DOE/CH10093-171 DE9216426
March 1993

Tomorrow's Energy Today for Cities and Counties: The Clean Air Act: What It Means for Municipal Fleets[1]

U.S. Department of Energy[2]

Tough new emissions standards will soon take effect. And beginning in 1998, in metropolitan areas with serious or extreme air pollution problems, 30% of new vehicles purchased for municipal fleets must be "clean fueled." Many of these vehicles will run on alternative fuels.

The Clean Air Act Amendments of 1990 specifically target vehicle fleets. Today, fleet managers all over the country are taking account of how this will affect them.

The amendments mandate a broad range of new requirements aimed at improving air quality. The goal is for air quality in all metropolitan areas in the country to eventually meet federal standards, which are based on human health concerns. The standards will list maximum acceptable levels (in a specified time period) of nitrogen oxides, carbon monoxide, hydrocarbons, sulfur oxides, ozone, and suspended particulates.

Metropolitan areas that fail to meet federal standards will be required to comply with state plans to improve air quality. Areas that fail to comply with the state plans will risk the loss of federal funds for constructing new highways and other sanctions.

Beginning in 1998, greatly reduced emissions levels will be required for fleet vehicles. And fleet operators will be encouraged to use clean, alternative fuels.

CLEAN-FUELED VEHICLES WILL BE REQUIRED FOR FLEETS

In 1998, 30% of new vehicles purchased for fleets in 22 metropolitan areas (Figure 1) that have serious or extreme air quality problems must be "clean-fueled vehicles." (Vehicles used for emergency, law enforcement, or off-road applications such as construction are exempt from the fleet provisions of the Clean Air Act Amendments of 1990.) In 1999, the requirement increases to 50% of new purchases, and by 2000, 70% of new vehicles must be clean-fueled vehicles.

Clean-fueled vehicles burn fuels more efficiently than conventional vehicles and will meet emissions standards set by the Environmental Protection Agency (EPA). While it will be possible for redesigned conventional vehicles burning reformulated gasoline to meet these EPA standards, many clean-fueled vehicles will use alternative fuels.

Fleet operators will be able to meet the clean-fueled requirements of the amendments in three ways. First, the operators can purchase new vehicles that meet the minimum standards. Second, the operators can convert older, conventional vehicles to meet the standards. And finally, the operators can redeem credits that they either generate themselves or purchase from other fleet operators.

---

1. This document is DOE/CH10093-171 DE9216426, from the series Tomorrow's Energy Today for Cities and Counties produced for the U.S. Department of Energy. Publication date: March 1993.
2. This document was produced for the U.S. Department of Energy (DOE) by the National Renewable Energy Laboratory, A DOE national laboratory. The document was produced by the Technical Information Program, under the DOE Office of Energy Efficiency and Renewable Energy.

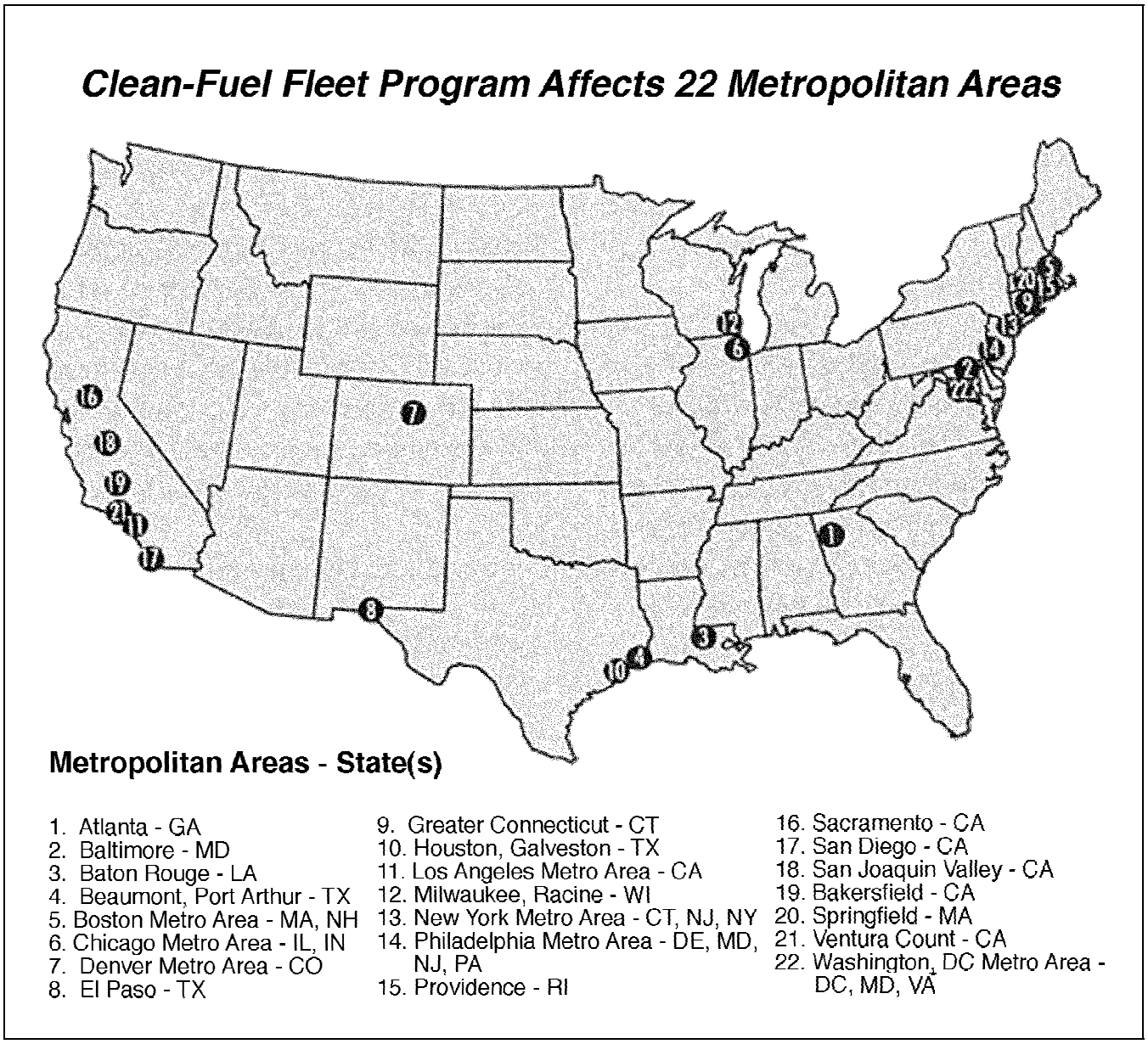

Figure 1. 22 Metropolitan Areas Affected by Clean Air Act Amendments of 1990.

These credits can be generated only by operating vehicles that exceed the minimum EPA standards. Although any vehicle-fuel combination is eligible, the vehicles that the EPA will qualify to earn credits will most likely run on alternative fuels.

ALTERNATIVE FUELS WILL BE ENCOURAGED

The Clean Air Act Amendments of 1990 encourage the use of alternative fuels for both environmental and economic reasons. Alternative fuel vehicles (AFVs), using effective air/fuel ratio controls installed by certified mechanics, have the potential to produce significantly fewer emissions than engines running on gasoline. For example, propane and compressed natural gas are stored under pressure and therefore do not generate evaporative emissions. Propane and natural gas also produce few carbon monoxide emissions than gasoline because they combust more completely inside the engine. Ethanol and methanol also produce fewer carbon monoxide emissions because they are richer in oxygen than is gasoline.

Furthermore, using alternative fuels can help the economy. Because they are mostly produced domestically, alternative fuels will help reduce petroleum imports and address the nation's balance-of-payments

deficit. Local economies can also benefit from the establishment of local distribution and supply networks for alternative fuels.

The Clean Air Act Amendments of 1990 encourage states to establish programs for using alternative fuels and aiding in their distribution. In fact, 13 states and the District of Columbia already require that vehicle fleets use alternative fuels. Another 13 states (not all the same) provide financial incentives for using them.

The amendments also provide federal incentives for fleet operators to use alternative fuels. Fleet vehicles that use alternative fuels will be free to use lanes previously reserved for buses or car pool vehicles. These incentives will be available to all fleet operators, not just to operators of municipal fleets.

CHARACTERISTICS OF ALTERNATIVE FUELS ARE IMPORTANT

From their own experience operating vehicles using alternative fuels, fleet operators have learned the importance of issues such as fuel supply, fuel and maintenance costs, fuel characteristics, and engine performance.

While distribution networks for supplying gasoline and diesel fuels are well established, such is not always the case for alternative fuels. Fuel distribution can greatly affect a fleet operator's costs.

Fuel and maintenance costs are also important. Propane and natural gas are cheaper than gasoline or diesel fuel, while the other alternative fuels are currently more expensive. Perhaps because of lower fuel costs, fleet operators in this country were already operating 360,000 vehicles on propane and compressed natural gas as of 1990. Maintenance costs for oil changes and tune-ups are also lower for vehicles operating on these two alternative fuels. For electric vehicles, labor costs for maintenance are about half those for conventional vehicles.

Fuel characteristics affect the performance of AFVs in ways that can be very important for fleet operators. For example, methanol and ethanol have respectively about one-half and three-quarters the energy density of gasoline. This lower energy density reduces the range a vehicle can travel on an equivalent tank of fuel. Gaseous fuels such as compressed natural gas and propane require bulky, heavy storage cylinders that increase the weight of the vehicles and decrease the payload capacity.

Engine performance can also be affected. For example, early models of electric vehicles accelerated slowly, although acceleration is improving in recent models. On the other hand, vehicles using gaseous fuels may start better in cold weather.

Municipal fleet operators need to take these issues into account when operating AFVs. Distance and payload requirements, operating speeds, outside temperatures, and fueling locations along the route must match vehicle performance.

Today, fleet operators can experiment with demonstration models of all types of AFVs. Most likely, there is at least one combination of vehicle and alternative fuel that will meet each operator's specific needs. The more experience that fleet operators gain on a small scale now, the smoother the transition of an entire fleet to cleaner fuels will be in the future. For many municipal fleet operators, this transition is coming soon.

CLEAN ALTERNATIVE FUELS SPECIFIED IN THE CLEAN AIR ACT AMENDMENTS OF 1990

Compressed Natural Gas

Natural gas composed mostly of methane. Although it can be liquified, it is most commonly used in transportation vehicles in a compressed, gaseous form.

Natural gas has many advantages for use as a vehicular fuel. First, there is a large domestic resource, as the United States is one of the world's largest producers of natural gas. Second, establishing a fuel-delivery system for fleets could be relatively straightforward. Existing municipal gas lines could supply compressing stations, where the gas would in turn be delivered to vehicles. (However, gas lines that supply gas mixed with air would not be suitable.)

Disadvantages include a shorter distance traveled per tank of fuel and potentially higher nitrogen oxide emissions than those from gasoline. For fleet operators, the large size of the gas tank is an important consideration.

Electricity

Electric vehicles (EVs) employ electric motors that are powered by batteries. The batteries are usually recharged overnight while plugged into a 220-volt electric outlet.

EVs have some distinct advantages over conventional vehicles. First they are more energy efficient. According to a study by the Electric Power Research Institute, electric vehicles travel a greater distance per barrel of oil (burned in power plants to generate electricity). Second, emissions during driving are practically zero, so EVs can meet all tailpipe emissions standards. Third, EVs operate very quietly.

On the other hand, EVs are a new technology compared with other types of alternative vehicles (such as those using gaseous fuels), and they are limited by the capabilities of the batteries. Today's batteries limit the range of EVs and take a long time to recharge compared with filling a gas tank. In addition, heating and air conditioning pose a large power drain on batteries, which can further reduce the range of the vehicle.

Nevertheless, battery technology is advancing rapidly as government and industry work to extend vehicle range and reduce recharging times. Other disadvantages of electric vehicles for fleet operators to consider include high initial cost and battery replacement costs.

Ethanol

Also called grain alcohol, ethanol is reduced domestically from the fermentation of grains, sugars, cellulose, or agricultural waste products, or from ethylene, a derivative of the oil refining process.

Ethanol is already widely available as a fuel in the form of "gasohol," a mixture of 10% ethanol and 90% unleaded gasoline. In gasohol, ethanol acts as an oxygenate by adding chemically bonded oxygen to gasoline. Oxygenates reduce carbon monoxide emissions and increase the octane rating of gasoline.

Ethanol has the advantage for fleet operators of requiring few engine modifications. In fact, vehicles are now available on the market that run on varying mixtures of ethanol and gasoline. In addition, vehicles burning ethanol have slightly more power than those burning gasoline.

A disadvantage is that ethanol is currently more expensive than most other alternative fuels. And, like methanol, it can cause difficulty in starting a cold engine unless chemicals are added.

Methanol

Also known as wood alcohol, methanol is made domestically from natural gas, coal, wood, or fermented agricultural wastes.

Methanol has the advantage of providing fleet operators with flexibility. Specially manufactured vehicles available today can run on fuel mixtures ranging from 85% methanol to 100% gasoline. (Vehicles such as these, which run on mixtures of fuels, are called flexible-fuel vehicles.) Few engine modifications are required for engines to run on low concentrations of methanol. Compared with gasoline, methanol also slightly increases the power available.

On the other hand, methanol has the disadvantage of being toxic and corrosive. Fuel supply systems must be designed to prevent people from being exposed to it. Mechanics must be trained to properly handle methanol systems, because the flame is invisible to the human eye. Furthermore, vehicles must be designed to withstand corrosive effects if they are to run on high concentrations of methanol.

Propane

Also known as liquefied petroleum gas, propane is derived from either natural gas or petroleum. Propane is the third most common vehicular fuel today after gasoline and diesel.

When used in vehicles, propane is more comparable in range and octane rating to gasoline than some of the other alternative fuels. Propane-fueled vehicles meet today's current emissions requirements.

On the other hand, vehicles require engine and fuel tank modifications to use propane. A large fuel-storage cylinder is necessary, which takes up room that could be used for cargo. And propane engines may need improvements to meet the 1998 emissions requirements.

Reformulated gasoline

Reformulating gasoline involves removing chemicals that produce evaporative emissions, called aromatics, followed by the addition of an oxygenate, usually methyl tertiary butyl ether (MTBE) or ethanol. The result is a fuel that reduces emissions, but also reduces gas mileage slightly in today's gasoline engines. Furthermore,

reformulation requires additional refining, and therefore costs slightly more than ordinary gasoline.

Many fleet operators will prefer to use reformulated gasoline to meet the minimum EPA standards for clean-fueled vehicles because it presents one of the most economical methods of compliance. For example, operators can take advantage of the same fuel distribution networks that currently exist for ordinary gasoline.

Nevertheless, reformulated gasoline is not a true alternative fuel because it is largely produced from crude oil, and almost half of this country's oil is imported. Reformulated gasoline, therefore, does not have the positive impact on local economies or on the country's trade balance as do the other alternative fuels.

FOR MORE INFORMATION

U.S. Environmental Protection Agency
Bryan Manning
Regulation and Development Support Branch
2565 Plymouth Road
Ann Arbor, MI 48105
(313) 741-7832

Public Technology, Inc.
1301 Pennsylvania Avenue, NW
Washington, DC 20004
(202) 626-2400
A Guidebook for Alternatively-Fueled Vehicles

National Alternative Fuels Hotline
U.S. Department of Energy
Alternative Fuels Program
(800) 423-1DOE

U.S. Department of Energy
Electric and Hybrid Propulsion
1000 Independence Avenue, SW
Washington, DC 20585
(202) 586-8063

Electric Power Research Institute
Electric Transport Program
P.O. Box 10412
Palo Alto, CA 94303
(415) 855-2981

California Energy Commission
Transportation Technology and Fuels Office
1516 Ninth Street, MS-41
Sacramento, CA 95814-5512
(916) 654-4634

EREC
P.O. Box 3048
Merrifield, VA 22116
(800) 523-2929

The Energy Efficiency and Renewable Energy Clearinghouse (EREC) is a service funded by the U.S. Department of Energy to provide general information on renewable energy and energy efficiency.

DOE REGIONAL SUPPORT OFFICES

The DOE Office of Energy Efficiency and Renewable Energy reaches out to the states and private industry through a network of regional support offices. Contact your DOE regional support office for information on energy efficiency and renewable energy technologies.

Atlanta DOE Support Office
730 Peachtree Street NE, Suite 876
Atlanta, GA 30308
(404) 347-2837
(AL, FL, GA, KY, MS, NC, PR, SC, TN; Territory: VI)

Boston DOE Support Office
One Congress Street, 11th Floor
Boston, MA 02114
(617) 565-9700
(CT, MA, ME, NH, RI, VT)

Chicago DOE Support Office
9800 South Cass Avenue
Argonne, IL 60439
(708) 252-2000
(IL, IN, MI, MN, OH, WI)

Dallas DOE Support Office
1420 West Mockingbird Lane, Suite 400
Dallas, TX 75247
(214) 767-7245
(AR, LA, NM, OK, TX)

Denver DOE Support Office
2801 Youngfield Street, Suite 380
Golden, CO 80401
(303) 231-5750
(CO, MT, ND, SD, UT, WY)

Kansas City DOE Support Office
911 Walnut Street, 14th Floor
Kansas City, MO 64106
(816) 426-4784
(IA, KS, MO, NE)

New York DOE Support Office
26 Federal Plaza, Room 3437
New York, NY 10278
(212) 264-1021
(NJ, NY)

Philadelphia DOE Support Office
1880 JFK Boulevard, Suite 501
Philadelphia, PA 19103
(215) 656-6950
(DC, DE, MD, PA, VA, WV)

San Francisco DOE Support Office
1301 Clay Street, Room 1060 North
Oakland, CA 94612
(510) 637-1960
(AZ, CA, HI, NV; Territories: AS, CM, GU, RP)

Seattle DOE Support Office
800 Fifth Avenue, Suite 3950
Seattle, WA 98104
(206) 553-1004
(AK, ID, OR, WA)