

## **ENVIRONMENTALLY PREFERABLE PROCUREMENT: GREENING U.S. STATE GOVERNMENT FLEETS**

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**ABSTRACT.** Since passage of the Energy Policy Act (EPAct) in 1992, the U.S. federal government has imposed procurement restrictions on state government fleets. Regulations, overseen by the Department of Energy (DOE) require that a high percentage of new state fleet acquisitions be “green” alternative fuel vehicles (AFVs). This paper first reviews AFV technologies, advanced technology designs, and alternative fuels. A discussion of the EPAct mandates and other policy incentives for state fleets follows. We present findings of a survey of state fleet managers regarding their compliance obligations. We conclude with a discussion of the recently passed EPAct of 2005 and how its provisions may affect the continued greening of state fleets.

### **INTRODUCTION**

Concerns about dependence on foreign oil as well as petroleum’s adverse environmental impacts keep the issues of vehicle fuels and vehicle fuel efficiency highly salient in the United States. Environmental quality issues also peak interest in vehicle fuel efficiency, alternative fuels, and better technologies. Air pollution is a major issue in the U.S. and vehicle emissions account for a large amount of the carbon monoxide (CO), lead, nitrogen oxides (NO<sub>x</sub>), ground-level ozone (smog), sulfur oxides (SO<sub>2</sub>), and particulate matter in the air. Vehicles that use less gasoline emit fewer pollutants. Also, despite the fact that

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the U.S. is not thus far a party to any international agreement that provides for mandatory reductions in greenhouse gases (GHG), provisions in domestic energy laws do take GHG production into account especially in designation of alternative (non petroleum-based) fuels.

“Green” or environmentally-friendly fleets can be comprised of vehicles that burn alternative fuels, such as propane, compressed natural gas, methanol, ethanol, and biodiesel, that are less polluting than conventional gasoline. Green fleets can also be obtained by using new vehicle technologies, such as hybrid-electric vehicles and plug-in hybrid-electric vehicles, substantially lowering gasoline usage. Other technologies, such as fuel cells, are under pilot testing and undoubtedly will be deployed as they become commercially viable.

Regulation of the nation’s fleet of vehicles has been used in policy efforts to improve the environmental performance of all cars and trucks on U.S. highways as well as to reduce dependency on oil imports. Regulatory efforts have targeted high fuel economy for gasoline and diesel burning vehicles. The largest, albeit disappointing, effort to broadly regulate the entire U.S. fleet came with the imposition of corporate average fuel economy (CAFE) standards in 1975. Regulations have also targeted sub-sectors of the overall U.S. fleet. Government fleets, for instance, have been the object of such regulatory efforts largely because government fleets can be easily and effectively regulated to require attention to fuel efficiency and environmental protection (Langer and Williams, 2002). The Energy Policy Acts (EPAct) of 1992 and 2005 enforced fuel-efficiency and alternative fuel requirements on government fleets in an effort to both improve air quality and to reduce dependence on foreign oil. Requirements of these acts mandate that federal and state governments purchase increasing percentages of green vehicles. Additional impetus for movement toward green fleets has come from clear air protections established by the Clean Air Act (CAA) and subsequent amendments which have resulted in mandated vehicle emissions reductions in many of the country’s largest metropolitan areas. States fleets operating in large cities must consider clean air requirements when provisioning their fleets. In addition to the federal requirement, more than 25 states and dozens of cities have established regulatory frameworks requiring the purchase or conversion of vehicles to alternative fuel vehicles (Nesbitt and Sperling, 2001).

This paper explores how state government fleets are complying with federal green fleet guidelines. The paper begins with a discussion of the role of technology and fuels in green fleets. A discussion of the federal policy framework for state fleet regulation follows. We present findings of a survey of state fleet managers regarding their compliance obligations under EPCa. We conclude with a discussion of the recently passed EPCa of 2005 and how its provisions may affect the continued greening of state fleets.

### **WHAT ARE GREEN FLEETS?**

Green fleets are comprised, at least in part, by green vehicles. Green vehicles are those that are environmentally more benign than conventional gasoline or diesel vehicles. Green vehicles have high fuel economy. They may also be able to consume non petroleum-based alternative fuels that reduce air emissions. Greening fleets means increasingly composing them with higher numbers of green vehicles as well as employing energy efficiency strategies. These strategies may include reducing fleet size, training drivers to drive more efficiently, improving tire and lubricant quality, and reducing the overall number of miles driven by the fleet (Langer and Williams, 2002).

Green vehicles have been defined somewhat differently although all definitions include some aggregate of manufacturing impacts, emissions, and fuel economy. The Clean Car Campaign, a coalition of national, regional, and state environmental organizations working for a shift in the automobile industry, has established standards to designate clean cars. These standards seek to promote fuel efficiency, reduced emissions, clean manufacturing and recycling. The Campaign states its standards as:

*Fuel Efficiency and Reduced Auto Emissions.* The standard calls for fuel efficiency of at least 50% better than that achieved by other vehicles in a vehicle class and tailpipe emissions which meet California's "super ultra low emitting vehicle" (SULEV) standard. These targets can be achieved through a combination of innovative technologies such as hybrid gasoline-electric powertrains, durable lightweight materials and advanced emission controls and fuels.

*Clean Manufacturing and Recycling.* The standard also calls for best-in-class painting/coating practices, the elimination of heavy metals and other substances of concern, and design for recyclability and maximum use of recycled materials. These targets can be achieved through changes in design, use of nontoxic recyclable materials, and best-in-class manufacturing techniques (Clean Car Campaign, 2003).

The American Council for an Energy-Efficient Economy (ACEEE) publishes the ACEEE's Greenbook which scores cars on a scale of 0 to 100 based on emissions and fuel economy tests. The higher the score the greener the car. ACEEE's standards are based on a mix of fuel economy, toxic emissions ratings, and contribution to GHG levels (American Council for an Energy-Efficient Economy, 2006).

Alternative fuels and the vehicles that use them play a role in green fleets. The most extensive policy efforts thus far have addressed the issue of alternative fuels. Alternative fuels, such as propane, compressed natural gas, methanol, ethanol, and biodiesel, offer reductions in emissions of criteria pollutants, GHGs, and air toxics relative to gasoline fuel (Langer and Williams, 2002). Green fleets also take advantage of advanced vehicle technology designs to accomplish the goals of fuel efficiency and emission reduction. Each of these is discussed in more detail below.

### **Hybrid Electric Vehicles**

This advanced technology design's primary characteristic is fuel economy. High fuel economy both decreases fuel use and drastically lowers emissions. These vehicles typically combine a traditional gasoline internal combustion engine with a battery and electric motor which assists the internal combustion engine or takes over completely for the gasoline engine. Hybrids use the energy generated by braking to recharge the battery (regenerative braking). Most hybrids have an automatic idle that shuts the gasoline engine off while the vehicle is stopped. By using the electric motor to supplement the gasoline engine, hybrids obtain better fuel efficiency and emit much less pollution than conventional vehicles.

There are three basic types of hybrids: parallel, series, and split. Parallel hybrids are configured so that both the engine and the electric motor are connected to the transmission so that either can supply power

to the wheels. In a series hybrid, the engine drives the generator which can either charge the batteries or power the electric motor which moves the wheels. In a split hybrid, the engine drives one axle while the electric motor drives the other (U.S. Department of Energy, 2005a).

Hybrids can be further enhanced by making them “plug-ins.” With some modifications, hybrids can be plugged into a wall socket to recharge an additional battery and then run totally on that battery until it is discharged before shifting to standard hybrid operation. In addition, hybrids can be made to run as flexible fuel vehicles so that they could operate on ethanol or other renewable fuels (Plug-In Partners, 2005).

While the regulatory framework promoting green fleets is discussed more thoroughly below, hybrid vehicles as currently manufactured are not compliant with either EPA 1992 or EPA 2005 for federal fleets. However, DOE is currently considering the implication of EPA 2005 on state fleet requirements.

Aside from saving fuel, hybrids dramatically lower tailpipe emissions making them ideal vehicles for cities or counties listed as nonattainment areas under the 1990 Clean Air Act Amendments. In comparisons between a 2004 Chevy Malibu and a 2004 Prius, the hybrid emitted 92% less non-methane organic gases, 76% less carbon monoxide, 90% less nitrogen oxides, 50% less particulate matter, and 49% less carbon dioxide (Center for A New American Dream, 2004). Because of these environmental benefits, many states have incentive programs in place to encourage the purchase of hybrids. In Virginia and Utah, hybrids are allowed to use high-occupancy lanes regardless of the number of people in the vehicle. Similar plans are under consideration in California, Colorado, Georgia, and Florida. In addition, the Federal government provides a tax break for those who purchase hybrids (Alvord, 2005).

### **Biodiesel**

Biodiesel is a renewable fuel made by processing vegetable oils, fats, or greases with alcohol. The percentage of vegetable oil in the fuel mix is indicated by denoting the fuel by the percentage of biodiesel used such as B20 (twenty percent vegetable oil) or B100 (pure biodiesel). Pure biodiesel is nontoxic, biodegradable, and is designated an alternative fuel by the Department of Energy (DOE). Using biodiesel in conventional diesel engines can reduce toxic emissions. Particulate matter, for

instance, is reduced by 94% by burning pure biodiesel as opposed to regular diesel while B20 will reduce particulate emissions by 27%. Most diesel engines can burn B5 without any engine modifications; however, higher level blends typically require some modification of the fuel system. Most of the modifications are due to the fact that biodiesel is a solvent. B100 can cause rubber and other components to fail thus necessitating engine modifications. Biodiesel can be used in light-, medium-, and heavy-duty fleets. Fueling with biodiesel makes a conventional vehicle an alternate fuel vehicle. Biodiesel is currently being used in school and transit buses, refuse haulers, military support vehicles, farm equipment, and national park maintenance vehicles. In January 2001, DOE published a final rule on the use of biodiesel to fulfill requirements of EPA Act 1992. This rule allows fleets to fulfill as much as 50% of their AFV vehicle purchase requirements by using biodiesel. The rule allocated one biodiesel fuel use credit (the same as one AFV purchase) for each 450-gallon purchase of B100 (U.S. Department of Energy, 2005b).

### **Ethanol**

Ethanol is the most widely used renewable alternative fuel. Ethanol is made from corn or other starch crops such as barley or wheat that have been converted into sugars and then fermented and distilled. Vehicles fueled with ethanol have lower emissions than those fueled with gasoline. The U.S. blends more than 1.5 billion gallons of ethanol with gasoline each year to produce an E10 fuel mix (90 percent gasoline and 10 percent ethanol). The EPA Act of 1992, however, only provides alternative fuel credits for use of E85 and higher. Vehicles that can fuel with E85 are called flexible fuel vehicles (FFVs). FFVs can run on E85, gasoline, or any mix of the two. As of 2003, about 3 million FFVs had been sold in the U.S. but many auto owners are not aware that they can use ethanol in their cars. FFVs have been used in light-fleet applications including mail delivery and support vehicles for state and municipal governments (U.S. Department of Energy, 2005c). E85 is generally not easily available across the U.S. today. It is available primarily in the Midwest. Minnesota has 170 stations selling E85. It is also widely available in Illinois, Missouri, Kansas, and South Dakota (Durbin, 2005).

### **Electric Vehicles**

Electric vehicles run on batteries. How beneficial they are to the environment depends on what source of power is used to charge the

batteries. That said, they do not have any tailpipe emissions, so they may certainly benefit urban regions with air quality issues associated with mobile sources. There are a limited number of full-sized electric vehicles available commercially (Langer and Williams, 2002).

Neighborhood Electric Vehicles (NEVs) are compact, one to four passenger vehicles powered by rechargeable batteries and electric motors. As of 1998, the National Highway Traffic Safety Administration (NHTSA) officially recognized these vehicles as a form of transportation. Since then, 37 states have passed legislation allowing these vehicles to be driven on roads with posted speed limits of 35 miles per hour or less. NEVs are designed for traveling short distances at slow speeds. NEVs are zero emission vehicles and can recharge by plugging into a 110-volt outlet. NHTSA requires them to have a maximum allowable speed of 25 mph and be equipped with windshields, turn signals, wiper blades, review mirrors, head and tail lights, seatbelts, reflectors, and a parking brake. Despite the fact that NEVs are cleaner and use less fuel than conventional cars, NEVs are not EPA-compliant so they cannot be used to satisfy EPA acquisition requirements (U.S. Department of Energy, 2005d).

#### **Liquefied petroleum gas (LPG)**

Also known as propane, LPG is the most widely available alternative fuel in use today. Propane vehicles emit fewer pollutants than gasoline powered vehicles. Propane vehicles can be equipped with a dedicated fueling system designed only for propane use, or with a bi-fueling system that allows fueling with either propane or gasoline. There are about 350,000 propane vehicles in use in the U.S. today including delivery trucks, school buses, trolleys, shuttles, transit buses, cars, pickup trucks, and vans (U.S. Department of Energy, 2005e).

#### **Compressed Natural Gas (CNG)**

One of the most widely used alternative fuels, CNG is far cleaner than gasoline. CNG reduces particulate matter significantly and gives some NO<sub>x</sub> reduction as well. As is the case with LPG, CNG has an established delivery infrastructure in place. The major problem with CNG, however, is that vehicles using it either have to have larger tanks or deal with reduced driving ranges due to the low energy density of CNG (Langer and Williams, 2002).

Honda has sold the natural gas Civic GX since 1997. Of the 7,000 thus far sold, the vast majority have been to fleet operators of utilities and municipalities. Due to California's troubled air quality, Honda has expanded its offerings of the GX in that market. In 2005, 310 GXs were sold in the state. The Honda GX has the distinction of being the cleanest car that the EPA has ever tested. Only a few highly efficient hybrids including the Toyota Prius, Honda Civic Hybrid, and the Honda Insight have equivalently low emissions (Dixon, 2005).

### **Liquified Natural Gas (LNG)**

In addition to compressed natural gas, natural gas can also be cooled to about 260 degrees below zero to create a liquid state. LNG must be transported in special vessels and stored in specially designed tanks. The cooling and liquefaction process significantly concentrates the gas making it transportable where pipelines are unavailable. The production costs, however, are high enough to have prevented LNG from being widely used commercially (Wikipedia, 2006). LNG can be used in vehicles as a fuel. It is odorless, colorless, noncorrosive, and nontoxic because during the cooling process the fuel is purified, making its methane content almost 100%. This results in an extremely clean burning fuel. While generally not available to the public, LNG is used by fleet managers to fuel fleets (Environmental Protection Agency, 2002).

### **Methanol**

Most commonly derived from natural gas, methanol (or wood alcohol), can be used in flexible fuel vehicles that are designed to run on M85 (a blend of 85% methanol and 15% gasoline). Methanol can also be produced from non-petroleum substances such as coal or biomass. It is not often used, however, because automakers are no longer supplying methanol-powered vehicles. Methanol is also used to make the gasoline additive MBTE (U.S. Department of Energy, 2005f). MBTE use has declined because, although mandated for use by the EPA to produce cleaning burning fuel, MBTE has leaked into the ground water from leading underground storage tanks. It is a known carcinogen and its use has been banned in many states.

### **Hydrogen Fuel Cells**

Currently under research and development, fuel cells offer the promise of nonpolluting and abundant energy for vehicles. Fuel cells



produce electricity from the reaction between the hydrogen and the oxygen from the air. The only byproducts are heat and water. Fuel cell vehicles are not currently available for consumers. Only a few pilot vehicles have been produced to date. Several transit and truck fleets are testing fuel cell powered vehicles. For instance, buses fueled by hydrogen fuel cells have been tested in Chicago and southern California. But much R&D remains to be done before they are ready for widespread deployment (U.S. Department of Energy, 2005g).

A fuel cell operates like a battery. Fuel cells convert chemical energy into electricity by combining oxygen in the air with the hydrogen in the fuel cell. The hydrogen can be produced from a variety of sources including gasoline, methanol, ethanol, natural gas, coal, oil, or a host of renewable energy sources including biomass, wind, solar, and geothermal. It can also be produced by splitting water into oxygen and hydrogen.

## **U.S. FEDERAL POLICY FRAMEWORK**

### **The Clean Air Act (CAA) of 1970**

The CAA required the EPA to develop federal air quality standards (the National Ambient Air Quality Standards or NAAQS), establish emissions standards for motor vehicles, and develop hazardous emission standards for stationary sources. The law gave EPA the authority to regulate fuels and fuel additives, to require automobile inspections for on-the-road vehicles, and to conduct assembly-line testing of exhaust systems. The states were required to prepare emission reduction plans that would achieve the new federal standards within three years. Unfortunately, the law was a bit ambiguous regarding the standards for auto emissions and gave automakers a one year compliance extension if they found technology was not available to meet the new standards. Chrysler, Ford, General Motors, International Harvester, and Volvo each filed for an extension. These appeals, initially denied by EPA, ended up in the courts and were eventually granted (Switzer, 2004).

When the OPEC oil embargo of 1973 brought more pressure on oil use, the federal government relaxed the timeline for auto emissions established by the law. Industry demands combined with OPEC pressure resulted in the passage of the Clean Air Act amendments in 1977 which suspended deadlines for automakers. The 1977 law, however, gave EPA the authority to designate regions in the country that did not meet federal

standards as “nonattainment” areas and to subject them to special air quality requirements (Switzer, 2004).

### **The Energy Policy and Conservation Act of 1975**

Title V of the Energy Policy and Conservation Act of 1975 established Corporate Average Fuel Economy (CAFE) standards for passenger cars and light trucks. The law applied to auto manufacturers’ light-duty vehicle fleets -- cars and light trucks weighing 8,500 pounds or less manufactured in the United States (National Highway Traffic Safety Administration, 2006). The standards, aimed at doubling fuel economy of passenger vehicles within 10 years, required manufacturers to meet a passenger car fleet average of 27.5 mpg by 1985 and light-duty trucks (including sport utility vehicles, minivans, and pickups) a fleet average of 20.7 mpg (Switzer, 2004). Once imposed, CAFE standards rapidly fell out of vogue. Automotive manufacturers lobbied hard against them, and with an upsurge in auto fatalities blamed on smaller light weight cars, Congress lowered CAFE standards for model years 1986 through 1990. In 1990 the passenger car standard was set to 27.5 mpg and it currently remains at this level (National Highway Traffic Safety Administration, 2006).

Unfortunately, Congress did not set a target for improvement in truck fuel economy. That omission was significant. Since 1975 there has been a large shift to light truck class vehicles largely due to the popularity of SUVs. When the law was written, light trucks accounted for only 2 million of the 10 million vehicles sold in the U.S. By 2001, 51 percent of the 17 million vehicles sold that year were classified as light-duty trucks. This change in the vehicle mix, along with an increased number of miles being driven each year, resulted in a reduction of overall fuel economy since the passage of the law (Switzer, 2004). In 2003 the NHTSA issued new light truck standards of 21.0 mpg for model year 2005, 21.6 mpg for model year 2006, and 22.2 mpg for model year 2007 (National Highway Traffic Safety Administration, 2006).

Alternative fuel vehicles (AFV) and dual fuel vehicles are given special consideration under the CAFE standards, through model year 2008. For a dedicated AFV, mileage is determined by dividing its fuel economy by 0.15, thus, a 15 mpg AFV will be rated at 100 mpg for CAFE rules. Dual fuel vehicles, those that can use alternative fuel and gasoline or diesel in some mix, are rated by averaging the fuel economy for both gasoline or diesel and the alternative fuel. So, if a dual fuel

vehicle averages 25 mpg on gasoline and 100 mpg for alternative fuel, the over all CAFE rating would be 40 mpg (National Highway Traffic Safety Administration, 2006).

### **The Clean Air Act Amendments of 1990**

This 700-page law contained several provisions that went far beyond the air quality standards set by the Clean Air Acts of 1970 and 1977. The act established five categories of nonattainment areas and based on the category into which a region fell, established new deadlines by which nonattainment areas needed to meet federal air quality standards. Ground-level ozone was identified as the major air pollutant of concern. Extreme nonattainment areas, such as the Los Angeles/South Coast Air Basin, were given twenty years to clean the air. Nonattainment regions classified as severe were given fifteen years to comply, serious nonattainment areas nine years, moderate areas six years, and marginal areas three years. A portion of the law required state and local planners to include air quality goals in their transportation planning. The goal was to force municipalities to find alternatives to fuel inefficient, highly polluting vehicles (Switzer, 2004).

The original CAA granted California, which has some of the worst air quality in the nation, the authority to set its own vehicle emission standards. Other states began adopting California's stricter standards in 1990. Federal and California standards limit exhaust emissions of five pollutants: smog, nitrogen oxides, carbon monoxide, particulate matter, and formaldehyde. Carbon dioxide, a major greenhouse gas, is not regulated. It, however, is a byproduct of fuel economy (Hybridcars.com, 2005a). For every gallon of gas burned in vehicles, about 20 pounds of carbon dioxide are created (Hinrichs and Kleinbach, 2002).

Federal standards rate cars by Tier and bin number. The lower the bin number, the cleaner the car. The 2004 Toyota Prius rates bin 3 while the Hummer H2 rates bin 11. California standards rate cars such as the Honda Civic Hybrid and Toyota Prius as Partial Zero Emission Vehicle (PZEV). At the low end of the rating scale are electric vehicles with no emission, rated as Zero Emissions Vehicles (ZEV). California standards also include Super-Ultra-Low Emissions Vehicle (SULEV), Ultra Low Emission Vehicle (ULEV), and Low Emission Vehicle (LEV) (Hybridcars.com, 2005a).

### **The Energy Policy Act of 1992**

The 1992 Energy Policy Act (EPAct of 1992), Public Law 102-486, was the most important energy bill of the 1990s, albeit the only major one. Titles III and V of EPAct of 1992 contained provisions to promote the use of alternative fuels. Congress established requirements under EPAct to build fleets of alternative fuel vehicles. The law gave the Department of Energy (DOE) the authority to manage requirements for federal, state and fuel providers, local, and private programs for fleet acquisition. DOE never implemented mandated controls for local or private fleets and instead issued January 2004 a determination that regulation for private and local government fleets to acquire AFVs was not necessary (U.S. Department of Energy, 2005h). The discussion below addresses the EPAct provisions applying to state fleets.

EPAct applies to state fleets of more than 50 vehicles, of which at least 20 must be operating in a single metropolitan area and are capable of being centrally fueled. A vehicle is considered centrally fueled or capable of being centrally fueled if it can be refueled, at least 75% of the time, at a location that is owned, operated, or contracted for by the fleet. Both AFVs and dual-fuel vehicles (those that have separate tanks for two fuels) meet the requirements of the EPAct. The law does not require that state fleet dual-fuel vehicles use alternative fuels (Langer and Williams, 2002). State fleet managers are quite aware of this loop hole.

The EPAct requires that a fixed percentage of state fleet vehicles be AFVs. Vehicles other than light duty vehicles – those weighing 8,500 pounds or more – are not covered by the law. Law enforcement, emergency, and military vehicles are also exempted. State fleets can also qualify for exceptions from the law's requirements for a variety of additional reasons. State fleets that are subject to EPAct are required to acquire a certain percentage of AFVs each model year when adding new vehicles to their fleets. For states, 75% of their new light-duty acquisitions beginning in 2001 need to be AFVs.

The DOE manages this AFV requirement by using a system of credits granted to various vehicle types and alternate fuel use. Fleets earn 1 vehicle credit for every light-duty AFV they buy annually beyond their base requirement. Once a fleet has satisfied its annual requirements, they may also earn 1 credit for every heavy-duty AFV they acquire. The credits generated by these additional acquisitions may be sold or banked for future use. Credit trading is permitted. States are permitted to purchase credits from other covered fleets, sell excess

credits they may have, bank excess credits, or use their own previously baked credits to meet requirements. The Energy Conservation Reauthorization Act of 1998 (ECRA) amended EPCRA for biodiesel use. Biodiesel fuel use earns 1 credit for each 450 gallons of pure biodiesel (the equivalent of 2.250 gallons of B20) for dedicated vehicles and 1 credit (but only up to 50% of the EPCRA requirement) for dual or flexible vehicles. States are also permitted to buy biodiesel fuel blends of B20 or more or to purchase conventionally fueled vehicles and have them converted to AFVs within 4 months of purchase. States are required to report their acquisition activity to DOE each year (U.S. Department of Energy, 2004).

### **The Energy Policy Act of 2005**

After four years in the making, the Energy Policy Act (EPA) of 2005 was passed in August of 2005. While largely a law designed to support fossil fuel producers and nuclear energy, the energy bill included a number of initiatives designed to promote renewable energy and green fleets.

Section 703 of EPA of 2005, subtitled Alternative Compliance for State and Alternative Fuel Provider Fleets, expanded compliance options issued under EPA of 1992 by allowing state fleets to choose a petroleum reduction path instead of acquiring AFVs. State fleets interested in this approach must obtain a waiver from DOE to do this. To qualify for a waiver, fleets must prove that they will achieve gas reductions equivalent to their AFVs running on alternative fuels 100% of the time (U.S. Department of Energy, 2005h). It is not clear at this time if DOE will interpret the use of hybrid vehicles by state fleets as a petroleum reduction path. DOE is currently in the process of writing the guidance on this section of the statute.

### **THE IMPACT OF MANDATORY PURCHASE REQUIREMENTS**

The Energy Information Administration provides information on the status of alternative fueled vehicles in use. As Table 1 shows, in 2004 state fleets had 57,510 AFVs in use. State fleets had their highest percent of their AFV using ethanol (over 32,000) and the second largest percent using CNG (over 12,000). State fleets, however, also had a high count of liquefied petroleum gas (LPG) vehicles (more than 9,000).

Rapid growth rates for AFVs can be seen for state fleets which grew from 33,449 AFVs in 2001 to 36,327 in 2002, to 41,918 in 2003 and to 57,510 in 2004 (Energy Information Administration, 2004). State fleets use of AFVs between 2001 and 2003 increased by 25%. Between 2001 and 2004 state fleets percentage increase in AFVs use was nearly 72%.

**TABLE 1**  
**Number of Onroad Alternative Fuel Vehicles in Use by State Agencies, 2004**

<b>Fuel Type</b>	<b>Light-Duty</b>	<b>Medium-Duty</b>	<b>Heavy-Duty</b>	<b>Total</b>
Compressed Natural Gas (CNG)	10,872	873	511	12,256
Electric	1,372	5	3	1,380
Ethanol (E85)	32,605	197	0	32,802
Hydrogen	1	1	0	2
Liquefied Natural Gas (LNG)	1,591	11	0	1,602
Liquefied Petroleum Gas (LPG)	7,124	1,386	634	9,144
Methanol (M85)	324	0	0	324
<b>TOTAL</b>	<b>53,889</b>	<b>2,473</b>	<b>1,148</b>	<b>57,510</b>

Source: Energy Information Administration, 2005. Form EIA-886 "Annual Survey of Alternative Fueled Vehicle Suppliers & Users" and the General Services Administration (GSA)/Department of Energy (DOE) Federal Automotive Statistical Tool (FAST).

The use of hybrid vehicles is increasing. Worldwide sales of light-duty hybrids by 2004 had exceeded 150,000. But fleet managers must work within government guidelines. Since the EPCRA requires that 75% of new vehicle purchases must be AFVs, and hybrids do not qualify as AFVs for the purposes of EPCRA, hybrid purchases must be limited to a maximum of 25% of fleet purchases for state fleets. Until the federal government rules change the specification from "alternative fuel

vehicles” to “the cleanest vehicle in the category” this pressure against hybrids will persist (Hybridcars.com, 2005b). Forthcoming guidance on DOE’s interpretation of Section 703 of EPA Act 2005, if it should make hybrid purchases compliant with requirements, will have a considerable impact on state fleet managers’ purchase decisions.

Fleet managers also have to consider hybrid economics. A gasoline powered vehicle is more expensive to operation than a hybrid. Gasoline usage alone makes an enormous impact when comparisons are made between cars that get 15 or so mpg versus a hybrid yielding mpg in the low to mid-40s. A CNG car, though, is extremely cost effective to operate. For state fleet vehicles operating in some municipalities, air quality issues are the most important considerations. Both hybrids and AFVs are far cleaner than conventional vehicles; however, choosing between an AFV versus a hybrid may be a more difficult choice to make. Fleet managers do have to consider the drivers of vehicles, who typically do not like change. Having to learn how to refuel a CNG car might push the purchasing decision to the hybrid which allows conventional re-fueling (Hybridcars.com, 2005b).

Preliminary evaluations of the use of hybrids in government fleets are revealing the extent to which inclusion of hybrids in green fleets will both decrease fuel costs and reduce emissions. One such evaluation was undertaken by Colorado and based upon data of hybrid performance in their state fleet for the years 2001 and 2002. The results indicate that if the state were to implement a green fleet program utilizing hybrid vehicles, between 2005 and 2015 the state would save \$2,850,000 in fuel costs and reduce emissions of carbon monoxide by 12.91 tons, particulate matter by 80.616 pounds, volatile organic compounds by 928 pounds, nitrogen oxides by 1,453 pounds, and greenhouse gases by 771 tons (Colorado Department of Public Health and Environment, 2004).

### **SURVEY OF STATE FLEET ADMINISTRATORS**

In this section, we report an original survey of fleet administrators in the American states. The anonymous web-based survey, administered in March and April 2006, targeted the National Conference of State Fleet Administrators (NCSFA). NCSFA is a professional association comprised of state and local fleet administrators and fleet service vendors: the survey was limited to the subset of NCSFA’s membership

working directly as state agency fleet managers. Of these 59 members, 30 responded to the survey for an effective response rate of approximately 51%. The overwhelming majority (86.7%) of respondents report having “substantial influence” on their agency’s fleet purchasing decisions (10% indicated “some influence,” and 3.3% reported “little influence”), thus survey respondents represent influential actors at the state level, making them an appropriate target for this investigation. Additional demographic information collected in the survey shows that respondents are overwhelmingly male (93%), are in their mid-forties or older (78%), have worked in fleet management for at least 10 years (64%), do not possess professional purchasing certifications (89%), and are geographically dispersed across the 50 states.

### State Fleet Composition

Fleet sizes reported by survey respondents ranged from a high of 16,000 to a low of 327, with an average size of 2,774 vehicles. Table 2 provides data on the composition of these fleets.

As shown, the majority (69%) of these vehicles are conventional gasoline powered, followed in percentage size by FFVs (17%), AFVs (13%), and three other vehicle categories comprising less than 1% each (gas-electric hybrids, .76%; hydrogen fuel cell, .03%; and plug-in hybrids, 0%). These data suggests that some progress has been made in the states on meeting EPAct’s green fleet acquisition mandates.

**TABLE 2**  
**The Composition of Respondents’ Agency Fleets**

<b>Of the vehicles in your fleet, approximately what percentage are:</b>	<b>Percentage Reported</b>
Conventional gasoline powered	68.97%
Flexible fuel vehicles (FFV)	17.14
Gas-Electric Hybrids	0.76
Plug-In Hybrids	0.00
Alternative fuel vehicles (AFV)	13.10
Hydrogen Fuel Cell	0.03

Source: Survey of the National Conference of State Fleet Administrators conducted by the authors March-April 2006.

### Implementation Issues



Concern exists about the effects of green procurement practices, like green fleet initiatives, on the attainment of classic managerial values of effectiveness, efficiency, and economy (National Association of State Procurement Officials [NASPO], 2001). Coggburn (2004), in contrast, argues that green procurement is not necessarily at odds with these values. As shown in Table 3, survey results seem to support this view. On an item related to efficiency, 54% agreed that purchasing AFVs and/or hybrids “is no more technically difficult or time consuming than

**TABLE 3**  
**Opinions on Purchasing Green Vehicles**

Purchasing alternative fuel vehicles (AFVs) and/or hybrids vehicles:	Percentage that		
	Agree	Disagree	Neutral
Is no more technically difficult or time consuming than purchasing conventional gasoline powered vehicles	54%	25%	21%
Results in the acquisition of vehicles that meet end users' needs as well as conventional gasoline powered vehicles	71	7	21
Is as economical as purchasing conventional gasoline powered vehicles when full life-cycle costs (that is, purchase price, operational costs, maintenance costs, final disposal/resale costs, etc.) are taken into consideration	25	36	39
Is an effective way to support our government's efforts to improve environmental performance	78	7	14
Is something that governments should do to help develop and promote green markets	75	4	21

Note: Figures in the table are percentages. The survey employed a five-point Likert scale with response categories coded as: 1 for “strongly agree,” 2 for “agree,” 3 for “neither agree or disagree,” 4 for “disagree,” and 5 for “strongly disagree.” For ease of presentation, the “strongly agree” and “agree” categories were combined as were the “strongly disagree” and “disagree” categories. Percentages may not sum to 100 due to rounding.

Source: Survey of the National Conference of State Fleet Administrators conducted by the authors March-April 2006.

purchasing traditional gasoline powered vehicles” (25% disagreed, 21% were neutral). Similarly, on an item related to effectiveness, 71% agreed that purchasing AFV and/or hybrids “results in the acquisition of vehicles that meet end users’ needs as well as conventional gasoline powered vehicles” (only 7% disagreed, 21% were neutral). Finally, on the survey item related to economy, there was more split opinion: 25% agreed (36% disagreed, 39% were neutral) that purchasing AFVs and/or hybrids was as economical as purchasing conventional gasoline powered vehicles when full life-cycle costs are taken into consideration.

More broadly, most respondents (78%) view efforts to green fleets as an effective way to improve government’s environmental performance, and most (75%) agree with the notion that that government should use its purchasing power to help develop and promote green markets. These findings suggest substantial identification with the use of government’s purchasing power to achieve environmental policy objectives and promote the viability of green products.

### **Limits on Greening Fleets**

Given the general support for greening government fleets, it is important to examine what factors impede the implementation of such efforts. Several survey items, presented in Table 4, examine potential limits on efforts to green state fleets. Previous studies have shown that green products (in general) suffer because of perceived product costliness, inferiority or unsuitability, and lack of visible political support (National Association of State Procurement Officials [NASPO], 2001; White House Task for on Recycling, 2001; Coggburn & Rahm, 2005). Additionally, purchasing green vehicles may be limited by factors like inadequate alternative fueling infrastructure, inexperience among government’s in-house mechanics with servicing green vehicles, and scarcity of green vehicles in the marketplace (Enos, 2006).

On these potential limits, NCSFA members agreed that financial considerations—namely, higher initial purchase prices for green vehicles and insufficient budgetary resources—limited their green vehicle purchases. Large percentages also agreed that inadequate fueling infrastructure for AFVs and manufacturers’ decisions to produce fewer AFVs and hybrids constrained their green purchasing efforts. On the infrastructure issue, one respondent commented: “While we have

approximately 440 FFVs we do not have any E85 fuel. [This is a] waste of my time just to meet the mandate.” Pluralities agreed that end users’ perceptions of green vehicle inferiority limited their purchases but

**TABLE 4**  
**Limits On Green Fleet Purchases**

Our purchase of alternative fuel vehicles (AFVs) and/or hybrids vehicles is limited by:	Percentage that		
	Agree	Disagree	Neutral
Higher initial purchase prices for these vehicles	72%	18%	11%
A lack of visible support by political leaders for such purchases	28	46	25
A lack of in-house maintenance expertise for these vehicles	14	39	46
A lack of adequate fueling infrastructure for AFVs	78	11	11
End users' perceptions of performance inferiority for these vehicles	43	32	25
Insufficient budgetary resources	61	21	18
Manufacturers' decisions to produce fewer of these vehicles	65	15	21

Source: Survey of the National Conference of State Fleet Administrators conducted by the authors March-April 2006. See Table 2 “note” for response coding details.

disagreed that a lack on in-house maintenance expertise or visible political support served as impediments.

#### **Raising the Profile: Activities to Promote Green Fleets**

As just mentioned, green vehicles face reputation problems that often plague green products. To counteract these effects, research suggests several measures purchasing officials can take to promote the use and acceptance of green products (Coggburn, 2004; Coggburn & Rahm, 2005). As reported in Table 5, state fleet administrators have, to varying degrees, undertaken these measures. First, a plurality agrees to having taken steps to publicize green vehicle “success stories.” Significantly more respondents agreed (41%) than disagreed (8%) to having conducted outreach efforts to educate end users on the benefits and performance of green vehicles. Finally, respondents were equally divided (30% agreed,

29% disagreed) that they have held vendor fairs whereby end users can see the functionality and performance of green vehicles.

So while much of the green fleet effort at the state level can be understood as a response to federal mandates, it is also true that state fleet administrators perceive the products to be as effective as conventional gasoline vehicles (see Table 3). Although there are some

**TABLE 5**  
**Raising End User Awareness of Green Vehicles**

When it comes to raising end users' awareness of alternative fuel vehicles (AFVs) and/or hybrids vehicles, my agency:	Percentage that		
	Agree	Disagree	Neutral
Hosts vendor fairs where AFV and hybrid manufacturers can demonstrate the functionality and performance of their vehicles	30%	29%	41%
Conducts end user outreach efforts to educate them on the benefits and performance of AFVs and hybrids	41	8	52
Publicizes AFV and hybrid vehicle "success stories" to raise end users' awareness and support for these vehicles	44	30	26

Source: Survey of the National Conference of State Fleet Administrators conducted by the authors March-April 2006. See Table 2 "note" for response coding details.

efforts afoot, the next step for fleet administrators is to act more aggressively on this belief, through a variety of means, to raise end user awareness and acceptance for these viable vehicle alternatives.

### **Complying With EAct: Implementation Issues and Credit Trading**

In addition to items related to purchasing green vehicles, respondents were also presented with statements specifically related to EAct implementation. The first series of statements, presented in Table 6, deal with various implementation issues. As shown, NCSFA members do not perceive the EAct mandate to purchase AFVs to stifle competition.

This is important because procurement provisions that seek social policy ends (e.g., green procurement, “buy local” clauses, minority-owned business set asides, etc.) have long been viewed by professional procurement organizations as restraints on competition (National Association of State Procurement Officials [NASPO], 2001).

Other items in Table 6 speak to more practical concerns. First, respondents were almost evenly divided about their likely purchasing practices were EPAct not in effect: 48% agreed and 45% disagreed that they would buy fewer AFVs absent the EPAct mandate. Results also

**TABLE 6**  
**Effects of the Energy Policy Act (EPAct)**

Please indicate your level or agreement or disagreement with the following statements related to the Energy Policy Act (EPAct):	Percentage that		
	Agree	Disagree	Neutral
Federal requirements for purchasing AFVs stifle competition and hurt our ability to get the best deal for our fleet purchasing dollars	26%	37%	37%
If EPAct did not mandate the purchase of AFVs, we would buy fewer of them	48	45	7
If EPAct allowed hybrids to count towards required AFVs purchases, we would buy more of them	48	15	37
Even though hybrids don't count toward EPAct, we continue to buy them because of concerns over air quality non-attainment in my government's jurisdiction	37	11	52

Source: Survey of the National Conference of State Fleet Administrators conducted by the authors March-April 2006. See Table 2 “note” for response coding details.

suggest that EPAct may undermine the purchase of hybrid vehicles. A near majority of 48% agreed that they would buy more hybrids if EPAct allowed these vehicles to count toward AFV purchasing requirements. It is impossible to say what effect this may be having on environmental performance, but it does seem clear that including hybrids within the EPAct framework would result in the acquisition of additional high-mileage/low-emissions vehicles. This potential for hybrids to aid in

environmental performance is underscored by the 37% of respondents who agreed to purchasing hybrids even though they do not count for EAct purposes because of concerns over air quality.

Second, and as discussed above, EAct authorizes an AFV credit trading system. Such systems, which attempt to inject market-like forces, are popular in other forms of environmental regulation (e.g., Bryner, 1999; Rondinelli, 2000). NCSFA members were asked about their experiences with credit trading activities. The results for these survey items appear in Table 7.

The result that stands out in the table is the large percentage (64%) that engage in the banking of AFV credits. Such credits offer a hedge

**TABLE 7**  
**Alternative Fuel Vehicle (AFV) Credit Activity**

Please indicate your agreement or disagreement with the following statements related to your agency's AFV credit-related activities. My agency:	Percentage that		
	Agree	Disagree	Neutral
Banks excess AFV credits	64%	11%	25%
Uses AFV credits banked in previous years	36	32	32
Sells excess AFV credits	0	67	33
Purchases needed AFV credits	0	79	21
Purchases biodiesel for fleet vehicles to earn additional AFV credits	47	21	32

Source: Survey of the National Conference of State Fleet Administrators conducted by the authors March-April 2006. See Table 2 “note” for response coding details.

against noncompliance in future AFV purchasing and, as such, are actively banked in the states. The results also suggest a tendency among respondents to bank excess credits for their own future use as opposed to selling them to other entities covered by EAct: 36% agreed to using their own previously banked credits whereas none of the respondents (0%) agreed that they had either bought or sold AFV credits. This raises some question as to the efficacy of the market-type provision, but a definitive judgment cannot be drawn given the sample size and the large percentages of respondents opting for the “neither agree nor disagree”

response on these items. Finally, buying biodiesel in order to accrue additional AFV credits is a strategy employed by a near majority (47%) of respondents.

### CONCLUSION

Environmental performance is a growing concern in the United States and the world. Governments are looking to a variety of environmental strategies to effect better environmental performance. This paper considered one such approach -- efforts to green the fleets of state governments in the United States.

If past trends continue, state government fleets will accumulate a greater number of fuel efficient and less-gasoline dependent vehicles. The number of hybrids in state fleets will certainly grow, especially if DOE interprets the purchase of hybrids as compliant with EPA's 2005's state fleet gasoline reduction provision. The number of flexibly fueled vehicles will also grow, taking some of the stress off of infrastructure demands for some AFVs. The result will be less reliance on imported oil, cleaner air, and fewer emissions of GHGs.

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