

**CITY OF OAKLAND
AGENDA REPORT**

OFFICE OF THE CITY CLERK

TO: Office of the City Administrator
ATTN: Deborah Edgerly
FROM: Public Works Agency
DATE: December 13, 2005

2005 NOV 29 PM 1:59

**RE: STATUS REPORT ON THE CITY'S ALTERNATIVE TRANSPORTATION FUELS
PROGRAM FOR FLEET VEHICLES AND EQUIPMENT**

SUMMARY

This is a status report from the Public Works Agency (PWA), Equipment Services Division (ESD) on the City's alternative fuel program for fleet vehicles. Included in this report are the results of a six-month pilot project to study the fiscal and mechanical effects of using biodiesel to fuel five City-owned refuse packer trucks and five diesel-powered dump trucks; the preliminary results of the Port of Oakland's pilot project using aqueous diesel in heavy-duty tractor trucks; and the Equipment Services Division's plans for alternative fuel-powered vehicles in the City fleet.

FISCAL IMPACT

Since this report is informational only, no fiscal impacts are included.

BACKGROUND

Congress passed the Energy Policy Act of 1992 (EPAcT) with the goals of enhancing our nation's energy security and improving the environment. Officially known as Public Law 102-486, EPAcT includes provisions on all aspects of energy supply and demand, including energy efficiency, alternative fuels, and renewable energy, as well as more traditional forms of energy such as coal, oil, and nuclear power.

Several parts, or titles, of EPAcT were designed to encourage use of "alternative fuels," i.e., those that are substantially non-petroleum, which could help reduce U.S. dependence on imported oil for transportation. As defined by the EPAcT, the U. S. Department of Energy (DOE) currently recognizes the following as alternative fuels:

- Mixtures containing 85% or more by volume of alcohol fuel, including methanol and denatured ethanol
- Natural gas (compressed or liquefied)
- Liquefied petroleum gas (propane) (LPG)
- Hydrogen
- Coal-derived liquid fuels
- Fuels derived from biological materials

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- Electricity (including electricity from solar energy)
- 100% biodiesel (B100)

Council Member Nancy Nadel, in conjunction with the American Lung Association and the ESD, formulated administrative policies that address the management, operation and procurement of fleet vehicles in order to continue improving the energy efficiency of its fleets, reduce emissions from the fleet, and increase the capacity of the fleet to save the City money; that ensure the City purchase vehicles powered by alternative fuel sources whenever financially possible; and that direct Oakland to continue to actively pursue federal, state, and other incentive programs related to clean air and energy efficiency. These policies are known as the "Green Fleet" resolution (77842 C.M.S.), which was adopted by the City Council on June 3, 2003.

The "Green Fleet" resolution codified the steps taken by the Public Works Agency since 1991 to reduce greenhouse gas emissions, increase the fleet's fuel efficiency, and improve local air quality.

The PWA ESD has worked aggressively to obtain funding for its alternative fuel vehicle program. Since 1991, the ESD has been awarded cash grants in excess of \$1.1 million to support the acquisition or conversion of alternative fuel vehicles and their related infrastructure. In addition, in 1992 Oakland was the only city in the Bay Area to be awarded a Pacific Gas and Electric Company \$500,000 compressed natural gas (CNG) fueling facility, which was placed at the City's Municipal Service Center. Currently, the Public Works Agency is working with the Port of Oakland to construct a second compressed natural gas refueling facility in the downtown area.

During 1993 the DOE formulated the Clean Cities Program with the overall goal to "promote and encourage the use of alternative fuel vehicles in significant quantities and to develop and support refueling and maintenance infrastructures." In response, Oakland, along with other Bay Area local, county, and federal government agencies, and PG&E, formed the Bay Area Clean Air Vehicle Coalition. This resulted in Oakland being designated a DOE Clean City in 1994. In 2002, East Bay Clean Cities recognized the City's leadership position in advancing clean air vehicles by awarding its "Clean Air Champion Award" to the City's Equipment Services Manager.

The ESD continues to actively seek grants, rebates and incentives to reduce the costs of acquiring alternative fuel vehicles and their refueling/recharging infrastructure. The City has received grants to participate in electric vehicle, LPG and CNG demonstration programs; to assist in the construction/placement of CNG and LPG refueling and electric recharging infrastructure; and as incentives to purchase alternative fuel vehicles.

In planning for alternative fuel vehicle acquisitions, the ESD searches for grant, rebate and incentive programs from:

California Energy Commission
California Air Resources Board
Alameda County Congestion Management Association
Bay Area Air Quality Management District

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Pacific Gas and Electric Company
 US Department of Energy Clean Cities Program
 East Bay Clean Cities Coalition
 Manufacturer rebates/incentives

In 2005, the ESD was awarded a grant for \$106,000 grant to upgrade the engines in the acquisition of one 26-yard garbage packer and one street sweeper from diesel power to compressed natural gas, and a \$48,000 grant to install diesel oxidation catalysts on select diesel-powered vehicles.

KEY ISSUES AND IMPACTS

The City of Oakland's ESD continues to maintain its leadership position in advancing the use of alternative fuel vehicles and related infrastructure. Currently, 14% of the City's vehicle fleet is powered by an alternative fuel:

CITY VEHICLES BY ALTERNATIVE FUEL TYPE		
Description	Type of Fuel	No. Units
Compact sedan	CNG	73
Mid-sized sedan	Bifuel CNG/Unleaded	19
Cargo van	CNG	60
Sidewalk scrubber and forklift	Propane	14
Heavy-duty 4-yard dump truck	CNG	7
Medium-duty pickup truck	CNG	7
Light-duty pickup truck	CNG	4
Subcompact SUV	Electric	4
Forklift	CNG	2
Street sweeper	CNG	1
Miscellaneous small equipment	Electric	3
TOTAL		194

Oakland Biodiesel Pilot

As part of its mission to explore opportunities to reduce vehicle emissions and run a cleaner fleet, the ESD undertook a six-month pilot project to study the effects of a blend of 20% biodiesel (a diesel-like fuel derived from vegetable oil or other renewable sources) and 80% low-sulfur diesel (B20) in selected fleet vehicles.

Ten City-owned vehicles were tested for a six-month period using B20 biodiesel. The vehicles included five dump trucks (one 2000-model year 10-yard dump and four 2001-model year 14-yard dumps) and five refuse packer trucks (ranging in age from 1994 to 2003 model years). A vehicle opacity (smoke) test was taken on each vehicle before the project began, midway during the project, and at completion of the project. For testing purposes a 1,000 gallon stand alone mobile fuel tank was rented for this project.

The results of the pilot project were varied—vehicles showed widely varying degrees of emissions increases and decreases. Four of the five dump trucks showed increases in opacity during and at the

end of the test (see *Figure 1*). Three of the five refuse packers showed decreases in opacity ranging from 32% to 60%. The two remaining packers showed significant increases (see *Figure 2*).

FIGURE 1

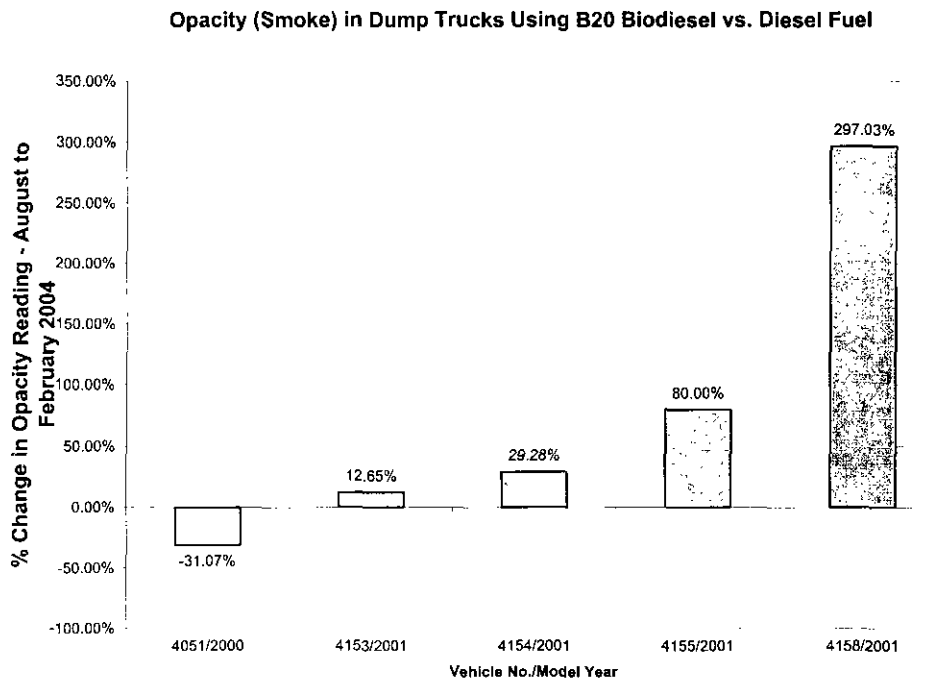
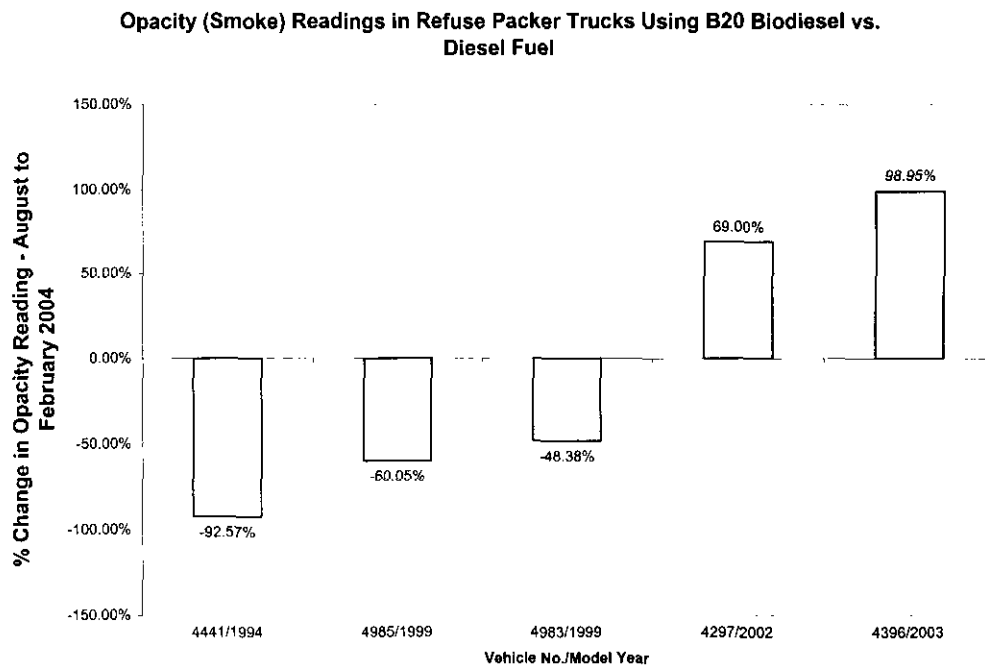


FIGURE 2



The age of the vehicle seemed to be a factor in whether opacity increased or decreased. The older vehicles showed opacity decreases, with the oldest vehicle (a 1994 refuse packer) showing the greatest decrease; the newer vehicles showed opacity increases.

Diesel engine technology has made significant progress in fuel efficiency and emissions reductions in recent years. Newer engines have been manufactured to adhere to stricter emission control, and may therefore show a lesser degree of emissions reductions with alternative fuels when compared to older, more polluting vehicles.

Biodiesel Pros and Cons

Biodiesel is a truly renewable petroleum displacement fuel that provides measurable greenhouse gas benefits. Based on data compiled by the National Renewal Energy Laboratory in Golden, Colorado, as the proportion of biodiesel as a blend with diesel fuel increases, particulate matter (PM), carbon dioxide and hydrocarbon emissions decrease proportionately. The converse is true, however, when evaluating biodiesel's effect on nitrogen oxides (NO_x)—as the proportion of biodiesel increases, NO_x increase proportionally.

In addition, using biodiesel has adverse mechanical effects. In a September 2004 presentation to the California Air Resources Board (ARB), the following were noted as characteristic problem areas for biodiesel:

Characteristic	Consequences for the Fuel Injected Engine (FIE)
Free glycerin	Corrosion, sediments, lacquering
Alkali (Na+K, Ca+Mg)	Sediment; pump and injector failure
Cold flow	Shortened system life, poor atomization
Aging Products (from Insufficient Oxidative Stability)	
Polymers, insoluble	<ul style="list-style-type: none"> • Filter clogging • Deposit formation inside FIE • Seizure of moving parts • Injection coking
Polymers, soluble	<ul style="list-style-type: none"> • Resins formed inside FIE
Aging acids	<ul style="list-style-type: none"> • Corrosion of metal parts • Soap formation with metal ions from wear or corrosion
Peroxides	<ul style="list-style-type: none"> • Embrittlement of elastomers

The City of Berkeley recently discontinued use of both B100 (100% biodiesel) and B20 (20% biodiesel/80% diesel blend) in its diesel fleet as a result of experiencing many of the problems listed in the chart above. Concerns of fuel stability and durability prevent many diesel engine manufacturers from certifying their engines for biodiesel blends greater than 5%.

In addition, biodiesel has a lower energy density than petroleum diesel (123,000 vs. 140,000 Btu/gallon), more oxygen (10 – 12% by weight), and a slightly higher cetane number than petroleum diesel. These factors result in a loss of power and fuel efficiency.

The greatest hurdle to using biodiesel fuel is the cost. In fiscal year 2004-05, the City used 368,798 gallons of diesel fuel at a cost of \$717,264. Wholesale No. 2 low sulfur diesel fuel costs ranged from \$1.57 per gallon in July 2004 to a high of \$2.21 per gallon in April 2005. (As of October 10, 2005, No. 2 low sulfur diesel costs \$2.79 per gallon wholesale.) Added to the cost of diesel fuel is the cost for biodiesel—approximately \$0.54 per gallon for B20, and \$1.35 per gallon for B100.

Escalating fuel costs and a static fuel budget, along with the mechanical problems associated with the use of biodiesel, make it impractical at this time to consider converting a portion of the fleet to biodiesel use. The ESD will pursue other avenues to reduce PMs and NO_x in diesel engine applications, such as using diesel oxidation catalysts, automatic engine shutoffs to reduce engine idling, and other developing technology.

Port of Oakland/Horizon Lines Aqueous Diesel Project

The Lubrizol Corporation developed the PuriNOx™ Technology, a low-emission diesel fuel system that combines proprietary PuriNOx™ additive chemistry, blending unit and emulsification. Fuel marketer and independent distributor partners use the special blending system, along with no. 2 diesel fuel, purified water and the fuel additive to mix a safe, stable formulation for use in diesel engines.

The PuriNOx™ Technology is proven to reduce both PM and NO_x in diesel engines, as stated by the California ARB:

"The ARB has verified Lubrizol's PuriNOx™ for 1988 through 2003 model year diesel engines used in on-road applications. PuriNOx™ is an emulsified diesel fuel which will achieve at least 50 percent reduction in PM and 15 percent reduction of NO_x."

The Port of Oakland and Horizon Lines, the ocean container shipping company, just concluded a pilot program in which Horizon agreed to dedicate 12 diesel-powered transport trucks with 1990 model year Cummins engines to the project. Six of the trucks were retrofitted with a diesel oxidation catalyst, and 8 trucks were fueled exclusively with aqueous diesel for the duration of the project. Horizon used 60,809 gallons of PuriNOx™ from November 2003 to August 2005, with the cost differential between diesel and PuriNOx™ ranging from \$.04 to \$.42 per gallon. Rental of the special fueling tank cost \$450 per month, rising to \$490 near the end of the program.

Horizon Lines noted a loss of approximately 20% power when using PuriNOx™, but overall was satisfied with the mechanical performance of the fuel. Horizon, however, could not continue to use aqueous diesel in its fleet without subsidy because of the cost and has therefore discontinued use of PuriNOx™.

Compressed Natural Gas (CNG)

The City currently has 173 vehicles powered by CNG. The City has used CNG as an alternative vehicle fuel since 1992, and in 2002 made a commitment to continue its use of CNG by purchasing the refueling station built at the City's Municipal Service Center. Oakland is currently working with the Port of Oakland to construct a second CNG refueling station near Jack London Square, which will allow the City to expand its use of CNG to vehicles that are garaged in the downtown area.

Compressed natural gas, "at the pump", costs have remained a consistent \$1.40 per equivalent gallon in fiscal year 2004-05. Fuel savings can exceed \$500 annually per vehicle when compared to gasoline, resulting in significant savings to the City. The United States is virtually self-sufficient in the production of natural gas, thereby reducing our nation's dependence on foreign oil.

The use of compressed natural gas releases up to 95% less air pollution from the tailpipe exhaust than gasoline. Carbon monoxide emissions are cut by 95%, hydrocarbon emissions by 80% and nitrogen oxides by 30%, making CNG one of the cleanest fuel options available. Compressed natural gas is also considered one of the pathway technologies to developing hydrogen fuel cell vehicles and infrastructure.

Electric Vehicles

The City currently has 7 electric zero emission vehicles (ZEV) in its fleet. Electric vehicles were in extremely limited production for several years; however, major manufacturers have ceased to produce dedicated electric vehicles because of lack of refueling/charging infrastructure, low mileage range, and smaller carrying capacity than with similar-sized vehicles. Some manufacturers produce neighborhood electric vehicles (NEVs), which use similar battery technology and are often used in limited on-road fleet applications. NEVs are zero emission vehicles, but most do not satisfy EPA's requirements for fleets. Until manufacturers overcome the problems associated with electric vehicles and make them available for fleet use, the ESD does not consider expanding the City's electric vehicle fleet to be a viable option.

Gasoline-Electric Hybrid

Gasoline-electric hybrid engines are relatively new to the alternative technology venue, becoming available to general consumers in 1999 with Honda's two-door Insight, and in 2000 with Toyota's Prius.

Alternative technology vehicles (ATV) cannot be officially classified as alternative fuel vehicles, but they use technology other than a straight internal combustion engine. ATVs are environmentally friendly and fuel efficient, and usually employ some type of battery-electric technology. Hybrid electric vehicles (HEVs), neighborhood electric vehicles or low speed vehicles (NEVs/LSVs), and electric bicycles are all considered by DOE to be ATVs. Fuel cell vehicles (FCVs) are also ATVs.

Vehicle incentives and grants are available from federal and state agencies for the acquisition of ATVs. The ESD continues to explore opportunities to place both AFVs and ATVs in the City's fleet wherever practical and cost effective.

Hydrogen Fuel Cell

In September 2003, the U.S. DOE unveiled the expanded FreedomCAR Partnership, which was originally established in January 2002. The CAR in FreedomCAR stands for Cooperative Automotive Research. The Partnership is an effort to examine the pre-competitive, high-risk research needed to develop the component and infrastructure technologies necessary to enable a full range of affordable cars and light trucks, and the requisite fueling infrastructure that will reduce the dependence of the nation's personal transportation system on imported oil and minimize harmful vehicle emissions, without sacrificing freedom of mobility and freedom of vehicle choice.

The federal government envisions fuel cell vehicles that are fueled with hydrogen, run far more efficiently than internal combustion engines, and emit nothing but water vapor. The Partnership also wants Americans to retain the freedom to choose the car or light truck that suits their needs and the freedom to drive where they want, when they want.

SUSTAINABLE OPPORTUNITIES

Economic:

Several studies have demonstrated that improving air quality has a positive effect on property values. Furthermore, decreasing vehicle emissions will improve public health, which will also have a positive effect on the economy. Clean air is a major priority for US cities and consumer demand for clean air vehicles is growing.

Environmental:

Using cleaner burning fuels will reduce emissions of hazardous compounds that have been linked to increased rates of cancer and asthma. Cleaner burning fuels will also decrease greenhouse gasses, which most scientists agree are a major contributor to global warming.

Social Equity:

The areas most affected by vehicle emissions are neighborhoods close to freeways and major transportation routes—areas that also tend to be lower-income. This project advances social equity by decreasing vehicle emissions in disadvantaged areas.

DISABILITY AND SENIOR CITIZEN ACCESS

Acceptance of this report does not have any impact on the Americans with Disabilities Act, the Older Americans Act, and other applicable laws.

RECOMMENDATION AND RATIONALE

The City's "Green Fleet" resolution requires that the Public Works Agency consider alternative fuel vehicles first when planning acquisitions for the City's non-emergency fleet. Where practical and within the budgeted amount for vehicle acquisitions, AFVs are the choice for fleet vehicles. Although many of these alternative pilots did not prove to be viable, the fact that PWA pursued these pilot projects demonstrates its commitment to pursue lower emissions and cleaner air. The Equipment

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Services Division of the Public Works Agency will therefore continue to explore opportunities to displace gasoline- and diesel-powered vehicles in the City's fleet with cleaner burning AFVs wherever practicable. Furthermore, technology advancements in both gasoline- and diesel-powered vehicles continue to burn cleaner and reduce emissions.

ACTION REQUESTED OF THE CITY COUNCIL

As this is an informational only report, no action is requested of the City Council.

Respectfully submitted,

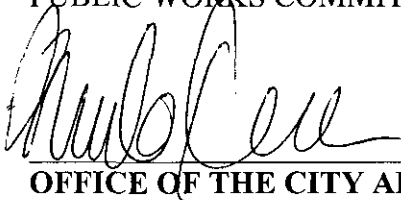


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APPROVED AND FORWARDED TO THE
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OFFICE OF THE CITY ADMINISTRATOR