduced.

<table>
<thead>
<tr>
<th>Emission Type</th>
<th>Percent Change in Emissions %</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nitrogen Oxide (NOx)</td>
<td>+ 2.0 %</td>
</tr>
<tr>
<td>Particulate Matter</td>
<td>- 10.1%</td>
</tr>
<tr>
<td>Hydrocarbons</td>
<td>- 21.1 %</td>
</tr>
<tr>
<td>Carbon Monoxide</td>
<td>- 11.0 %</td>
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**Pilot Information**

The Bio-Diesel Pilot Project is consistent with the Board of Education’s directive to pursue environmentally-friendly policies as appropriate. The pilot builds on the success of the Compressed Natural Gas (CNG) school bus purchases and infrastructure, further solidifying the District as a vanguard in the effort to reduce the negative impacts of pollution on school children. The Branch anticipates that the pilot will begin by December 2008, with an initial duration of approximately 6 months. The vehicles chosen are 25 heavy duty diesel trucks from
the Materiel Management Branch - Truck Operations and 93 heavy duty diesel school buses from the Transportation Branch (Chart 2). The 25 heavy duty diesel trucks represent about 15.5% of the diesel truck fleet, and the 93 heavy duty diesel buses represent about 8.4% of the diesel school bus fleet.

Currently, due to a lack of on-site “in-ground” fueling stations at the Pico Rivera warehouse facility, Truck Operations vehicles drive to fuel at the Business Division Garage, Sun Valley Garage, or Gardena Garage. The school buses from the Transportation Branch’s Alameda Garage are currently fueled by wet-lining (Diagram 2). In addition to offering a predictable and reliable source of fuel, wet-lining eliminates the need to store bio-diesel fuel on-site. This eliminates cleaning and other maintenance costs associated with storing bio-diesel. However, wet-line fueling does come with an added cost per gallon associated with delivery.
Bus drivers should not notice a difference in fueling, as overnight wet-line fueling schedules will remain unchanged. The truck drivers, on the other hand, may notice significant changes as a result of no longer having to drive off-site for fuel. The District should benefit from reduced “deadhead” time and miles associated with off-site fueling. This potentially increases time available for additional deliveries. Table 2 provides a summary of the fueling before and after pilot implementation.

<table>
<thead>
<tr>
<th>Table 2 – Fueling Summary</th>
</tr>
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<tbody>
<tr>
<td><strong>Branch</strong></td>
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<tr>
<td><strong>Location</strong></td>
</tr>
<tr>
<td><strong>Current Method of Fueling</strong></td>
</tr>
<tr>
<td><strong>Current Fuel Type</strong></td>
</tr>
<tr>
<td><strong>Pilot Method of Fueling</strong></td>
</tr>
<tr>
<td><strong>Pilot Fuel Type</strong></td>
</tr>
</tbody>
</table>

**Bio-Diesel Fuel Costs**

Bio-diesel fuel costs fluctuate depending mainly on the petroleum diesel market, and to some extent, the cost of soybean oil. Although the market price of B20 fluctuates, pricing is comparable to the market price of petro-diesel. Chart 3 shows a strong correlation between the nationwide retail price of petro-diesel and bio-diesel during the past few years. For the week of August 11, 2008, the District's price for petro-diesel was $3.29, which is about 5 to 8 cents per gallon lower than the price of a B20 bio-diesel blend. Cost savings is not an expected outcome from the use of bio-diesel fuel.

![Chart 3 – Average US Retail Fuel Prices per Gallon: Petro-diesel and Bio-diesel B20 Blend](image-url)
Pilot Challenges and Goal Evaluations

The pilot presents certain challenges to both the Transportation Branch and Materiel Management Branch. Although the selected bio-diesel fuel blend has shown to be generally compatible with engine components, the introduction of the blend into the District’s fleet may affect fuel and emissions components, reduce engine efficiency, and require operational adjustments. The Branch will gauge its effectiveness in addressing these challenges through a systematic gathering and analyzing of maintenance cost data that is directly attributable to the pilot.

The primary goals of the pilot are to lower fleet emissions and maintain the existing vehicle “in-service” rate. The vehicle in-service rate measures the Branch’s efficiency in servicing and maintaining the District’s vehicle fleet to ensure operational readiness in support of instructional programs. Accordingly, pilot vehicles will be measured against the Branch’s in-service rate of 93.5% for buses and 96% for other (non-bus) District vehicles (Chart 4). The Branch has consistently met its in-service rate goal (Chart 5).
Bio-diesel fuel usage can lead to fuel filter clog when a petro-diesel engine is first introduced to the alternative fuel. The bio-diesel fuel dislodges particles and rust that may have built up on the inside of the fuel tank as a result of petro-diesel use. The fuel filter may need to be changed within the first few weeks or months after use, usually after the first 600-800 miles traveled after switching to the bio-diesel fuel blend. However, after the fuel system is “cleaned,” the fuel filter should no longer clog. The exact effect of this “cleaning” on District vehicles remains unknown at this time. Fuel filter replacement comprises most of the capital investment required for the pilot. The replacement cost of fuel filters for pilot vehicles is about $5,000 (includes parts and labor).

Bio-diesel fuel softens and degrades certain types of elastomers and natural rubber compounds over time. Using high percent blends can impact fuel system components (primarily fuel hoses and fuel pump seals) that contain elastomer compounds that are incompatible with bio-diesel. Manufacturers recommend that natural or butyl rubbers not be allowed to come in contact with pure bio-diesel. It is for these reasons that the pilot is utilizing a 20% bio-diesel and 80% petro-diesel blend.

The use of a bio-diesel blend may also decrease power, torque, and fuel economy by approximately 1-2%. The advanced age of certain pilot vehicles may add to the performance decrease. Bio-diesel fuel increases the emission of NOx by about 2%. Further, bio-diesel may contain small but problematic quantities of water.

Another consideration is the effect of bio-diesel on pilot vehicles’ particulate matter traps. A particulate matter trap is a ceramic filter within the exhaust system of a diesel engine that captures particulates before they can enter the atmosphere. While there does not appear to be strong evidence that bio-diesel will clog a particulate matter trap, the exact effects on the District’s fleet remains to be seen.

Additionally, the particulate matter traps the District received from Air Quality Management District (AQMD) are not verified for bio-diesel fuel use. The traps are only verified for use with ultra low sulfur diesel fuel. An exemption or waiver from the California Air Resources Board (CARB) may be required to legally operate vehicles powered by bio-diesel fuel.

The vehicle “in-service” rate encompasses the maintenance and repair costs, and will play a major role in deciding the overall direction of the pilot at the conclusion of its initial six-month period. Using the “in-service” rate will enable the Branch to measure the pilot’s effect on the aggregate cost of parts such as fuel filters, fuel lines, fuel injectors, and fuel pumps. Labor costs will be captured by tracking labor hours and road calls associated with the pilot.
### Conclusion

The Transportation Branch is continually pursuing cost-efficient use of existing resources through procurement strategies, use of alternative fuels, and reduced consumption. The Bio-Diesel Pilot Program is consistent with the Branch’s goals of increasing the number of alternative fueled and hybrid vehicles, engaging in proactive environmental management, and procuring clean fuel technologies.

Implementation of the Bio-Diesel Pilot Program will continue to align the District as a leader in environmental stewardship. At this time, however, this initiative should be primarily thought of as pursuing environmental priorities rather than a mechanism to reduce fuel and maintenance costs.

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A: Source: A Comprehensive Analysis of Biodiesel Impacts on Exhaust Emissions, Environmental Protection Agency, October 2002
