STATE VEHICLE FLEETS AND THEIR POTENTIAL ACQUISITION OF ALTERNATIVE FUELED VEHICLES UNDER EPACT 507

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ABSTRACT

Section 507(o) of the Energy Policy Act requires state governments to purchase an increasing percentage of alternative fueled vehicles for their light-duty vehicle (LDV) fleets. This requirement began in model year 1996. To determine the effect of this mandate, this paper estimates the total number of state vehicles that may be "covered" under this mandate and the number of alternative fueled LDVs that may be acquired as a result of this mandate. In addition, this paper presents operating characteristics, fuel use, turnover rate, and refueling practices of state fleet vehicles.

Key Word List

- 1. Alternative Fuels
- 2. Alternative Fueled Vehicles
- 3. Energy Policy Act
- 4. Transportation Fuel Use
- 5. State Fleet Vehicles

INTRODUCTION

The Energy Policy Act (EPACT) was passed in 1992 to encourage nearly all economic sectors to increase their energy efficiency. EPACT also strives to increase U.S. energy security by introducing cost-effective and environmentally benign energy technologies and energy sources.

The transportation sector is the largest petroleum-consuming sector in the United States. Transportation energy comes almost solely from petroleum. Since 1975, petroleum consumed by the transportation sector alone has surpassed the amount produced domestically. The gap between transportation consumption and domestic production continues to grow (1). By 1995, petroleum consumed by the transportation sector accounted for more than two-thirds of the U.S. petroleum consumption; a significant increase from 53 percent two decades ago.

After the 1978-1981 increase in oil prices, the electric utility, industrial, residential, and commercial sectors shifted to other fuels. Such shifts have not occurred in the transportation sector (2). Although EPACT covers many economic sectors, it undoubtedly has the greatest potential to reduce imported oil consumption in the transportation sector. Almost 200 million cars and trucks consume about 10.4 million barrels of crude oil each day.

EPACT has major provisions for the development and deployment of alternative transportation fuels to replace petroleum-based fuels. Section 502 of EPACT designates the Secretary of Energy to determine whether it is feasible to achieve a goal of replacing 10 percent of petroleum-based transportation fuels consumed by LDVs with alternative fuels by the year 2000, and 30 percent by the year 2010. EPACT defines an LDV to be a vehicle weighing less than or equal to 3,859 kilograms (8,500 pounds) in gross vehicle weight rating.

A limited infrastructure for alternative fuel refueling and the limited availability of motor vehicles that can operate on alternative fuels make it difficult to achieve this goal. To help overcome these barriers, EPACT established two alternative fueled vehicle mandates—the alternative fuel provider vehicle acquisition mandate under Section 501, and the fleet requirement program under Section 507. The fuel provider mandate requires qualifying *alternative fuel providers* to acquire an increasing percentage of new alternative fueled vehicles (AFVs). The fleet requirement program (Section 507) mandates that certain *fleet operators* acquire an increasing percentage of new AFVs. State government fleets are mandated in Subsection (o) in Section 507 of this program.

To assess whether the 507(o) mandate will be effective in meeting the EPACT 502 fuelreplacement goal, it is essential to estimate the size and composition of the state vehicle fleets that may be covered under the mandate. This paper estimates the number of state vehicles that may be covered under this mandate and the number of alternative fueled LDVs that will probably be acquired because of this mandate. In addition, the paper describes the operating characteristics, fuel use, turnover rate, and refueling practices of state vehicle fleets.

EPACT SECTION 507(0)

EPACT 507(o) establishes the following schedule of AFV purchases as a percentage of total new LDV purchases by covered state fleets: 10 percent for model year (MY) 1996, 15 percent for MY 1997, 25 percent for MY 1998, 50 percent for MY 1999, and 75 percent for MY 2000 and beyond. The mandate does not include municipal fleets.

To qualify as a "covered" fleet, a state fleet must meet ALL of the following criteria:

- 1. the fleet has at least twenty LDVs;
- 2. the fleet vehicles are used primarily in an EPACT metropolitan statistical area (MSA);
- 3. the fleet vehicles are centrally fueled or capable of being centrally fueled; and
- 4. the fleet is owned, operated, or controlled by a government entity that owns, operates, or controls fifty or more light-duty vehicles.

In our assessment, we assume that all state fleets meet criteria 3 and 4. That is, state fleet vehicles are assumed to have the capability of being centrally fueled, despite whether they are actually centrally fueled or not, and all state governments own and operate fifty or more LDVs.

DATA

Although data on state fleet vehicles are available from several sources, no single source provides the data needed for this analysis. The annual *Highway Statistics*, published by the Federal Highway Administration, reports the total number of publicly-owned vehicles (3). However, these statistics include the total number of vehicles owned by states, counties, and municipalities combined. The data do not separate them into different types of vehicles. Generic statistics of government fleets are reported in *Automobile Fleet Fact Book* compiled by the Bobit Publishing Company (4). Bobit's data include fleets of ten or more vehicles, but do not distinguish state fleets from other government fleets and do not categorize vehicles into different vehicle types. *Dwight Energy's Operator File* categorizes vehicle fleets by Standard Industry Code (SIC) (5). Since the SICs for state government agencies are not unique, state government vehicle fleets cannot be distinctively identified from the Dwight's database. Problems with each of these three data sources prevent them from being used as the primary source for estimating the size and characteristics of state-owned vehicle fleets. However, these data sources serve as supplementary sources for our analysis.

In a previous project, we conducted surveys to collect state fleet data in all fifty states (6). This survey was conducted in the summer of 1993 and collected 1991 fleet data. Twenty-three state governments responded to that survey. A second survey was conducted in the fall of 1994 to obtain data from the remaining 27 states for the year 1994. Twenty states responded to the second survey. Each state government was asked in both surveys to provide the total number of cars, vans, light, medium- and heavy-duty trucks, the corresponding fuel use, and the annual miles driven per year.

ESTIMATION METHODS

Vehicle Stock

Although the two surveys had a high overall response rate of 86 percent, there are considerable data gaps due to incomplete responses by some states. Since data were collected in the two surveys for different years (i.e., 1991 and 1994), it is necessary to reconcile these data. The following adjustments and imputations were applied to the data to rectify four specific data issues/gaps:

- 1. data collected in the two surveys are for different years (1991 and 1994);
- 2. data provided by nine states cover the vehicles operated by part of the state government rather than the whole state government;

- 3. data provided by seven states do not cover all vehicle types; and
- 4. data are lacking for the seven states that did not respond to the surveys.

Comparability in Time

Since the data collected from the two surveys are three years apart (1991 and 1994), growth rates were applied to the 1991 data collected from the first survey to provide estimates for 1994. We calculated an annual growth rate for automobiles owned by governments (state, county, and municipalities) using 1991 and 1993 data presented in *Highway Statistics*, Table MV-7 (*3*). We assumed that the calculated average annual rate would continue from 1993 to 1994. An annual growth rate for trucks and truck-tractors was similarly calculated. *Highway Statistics* does not provide separate statistics for vans and light-, medium- and heavy-duty trucks. The growth rate for vans was assumed to be the same as that of automobiles. Light-, medium-, and heavy-duty truck fleets were assumed to increase at the average annual rate of 1.37 percent for state-owned automobile and van fleets; and an annual rate of 1.05 percent for light-, medium-, and heavy-duty truck fleets. These annual growth rates were used to adjust the 1991 fleet sizes to estimate the fleet sizes in 1994.

Partial State Data

Nine states provided data on vehicle fleets operated by some of their departments, rather than all of their departments. In particular, five states (Arizona, Colorado, Idaho, Missouri, and Montana) reported the number of vehicles operated only by their departments of transportation (DOT); Wyoming reported data on its Central Services and Game and Fish Department; Utah reported data for only its central government and safety and education agencies; and Maryland and Tennessee did not include vehicles operated by their university systems. The question was how to estimate the total number of vehicles that the whole government operated in each of the nine states.

Four states (Iowa, Nebraska, Nevada, and Oregon) reported separate fleet statistics by department (i.e., state DOT, university system, and other state agencies). Using the separate fleet data, we calculated each department's portion of the total state government fleet. These shares were used to "expand" the partial state data to estimate the fleet of an entire state government. Based on these extremely limited data, automobiles in the state DOT account for, on average, 16.7 percent of the total automobiles operated by state government (Table 1). This calculation assumes that the departmental composition of the state fleets in the nine states with incomplete data is the same as the average composition in Iowa, Nebraska, Nevada, and Oregon. Until more data become available, this assumption cannot be validated.

Data on Partial Vehicle Types

State governments were asked in our surveys to report the number of fleet vehicles in their fleets, in each of five vehicle categories: car, light truck, van and utility vehicle, medium and heavy truck, and others (including construction equipment). Seven states did not report data on some vehicle types. Based on data from the states that submitted complete vehicle data, we estimated that 41.5 percent of a typical state fleet consists of automobiles, 22.7 percent light trucks, 11.7 percent vans and utility vehicles, 18.9 percent medium and heavy trucks, and 5.2 percent other types of vehicles.

	State Agency				
Vehicle Type	Department of Transportation	University System	Others	TOTAL	
Automobile	16.7%	8.2%	75.1%	100%	
Light Truck	44.8%	25.9%	29.2%	100%	
Van	24.2%	14.7%	61.1%	100%	
Medium and Heavy Truck	96.2%	0%	3.8%	100%	

Table 1 Shares of Total State Fleet Vehicles by State Agency and Vehicle Type*

^{*}Based on data from four states (Iowa, Nebraska, Nevada and Oregon) only.

These values were used to impute estimates for the vehicle types whose total number was not reported. One drawback of this approach is that the average vehicle stock composition—that was calculated using the data from the states that reported them—may not represent the vehicle stock composition in the states that did not report it. Vehicle stock composition can vary considerably from one state to another.

Non-responding States

Seven states (Florida, Illinois, Kentucky, Massachusetts, Mississippi, New Mexico, and Ohio) did not respond to the second survey. Since the coverage of the New York data is extremely questionable, New York was considered a non-respondent. Using the data that we collected from state governments, we calculated that 27.7 percent of the publicly-owned cars (which include state, county, and municipal cars but exclude Federal cars) and 24.2 percent of the publicly-owned trucks are operated by state governments. Using these percentages and the total number of publicly-owned vehicles as published in Table MV-7 of *Highway Statistics (3)*, we estimated state governmentowned fleet vehicles for each of the eight states.

The reason for not having separate percentages for vans, light, medium, and heavy trucks is statistics reported in the *Highway Statistics* have only two categories of vehicle types: automobile and truck/truck-tractor combined. Once the state-owned truck stock was estimated using the above approach, the next step was to disaggregate it to different truck types: van, light truck, and medium and heavy truck. Using the data that we collected from state governments, we estimated that 40.9 percent of the truck population in state fleets are light trucks, 26.3 percent are vans, and 32.9 percent are medium and heavy trucks.

Fuel Use

In our first survey (6), some states provided data on vehicle miles driven (VMT) and miles per gallon (mpg). For these states, the total fuel used by each type of vehicle was calculated as:

Fuel
$$use_i$$
 ' ($VMT_i \times N_i$) $\div mpg_i$

where

Fuel Use_i	=	fuel used by vehicles of type <i>i</i> in gallons per year, $i = 1$ for cars, and $i = 2$ for
		light trucks,
VMT_i	=	average annual VMT by vehicles of type <i>i</i> ,
N_i	=	number of vehicles of type i that may be covered under Section 507(o), and
mpg_i	=	fuel economy of vehicles of type <i>i</i> in mpg.

Unfortunately, more than thirty states did not provide data on the annual VMT and/or mpg of their state-owned vehicle fleets. For these states, a regression model, developed previously by Oak Ridge National Laboratory, was used to predict the total fuel use by a fleet of a given vehicle type based on the size of the fleet (6). The regression model has the following form:

 $\log(y) ' \alpha \otimes \beta \log(x) \otimes \epsilon_i$,

where *log* is the natural logarithm, y is the amount of fuel use by a fleet of size x, α and β are the unknown regression parameters to be estimated from survey data, and ϵ are the model's residuals that have a normal distribution with mean zero and constant variance.

Survey data show that the variation in the amount of fuel used per vehicle is proportional to fleet size. That is, the larger the fleet the greater the variation in fuel use among vehicles in that fleet. This observation shows that the assumption of a constant variance in the general linear regression modeling framework is not met. To conform to this constant variance assumption, a "log-log" functional form was established between the amount of fuel used per vehicle and the size of the fleet to estimate the average fuel use per vehicle (6). Based on this approach, the estimated total amount of fuel used by a state fleet of **cars** or **vans** can be calculated as:

Total Fuel Used by a Fleet of Cars and Vans
=
$$exp \left[\alpha + \beta \times log (Fleet Size) + \frac{1}{2} \times \sigma^2 \right]$$

= $exp \left[6.5423 + 0.9989 \times log (Fleet Size) + \frac{1}{2} \times 0.2181^2 \right]$

Similarly, the equation to estimate the total amount of fuel used by a state fleet of **light trucks** or **medium and heavy trucks** is:

Total Fuel Used by a Fleet of Trucks
=
$$exp [8.7583 + 0.7990 \times log(Fleet Size) + \frac{1}{2} \times 0.4110^{2}]$$

The term, $\frac{1}{2} \times \sigma^2$, is an adjustment factor to remove the detransformation bias in the estimators,

 $\hat{y}_i^{\,\,\prime}s$ (7).

RESULTS

State Vehicle Fleets and Their Fuel Use

All state governments, as a whole, operate 525,000 vehicles. These vehicles consume 1,855 million liters (490 million gallons) of fuel per year (Table 2). Since the data on the "Other" category of vehicle types are remarkably sparse and their quality questionable, vehicles categorized as "Other" are not included in the final results. On average, a state government operates a fleet of 10,500 vehicles. Not surprisingly, the size of state government fleets varies widely from state to state (see Figure 1). The state-fleet-size distribution skews markedly to the left, indicating that most state fleets are smaller in size than the average size of 10,500, and that a few states with very large fleets impart a large influence. This distribution results in a somewhat deceptively high average fleet size. In fact, half of the states operate fleets with less than 6,800 and less than a quarter of the states operate fleets with more than 10,000 vehicles.

With this skewness in the distribution of state fleet sizes, the median value is a better indicator of the central value of the distribution than the mean value. The median value is the number that evenly splits all of the data points into two clusters. That is, half of the data points are smaller than the median value and half are greater. We estimate that 50 percent of the states operate an *automobile* fleet of no more than 2,700, a *light truck* fleet of no more than 1,400, a *van* fleet of no more than 900, and a *medium and heavy truck* fleet of no more than 1,100. Automobiles are the most common vehicle type. They account for 43.5 percent of the total state government-owned vehicle stock, with light trucks and heavier trucks being the next most common. Although medium and heavy trucks account for only 22 percent of the total state government vehicle stock, they account for 31 percent of the total fuel consumption.

	Vehicle Stock		Potentially "Covered" Vehicles	
Vehicle Type	No. of Vehicles	Fuel Use**	No. of Vehicles	Fuel Use**
Automobile	229,000 (±5,700)	560,180 (±14005)	140,000	340,650
Van	69,000 (±1,600)	185,465 (±4,542)	39,000	102,195
Light Truck	112,000 (±2,400)	526,115 (±10,220)	62,000	314,155
Medium and Heavy Truck	115,000 (±3,200)	575,320 (±12,491)	-	-
TOTAL	525,000 (±3,800)	1,847,080 (±10,977)	241,000	757,000

Table 2 Summary Statistics of 1994 State Vehicles*

*Number in parenthesis is the estimated standard deviation.

**Shown in liters. 1 liter = 0.2624 gallons.

Potentially Covered Fleets

As mentioned previously, EPACT defines a government "fleet" to be a group of **twenty or more light-duty motor vehicles** that are used primarily in an **EPACT MSA**; that are **centrally fueled** or capable of being centrally fueled; and that are owned, operated, leased, or controlled by a governmental entity that owns, operates, leases or controls **fifty or more such vehicles**. In this estimation procedure, we assumed that all state governments own and operate more than fifty LDVs and that all of these vehicles are capable of being centrally fueled. Given these two assumptions, a question remains. How many state government-owned LDVs are operated in EPACT MSAs and in a fleet with twenty or more LDVs? The data needed to address this question are extremely limited. Information in *Dwight Energy's Operator File* was used to estimate the proportion of state government-owned vehicle fleets that have twenty or more LDVs (5). *Dwight Energy's Operator File* identifies fleet operators by SICs. Since SICs for state government agencies are not unique, the drawback of using Dwight's data is that state government vehicle fleets cannot be specifically identified. Consequently, data on all publicly-owned vehicle fleets are used to estimate the fleet size distribution by assuming that federal, state, and local government fleets have similar distributions.

Data do not exist on the percentage of state government-owned vehicles that are primarily used in EPACT MSAs. We assumed that the size of a fleet that operates in a certain area is correlated with the number of employees working in that area, who presumably have a need to use fleet vehicles. That is, the greater the government labor force in an area, the larger the fleet that is required to meet the transportation needs of this labor force. Using this rationale for a given state, we used Bureau of Economic Analysis data to calculate the number of state government employees working in EPACT MSAs as a percentage of total state employees (8, 9). This percentage was used as a proxy for the percentage of state government-owned vehicles used primarily in EPACT MSAs within a given state. It is recognized that the transportation needs of a government agency depend largely on its function. For instance, the transportation needs of an administrative branch of a government is considerably different from that of an operations branch. Therefore, our method of allocating the total state fleet vehicles into EPACT MSA fleet vehicles should be verified when more data become available.

The number of light-duty vehicles that may be "covered" under EPACT Section 507(o) is then estimated as:

$$N_{i,s}$$
 ' $Veh_{i,s} \times \gamma_s \times \beta_s$

where

- $N_{i,s}$ = the estimated number of type *i* vehicles, owned/operated by state *s*, that may be covered under Section 507(o); *i* = 1 for cars and *i* = 2 for light trucks.
- $Veh_{i,s}$ = the estimated number of type *i* vehicles owned by state *s*,
- γ_s = the estimated percentage of fleet vehicles operated by state *s* in fleets with twenty or more LDVs, and
- β_s = the estimated percentage of fleet vehicles operated by state *s* that are located in EPACT MSAs.



Figure 1 Distribution of States by Fleet Size (including medium and heavy trucks).

Across the U.S., seven states do not contain EPACT MSAs at all; these seven states are not subject to the 507(o) mandate. For the remaining 43 states, Section 507(o)'s coverage of the state fleet vehicle stock varies by state, depending primarily on the estimated percentage of the state government labor force located in EPACT MSAs. The percentage ranges from 12.5 percent in Kansas to 91 percent in Rhode Island.

Overall, we have estimated that about 241,000 state LDVs (including automobiles, light trucks and vans) may be covered under the EPACT Section 507(o) mandate. These vehicles amount to 46 percent of the entire state government vehicle stock in 1994 and consume 757 million liters (200 million gallons) of fuel per year (Table 3). Cars account for 58 percent of the total "covered" vehicle stock and 45 percent of the total fuel consumed by the "covered" vehicles (Figure 2).

Mandated Alternative Fueled Vehicle Acquisition

EPACT's mandated AFV acquisition pertains solely to the purchase of new LDVs. The number of new LDVs acquired by the "covered" state governments was estimated as a function of the turnover rate of the existing fleet stock and the growth rate in the state vehicle stock. Typically, the turnover rate depends on the type of vehicle and the age distribution of the stock. If data were available on the turnover rate by vehicle age group, then we could precisely estimate the number of state fleet vehicles that would be replaced in a year. Unfortunately, such data are not available. As an alternative, we estimated the turnover in the state vehicle stock based on the annual percentage of the **business** fleet that is replaced (10).

	Annual Replacement Rate			
Model Year	10%	20%		
1996	2,800	5,200		
1997	4,200	7,900		
1998	7,100	13,400		
1999	14,500	27,200		
2000	22,000	41,400		
2001	22,300	42,000		

Table 3 Projected AFV Acquisition by Covered State Fleets as Required by EPACT 507(o)

The National Conference of State Fleet Administration (NCSFA) conducted a survey in 1988 of state government fleets. Results from that survey indicate that the replacement policies of state fleets vary from state to state, and that the typical replacement cycle ranges from five to seven years or from 120,750 to 161,000 kilometers (75,000 to 100,000 miles). A 1993 survey of government and utility fleets conducted by Runzheimer International found similar ranges. Government and utility fleet vehicles are typically replaced after five to six years or 128,800 to 161000 kilometers (80,000 to 100,000 miles), and after ten years for heavy-duty or special purpose vehicles (13). By comparison, governments and the utility sector tend to replace their fleets at a slower rate than the private sector—81 and 68 months (respectively) versus 35 months (11). In general, LDVs are replaced at a faster rate than heavy-duty vehicles. These turnover rates imply that between 10 to 20 percent of the state LDV fleets will be replaced each year. This range is consistent with the average replacement cycle of 81 months (= 6³/₄ years) for government automobile fleets (11).

Given the predicted coverage of 241,000 LDVs in 1994, the average replacement cycle of 10 or 20 percent, and an annual growth rate of 1.37 percent for state LDV fleets, we projected the purchases of AFVs by covered state fleets (Table 3). If 10 percent of the existing LDVs are replaced annually, then an estimated 3,000 alternative fueled LDVs will be acquired in 1996 as a result of this mandate. If 20 percent of the existing LDVs are replaced annually, then an estimated 5,000 alternative fueled LDVs will be acquired. Future AFV purchases mandated by Section 507(o) will increase to between 22,000 and 42,000 by the year 2001.

OPERATING CHARACTERISTICS AND REFUELING PRACTICES

Results from our two surveys suggest that state automobiles travel an average of 19,320 kilometers (12,000 miles) per year; light trucks and heavy trucks operate at a very similar level of 17,710 kilometers (11,000 miles) per year; and vans are driven slightly less than government trucks. Miaou, et al. (11), compared average annual VMT by fleet vehicles in different sectors. They concluded that government light vehicles (e.g., cars, pickup trucks, and vans) are driven about half the distance of comparable fleet vehicles in the private sector; government-owned heavier trucks are



Figure 2 Distribution of Potentially "Covered" Vehicle Stock and Fuel Use by Vehicle Type, 1994

driven 80 percent less than heavier trucks in the private sector—17,710 kilometers (11,000 miles) for government heavy trucks versus 103,684 kilometers (64,400 miles) for those in the private sector (Table 4).

We assumed that a government fleet vehicle is operated 250 days a year. The average miles driven per day ranges from 77 to 89 kilometers (48 to 55 miles) for cars, 69 to 77 kilometers (43 to 48 miles) for medium and heavy trucks, 73 to 90 kilometers (45 to 56 miles) for light trucks, and about 44 miles for vans. Government and utility fleets are driven significantly less than business fleet vehicles.

Government and privately-owned heavy trucks are also used on different types of roads. While almost three-quarters of the travel by a private heavy truck is, on average, on interstate highways, the corresponding percentage is a mere 4 percent for government heavy trucks (11). In fact, 95 percent of the travel by government heavy trucks is in urban and suburban areas. This travel pattern of a typical government heavy truck, together with its average daily driving range, suggest that government-owned heavy truck fleets might be able to adopt to using alternative fuels more easily than those in the private sector (though the EPACT does not cover heavy-duty trucks at all). These fleets can be refueled and serviced at centralized locations, and would not have to rely on an extensive geographically dispersed infrastructure for refueling.

Information on refueling practices of government fleets is extremely limited. In general, large fleets use centralized refueling stations more frequently than small fleets; and public fleets are more likely to have such facilities than private fleets (12). Miaou, et al. (11), also found that over 80 percent of the vehicles operated by utilities and over 75 percent of the vehicles operated by governments are centrally refueled.

	Government		Business		Utility	
Vehicle Type	kilometers/yr	kilometers/day	kilometers/yr	kilometers/day	kilometers/yr	kilometers/day
Car	22,057	89	47,012	188	23,345	93
		90				
Light Truck	22,379		42,826	171	28,175	113
Medium Truck	19,159	77	28,175	113	18,998	76
Heavy Truck	17,227	69	103,684	415	22,218	89

Table 4 Average Annual Kilometers (Miles) Driven and Daily Driving Distance*

* Table 16 of Reference (11).

**1 kilometer = 0.6 miles.

A notable increase has been observed in the number of AFVs operated by state governments. In a 1991 study, 13 percent of states indicated that they operated some type of AFV, compared to 2 percent in the private business sector (*11*). The average number of AFVs in government fleets in 1991 was 34 per government entity. In our 1994 inquiry, 19 out of the 20 states reported use of AFVs. The fraction of AFVs as a percentage of the total vehicle stock varies greatly from state to state, ranging from zero percent for Kansas to 13 percent for Texas.

SUMMARY

EPACT Section 507(o) mandates that, beginning in MY 1996, an increasing percentage of new LDVs acquired for state government fleets shall be AFVs. To understand the potential impact of this mandate, this analysis has estimated the number of potentially covered state vehicles and future AFV acquisition as a result of this mandate.

Based on limited data, we estimated that state governments as a whole operated 525,000 vehicles in 1994. These vehicles consumed 1,855 million liters (490 million gallons) of fuel per year. State government fleet sizes differed considerably from one state to another. A few state governments operated very large fleets. Less than a quarter of the states operated a fleet with more than 10,000 vehicles. About half of the states operated a fleet with no more than 6,800 vehicles.

In our analysis, we assumed that every state government owns and operates at least fifty LDVs and that these vehicles are centrally refueled or are capable of being centrally refueled. Given these assumptions, the state government fleets were evaluated with respect to the two remaining EPACT criteria: (1) fleets having more than twenty LDVs, and (2) vehicles used primarily in EPACT MSAs. Since only 43 states have EPACT MSAs, seven states (Alaska, Maine, Montana, North Dakota, South Dakota, Vermont, and Wyoming) are automatically exempt from the 507(o) mandate.

On average, approximately 60 percent of the LDVs (or about 241,000 LDVs) that state governments operated in 1994 may be covered under the mandate. These vehicles accounted for 46 percent of the *entire* state government vehicle stock in 1994. Cars accounted for 58 percent of the total covered vehicle stock and 45 percent of the total fuel consumed by the covered vehicles.

To derive a simple projection of AFV penetration as a result of Section 507(o), we assumed that the following remain unchanged:

- forty-six percent the entire state government vehicle stock qualifies as a "covered" fleet under Section 507(o);
- between 10 to 20 percent of a state's existing LDV stock will be replaced each year; and
- state vehicle stocks continue to grow at the same annual rate as that observed from 1991 to 1994.

With these assumptions, we project by MY 2001, 16 to 30 percent of the entire state light-duty vehicle stock can be AFVs. That said, it should be pointed out that this simple projection does not take into account the credit program (EPACT Section 508), and the extent to which exemptions are requested and granted [EPACT Section 507(i)]. Furthermore, the projected AFV share of the total LDV stock will continue to increase into the future years due to increasing numbers of AFV purchases.

The average mileage driven per day ranges from 69 to 89 kilometers (43 to 55 miles) for government fleet vehicles, with automobiles having the greatest daily driving range. About 70 to 80 percent of the travel by fleet cars is within urban and suburban areas. That pattern is true of both publicly- and privately- owned vehicles. However, there is a marked difference in travel patterns for heavy trucks. While 95 percent of the travel by government heavy trucks is in urban and suburban areas, 71 percent of the travel by private heavy trucks is on interstate highways. The fact that relatively short distances are travelled by government heavy trucks each day, and that most of their travel is within urban areas, suggests that government heavy truck fleets may be able to adopt to alternative fuels more easily than those in the private sector (though EPACT excludes heavy trucks).

Other key operating characteristics and refueling practices of government-owned fleets are that:

- seventy-five percent of fleet vehicles are centrally refueled;
- the typical replacement cycle ranges from five to seven years or 120,750 to 161,000 kilometers (75,000 to 100,000 miles);
- between 50,000 to 102,000 state government-owned vehicles are replaced each year;
- the majority of the government fleets operate some kind of AFVs. However, the fraction of AFVs as a percentage of the total fleet varies considerably from state to state, ranging from zero percent to 13 percent.

ACKNOWLEDGMENTS

This work was supported by funds from the Office of Alternative Fuels of the U. S. Department of Energy (DOE). We thank Stacy Davis, Harith Rajagopalan, and Mara Kinke for their research assistance. The views in this paper are solely those of the authors and do not necessarily reflect those of DOE.

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