

## **Section 3.**

### **Fleets of Alternative Fuel Providers**

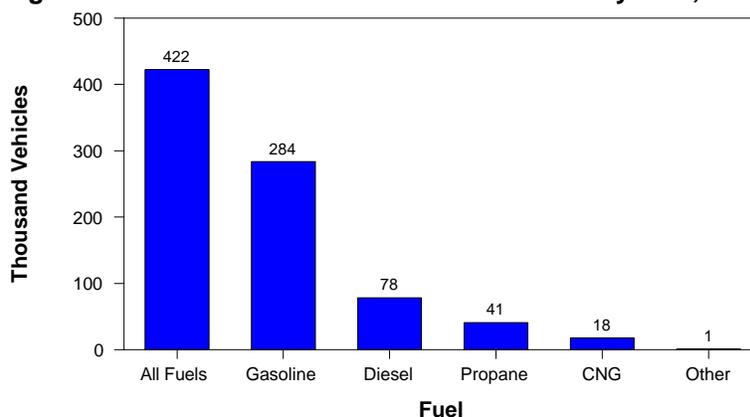
## 3.1. Introduction

The EPACT established vehicle purchase mandates for particular subsets of the U.S. vehicle fleet population. These mandates, which go into effect at different times for various fleet subpopulations, required that an incremental percentage of new vehicle purchases must be alternative-fuel vehicles (AFV's). The Federal government fleets were the first to be affected, with their purchase requirements going into effect with model year 1993. Beginning with model year 1996, providers of alternative fuels also will fall under AFV purchase mandates.

EIA established three surveys to collect information about the fleets operated by providers of propane, natural gas, and electricity. The reason for focusing on alternative-fuel providers is that they would likely be important early users of AFV's because they would derive publicity and public relations benefits from using their energy source as a vehicle fuel. The EIA surveyed only providers of propane, natural gas, and electricity because there were existing EIA databases that made the population of those providers easily accessible. At the time the surveys were conducted, there was no database in existence for easy access to the methanol and ethanol providers, and it was still uncertain (due to pending Rules) whether the oil providers/refiners would be covered under the EPACT as alternative fuel providers.

Survey data reveal that alternative-fuel providers are making use of alternative-fuel vehicles. The three classes of providers covered in this report operate a total of 422,127 vehicles in their fleets. Of those, approximately 60,000 vehicles (14 percent) are fueled by alternative fuels, with propane being the most common (Figure 3.1.1). Detailed tables display the complete survey results, and summary descriptions of survey methodologies and results are presented for each type of provider. Throughout this section of the report the term "multifuel" is used to refer to all AFV's that are capable of operating on more than one fuel type (i.e., bi-fuel, flex-fuel, dual-fuel, and hybrid).

**Figure 3.1.1. Alternative Fuel Provider Fleets by Fuel, 1993**



Sources: Energy Information Administration, Form EIA-885, Propane Provider Fleet Survey; Form EIA-861, Schedule VII, Electric Utility Fleet Survey; and Form EIA-176, Schedule B, Natural Gas Supplier Fleet Survey.

## Highlights

### ***Propane Provider Fleet Survey***

- The top 35 propane providers (as measured by sales volume) are responsible for nearly two-thirds of the propane deliveries in the United States, but they operate only about one-third of all propane provider fleet vehicles. The smaller companies operate approximately 70 percent of the total vehicle stock. However, the top 35 companies are much more likely to operate AFV's. Overall, about 80 percent of the top 35 companies' fleet vehicles use propane, while slightly less than one-third of those of the smaller companies use propane.

- On average, costs to acquire conventional-fuel vehicles were 42 percent higher than the costs of acquiring AFV's; however, acquisition costs varied widely over vehicles types. Respondents also reported lower maintenance costs for propane vehicles than for conventional-fuel vehicles, regardless of vehicle type.

### ***Electric Utility Fleet Survey***

- Although one may expect that electric utilities would use electric vehicles in order to promote their energy source as a transportation fuel, only 237 electric vehicles (4.2 percent of all AFV's) were reported in the Electric Utility Fleet Survey. One could speculate that this is probably because many electric utilities are opting to operate the more economical compressed natural gas (CNG) vehicles until electric vehicle technology develops further. Also, some of the utilities reporting data on the fleet survey are combined utilities, which provide natural gas as well as electricity. These utilities may be choosing to operate CNG vehicles and still are able to promote their energy source.
- After CNG, methanol/ethanol was the most common alternative fuel in electric utility fleets, followed by propane, and then electricity.

### ***Natural Gas Supplier Fleet Survey***

- Natural gas suppliers appear to be farther along than electric utilities in integrating AFV's into their fleets. Survey data indicate that nearly 12 percent of the fleet vehicles operated by natural gas suppliers are AFV's. This proportion is substantially higher than the 3 percent found in the electric utility fleets, but much lower than the 46 percent penetration realized by the propane providers.
- Vehicles fueled by CNG were predominantly multifuel vehicles--vehicles capable of using more than one type of fuel. Most AFV's were converted from the use of conventional fuels to the use of alternative fuels.

## 3.2. Survey Operations

### Propane Provider Fleet Survey

The Propane Provider Fleet Survey collected information from a sample of the approximately 7,800 propane providers in the United States. The top 35 propane providers in the United States (as determined by 1992 sales volumes<sup>1</sup>) were asked to provide detailed information on fleet characteristics and operating practices. These providers, who in 1992 accounted for two-thirds of total residential and commercial propane sales, were mailed a questionnaire that collected the following information:

- Distribution of fleet vehicles among size classes, fuel types, and AFV engine technologies (i.e., multifuel vs. dedicated)
- Fleet vehicle retirements, acquisitions, and conversions planned for 1994
- Source of AFV's (original equipment manufacturer vs. conversion)
- Fleet vehicle fueling practices for conventional-fuel and alternative-fuel vehicles
- Fuel consumption
- Vehicle miles traveled
- Employee usage of fleet vehicles
- Average length of service of fleet vehicles before retirement (in months and miles)
- Fuel storage capacity in fleet vehicles
- Vehicle acquisition costs
- Vehicle conversion costs (for converted AFV's)
- Comparison of maintenance costs between AFV's and conventional-fuel vehicles.

A stratified random sample of 100 of the remaining smaller providers was selected to provide basic information about their vehicle stock and 1994 acquisition plans by means of a brief telephone interview that collected only the first three items in the above list. These smaller providers were separated into four strata corresponding to the four Census regions. The sample was then drawn using proportional allocation.

### Electric Utility Fleet Survey

Approximately 1,000 electric utilities provided information on their fleets and fleet vehicles in response to the Electric Utility Fleet Survey. This survey was conducted as a supplement to the EIA survey "Annual Electric Utility Report" (Form EIA-861), a census survey of about 3,200 electric utilities in the United States. Only utilities operating a fleet of 10 vehicles or more were required to provide information on the fleet portion of the survey. The respondents to the Electric Utility Fleet Survey were asked (via a mail questionnaire) to report the following:

- Distribution of fleet vehicles among size classes, fuel types, and AFV engine technologies (i.e., multifuel vs. dedicated) and
- Fleet vehicle retirements, acquisitions, and conversions planned for 1994.

### Natural Gas Supplier Fleet Survey

As with the Electric Utility Fleet Survey, the Natural Gas Supplier Fleet Survey was conducted as a supplement to an existing EIA survey, "Annual Report of Natural and Supplemental Gas Supply and Disposition" (Form EIA-176). This form is a census survey of all companies in the United States that take custody of natural gas, excluding consumers and producers. For the 1993 survey, there were approximately 2,064 respondents that completed Form EIA-176. Of those companies, only 553 which operated a fleet of 10 vehicles or more were required to complete the fleet survey.

<sup>1</sup> "Top 35 U.S. LPG Retailers," *LP-Gas Magazine*, June 1993, pg. 22.

The respondents to the Natural Gas Supplier Fleet Survey were asked to provide the following information:

- Distribution of fleet vehicles among size classes, fuel type, and AFV engine technologies (i.e., multifuel vs. dedicated)
- Fleet vehicle retirements, acquisitions, and conversions planned for 1994
- Fleet vehicles fueling practices for conventional-fuel and alternative-fuel vehicles
- Fuel consumption
- Daily vehicle miles traveled range
- Employee usage of fleet vehicles
- Average length of service of fleet vehicles before retirement (in months and miles)
- Source of AFV's (original equipment manufacturer vs. conversion).

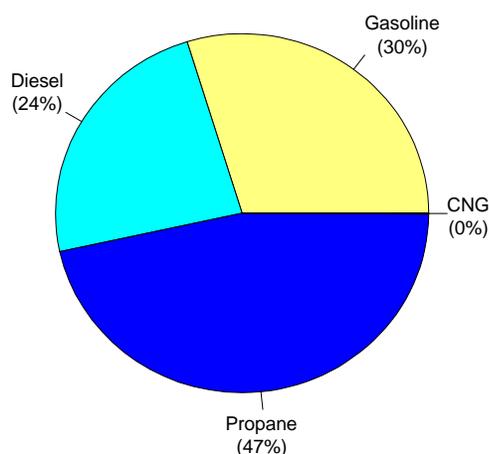
## 3.3. Fleet Size and Composition

### Propane Provider Fleet Survey

At the end of 1993, propane providers in the United States operated approximately 82,000 fleet vehicles. More than two-thirds of these vehicles were medium-duty and heavy-duty trucks, i.e., trucks with a Gross Vehicle Weight (GVW) greater than 8,500 pounds. These large vehicles tended to be trucks for making deliveries of propane to households and businesses. Large pickup trucks made up the next largest share of fleet vehicles.

Nearly half (47 percent) of the propane provider fleet vehicles were fueled by alternative fuels, more than were fueled by either gasoline or diesel alone (Figure 3.3.1). As expected, the primary alternative fuel used by propane providers in their fleet vehicles was propane. Only a small number (less than one percent) of their AFV's were fueled by compressed natural gas (CNG).

**Figure 3.3.1. Propane Provider Fleet Vehicles by Fuel, 1993**



Source: Energy Information Administration, Office of Energy Markets and End Use, Form EIA-885, Propane Provider Fleet Survey.

Nearly all of the propane vehicles reported by the propane providers (89 percent) were dedicated vehicles, that is, vehicles that operate solely on one fuel--in this case, propane. Multifuel vehicles, meaning AFV's capable of operating on more than one fuel, i.e., bi-fuel, flex-fuel, dual-fuel, and electric hybrid vehicles, made up the rest of the AFV's.

Considerable disparity in the proportion of AFV's in fleets existed between the fleets operated by the top 35 providers and the smaller providers. The top 35 providers operated about three times as many light-duty vehicles fueled by propane as light-duty vehicles fueled by gasoline or diesel alone. The top 35 providers operated nearly five times as many propane vehicles as gasoline or diesel vehicles within the medium- and heavy-duty classes. In contrast, the fleets operated by the smaller providers contain twice as many conventional-fuel vehicles as propane vehicles in these classes (Table 3.3.1).

**Table 3.3.1. Propane Provider Fleet Vehicles by Provider Category, 1993**  
(Number of Vehicles)

Provider Category and Vehicle Type	Total	Light-Duty Vehicles	Medium-/Heavy-Duty Vehicles
<b>Total</b> .....	81,967	25,648	56,319
<b>Top 35 Providers</b>			
Total Vehicles .....	24,236	6,730	17,506
Conventional-Fuel Vehicles .....	4,694	1,685	3,010
Propane Vehicles .....	19,448	4,956	14,492
<b>Remaining Providers</b>			
Total Vehicles .....	57,731	21,057	36,674
Conventional-Fuel Vehicles .....	39,005	14,375	24,631
Propane Vehicles .....	18,726	6,682	12,044

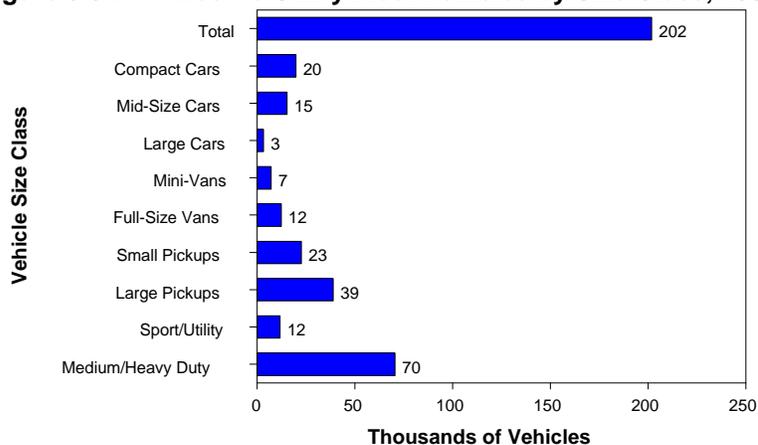
Source: Energy Information Administration, Office of Energy Markets and End Use, Form EIA-885, Propane Provider Fleet Survey.

Fleets can acquire alternative-fuel vehicles in two ways: by purchasing them from an original equipment manufacturer (OEM) or by converting a conventional-fuel vehicle to operate on an alternative fuel. The propane providers used both methods to place AFV's in their fleets, but for the most part the propane providers tended to operate converted AFV's. Among dedicated AFV's, only 27 percent were OEM vehicles and only 17 percent of multifuel vehicles were obtained from OEM's. Overall, three-fourths of the AFV's operated by propane providers were converted from conventional-fuel vehicles.

## Electric Utility Fleet Survey

As of December 31, 1993, electric utilities with fleets of 10 vehicles or more operated a total of 201,836 vehicles. These vehicles were widely distributed among the different vehicle size classes, although nearly one-third of the vehicles (70,448 vehicles) were medium-duty and heavy-duty trucks. Pickup trucks were the next largest category of vehicles, followed by compact and mid-size passenger cars. Nearly 20 percent of all fleet vehicles in electric utility fleets were passenger cars, in contrast to the propane provider fleets, which had only three percent passenger cars (Figure 3.3.2).

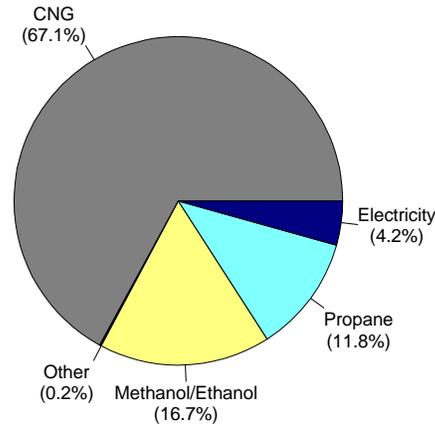
**Figure 3.3.2. Electric Utility Fleet Vehicles by Size Class, 1993**



Source: Energy Information Administration, Office of Coal, Nuclear, Electric, and Alternative Fuels, Form EIA-861 Schedule VII, Electric Utility Fleet Survey.

Nearly all fleet vehicles (97 percent) operated by electric utilities were conventional-fuel vehicles, with the vast majority of those being dedicated gasoline vehicles. Approximately 21 percent of the conventional-fuel vehicles in electric utility fleets were diesel vehicles. Only 3 percent of the fleet vehicles were alternative-fuel vehicles, and two-thirds of these AFV's were fueled with CNG. These CNG vehicles were mostly multifuel vehicles (78 percent), with only 821 of the 3,756 CNG vehicles being dedicated vehicles. The next most common alternative fuel used in electric utility fleets was methanol/ethanol (used in 935 vehicles), followed by propane (658 vehicles), and then electricity (237 vehicles). An insignificant number of alternative-fuel vehicles are fueled by other alternative fuels, mostly liquid natural gas (Figure 3.3.3).

**Figure 3.3.3. Electric Utility Fleet Alternative-Fuel Vehicles by Fuel, 1993**



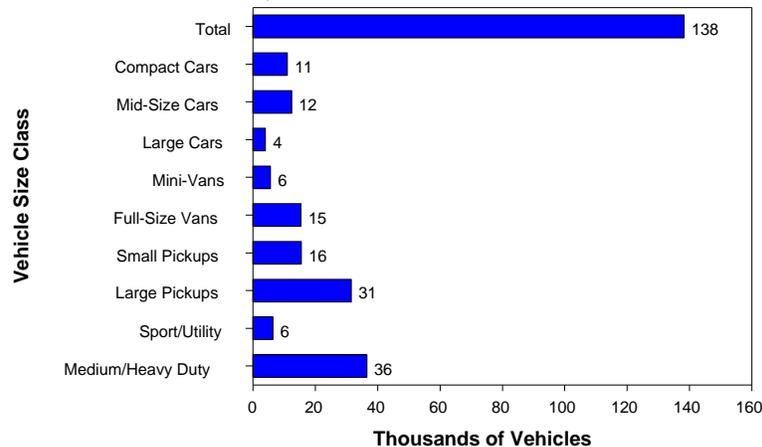
Note: Alternative-Fuel vehicles represent only three percent of the total fleet vehicles operated by electric utilities.  
 Source: Energy Information Administration, Office of Coal, Nuclear, Electric, and Alternative Fuels, Form EIA-861 Schedule VII, Electric Utility Fleet Survey.

## Natural Gas Supplier Fleet Survey

At the end of 1993, natural gas suppliers with fleets of 10 or more vehicles operated a total of 138,324 fleet vehicles. As with the fleets operated by electric utilities, the fleet vehicles operated by natural gas suppliers were well distributed among the various vehicle size classes. However, pickup trucks and full-sized vans made up nearly half (45 percent) of the fleet vehicles used by natural gas suppliers. Medium-duty and heavy-duty vehicles represented a substantial 26 percent of the fleet vehicles in use. Passenger cars made up another 20 percent (Figure 3.3.4).

Gasoline vehicles dominated the conventional-fuel vehicles with 85 percent of the total. These vehicles were mostly

**Figure 3.3.4. Natural Gas Supplier Fleet Vehicles by Size Class, 1993**



Source: Energy Information Administration, Office of Oil and Gas, Form EIA-176 Schedule B, Natural Gas Supplier Fleet Survey.

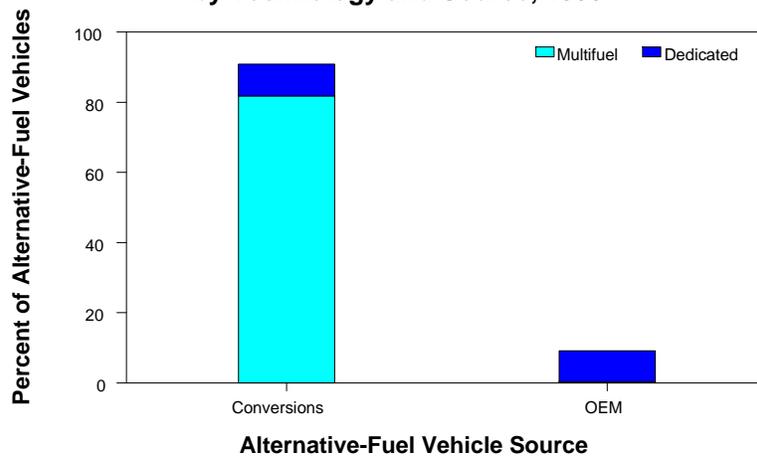
light-duty vehicles, with medium-duty and heavy-duty vehicles representing only 17 percent of the gasoline vehicles. The remaining 15 percent of the conventional-fuel vehicles were mostly medium-duty and heavy-duty diesel vehicles.

Predictably, most AFV's (87 percent) were fueled by CNG, but the natural gas providers did make significant use of propane as a vehicle fuel. Of the 14,032 CNG vehicles in natural gas supplier fleets, 84 percent (11,809 vehicles) were

multifuel vehicles. Conversely, dedicated propane vehicles outnumbered multifuel propane vehicles. Fewer than 1 percent were fueled by electricity and other alternative fuels.

The alternative-fuel vehicles in natural gas supplier fleets were almost all converted vehicles. The few OEM vehicles in use in natural gas supplier fleets tended to be dedicated vehicles--only 55 were reported to be OEM multifuel vehicles. The dedicated vehicles in operation were fairly evenly split between OEM and conversion vehicles: 1,582 OEM vehicles and 1,401 converted vehicles (Figure 3.3.5).

**Figure 3.3.5. Natural Gas Supplier Alternative-Fuel Vehicles by Technology and Source, 1993**



Source: Energy Information Administration, Office of Oil and Gas, Form EIA-176 Schedule B, Natural Gas Supplier Fleet Survey.

## 3.4. Fleet Vehicle Retirement/Acquisition Plans

### Propane Provider Fleet Survey

The propane providers were asked to report their plans for vehicle retirements and acquisitions during 1994. Only 6 percent (5,592 vehicles) of the fleet vehicles operated by propane providers were planned for retirement, nearly half (47 percent) of which were AFV's. The planned acquisitions, 6,970 vehicles, would more than make up for the vehicles being retired.

In addition to the acquisitions, 1,475 vehicle conversions were planned for 1994. There is some double counting in the acquisitions and conversions data. Analysis of the reported data revealed that if a respondent had plans to acquire a new vehicle in 1994 and then immediately convert that vehicle to an alternative fuel, in some cases that vehicle was reported as both an acquisition and a conversion. Analyzing the data to correct the double counting shows that of the 1,475 conversions planned for 1994, 921 were conversions of newly acquired conventional-fuel vehicles and 554 were conversions of vehicles previously operated within the fleet as conventional-fuel vehicles. Overall, more new AFV's were planned for service in 1994 than conventional-fuel vehicles, including both new vehicles and old vehicles being converted to use alternative fuels.

### Electric Utility Fleet Survey

Only about 9 percent of the fleet vehicles operated by electric utilities (18,956 vehicles) were planned for retirement during 1994. Most retirements were planned for gasoline vehicles; of the total of 16,438 gasoline vehicles planned for retirement, 2,736 were medium/heavy-duty vehicles, 5,675 were pickup trucks, and 3,052 were compact passenger cars. Only 455 AFV's were planned for retirement, and most of these were large pickup trucks. The acquisitions planned for 1994 (18,182 vehicles) would not completely replace all vehicles being retired. Only 724 conversions of conventional-fuel vehicles to alternative-fuel vehicles were planned.

As with the propane survey data, there is double counting within the data regarding fleet vehicle acquisitions and conversions. A similar analysis to the one conducted with the propane provider fleet data revealed that of the 724 conversions planned for 1994, only 159 were conversions of existing fleet vehicles. The other 565 planned conversions were of vehicles newly purchased as conventional-fuel vehicles. Further, only 1,003 of the planned new vehicle acquisitions (6 percent) were AFV's. The remainder were conventional-fuel vehicles, some of which were planned for subsequent conversion.

### Natural Gas Supplier Fleet Survey

The natural gas suppliers planned to retire a larger percentage of their fleet vehicles than either the propane providers or the electric utilities. About 12 percent (17,088 vehicles) of the fleet vehicles operated by natural gas suppliers were planned for retirement during 1994. In addition, only 14,374 vehicle acquisitions were planned, indicating that the fleets operated by natural gas suppliers tended to downsize in 1994. Only 7 percent of the planned vehicle retirements included alternative-fuel vehicles.

A total of 4,623 newly acquired AFV's and conversions of existing vehicles to AFV's were planned for service in 1994. Almost 80 percent of those planned vehicles were multifuel CNG vehicles. Most CNG vehicles were light-duty vehicles, with the largest proportion (40 percent) being large pickup trucks. The Natural Gas Supplier Fleet Survey did not experience the double counting problems encountered in the Propane Provider Fleet Survey and the Electric Utility Fleet Survey, so all of the 1,623 planned conversions represent conversions planned for existing fleet vehicles.

## 3.5 Fleet Operating Characteristics

In addition to the fleet size and composition characteristics covered above, the Propane Provider Fleet Survey (top 35 providers only) and the Natural Gas Supplier Fleet Survey also collected information regarding operating characteristics. Information collected included data concerning fleet vehicle fueling facilities, vehicle usage by employees, vehicle replacement cycles, vehicle fuel storage and consumption, and vehicle miles traveled. In addition, the top 35 propane providers responded to questions about vehicle costs.

### Fleet Vehicle Fueling Facilities

A company has several ways to fuel its fleet vehicles. Large commercial fleets tend to use their own fuel tanks located on a company site to fuel their vehicles. Fleets can also fuel at public fueling stations in the same manner as personal vehicles are fueled, or at private facilities that are designed for use by fleets and are not open to the general public. Fleets sometimes enter into fuel-purchase agreements with their fueling facilities, stipulating that the fleet agrees to purchase its fuel from a specific facility. If the fleet has a credit card for use at a facility but has no commitment to purchase fuel there, then such an arrangement is not considered a fuel purchase agreement.

The EPACT purchase mandates use central fueling as a criterion for determining which fuel provider fleets would be covered by vehicle purchase requirements, so questions about fueling arrangements were asked in order to determine whether alternative-fuel providers were centrally fueled or were capable of being centrally fueled.

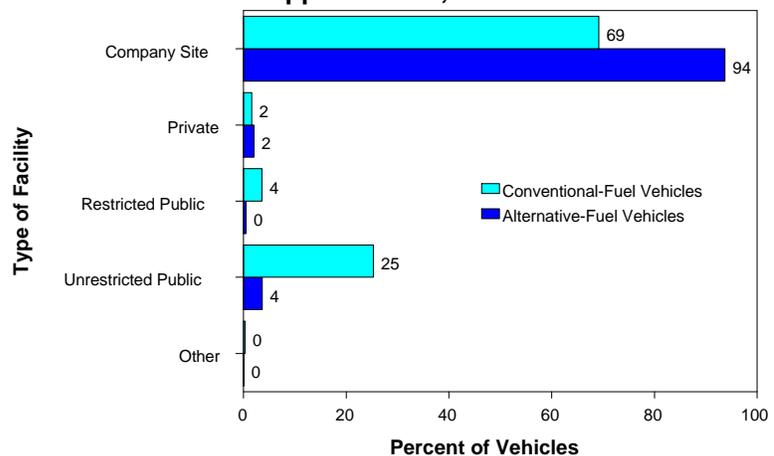
### Propane Provider Survey

Conventional-fuel vehicles, for the most part, were fueled either at a company-owned location or at a public fueling location without any type of fuel-purchase agreement. A small number of conventional-fuel vehicles also obtained their fuel at private facilities not open to the public. The data indicate that the propane provider fleets tended not to enter into fuel-purchase agreements with the facilities that provide their fuel.

Only a very small number of the AFV's operated by propane providers fuel at facilities other than company-owned sites. This is probably because almost all of the AFV's operated by propane providers run on propane and therefore use the company's fuel. Vehicles that do obtain their fuel off-site generally purchase the fuel through a fuel-purchase agreement with private facilities.

### Natural Gas Supplier Survey **Figure 3.5.1. Types of Fueling Facilities Used by Natural Gas Supplier Fleets, 1993**

Natural gas suppliers tended to fuel their fleet vehicles at a variety of types of facilities. For both the conventional-fuel vehicles and the alternative-fuel vehicles, the majority of vehicles were fueled on company-owned sites, but significant numbers of vehicles fueled at other types of facilities. More than one-quarter (35,370 vehicles) of the conventional-fuel vehicles operated in fleets belonging to natural gas suppliers were fueled at public fueling facilities. Nearly all of those (88 percent) were fueled without any commitments to a fuel purchase agreement.



Source: Energy Information Administration, Office of Oil and Gas, Form EIA-176 Schedule B, Natural Gas Supplier Fleet Survey.

Only 6 percent of AFV's, or 1,004 vehicles, were fueled off-site, a much lower percentage than for conventional-fuel vehicles (Figure 3.5.1).

## Fleet Vehicle Usage by Employees

Company vehicles parked overnight at an employee's residence and not centrally fueled from the provider's facility are excluded from a provider's fleet for purposes of determining whether a fleet is subject to EPACT's purchase mandates. For that reason, the Propane Provider Fleet Survey (top 35 providers) and the Natural Gas Providers Survey collected information regarding the availability of fleet vehicles to company employees.

### Propane Provider Survey

Nearly all vehicles (87 percent) operated by propane providers were available to their employees for business use only, and those vehicles were garaged overnight at a company site. The remaining vehicles were available to employees for commuting and business use or for unrestricted business and personal use, and would most likely be garaged overnight at the employees' residences. The respondents also indicated that 99 percent of employees who had the unrestricted use of company vehicles were required to keep a log to record personal and business use.

### Natural Gas Supplier Survey

Fleet vehicles operated by natural gas suppliers tended not to be available to company employees for uses other than business. Three-fourths of the fleet vehicles were designated as for business use only. Employees were allowed to use another 16 percent (22,662 vehicles) for commuting to and from work in addition to using them for business. A relatively small number of vehicles were available to employees for unrestricted or other uses. These data indicate that the fleets belonging to natural gas suppliers were, for the most part, garaged at a company site.

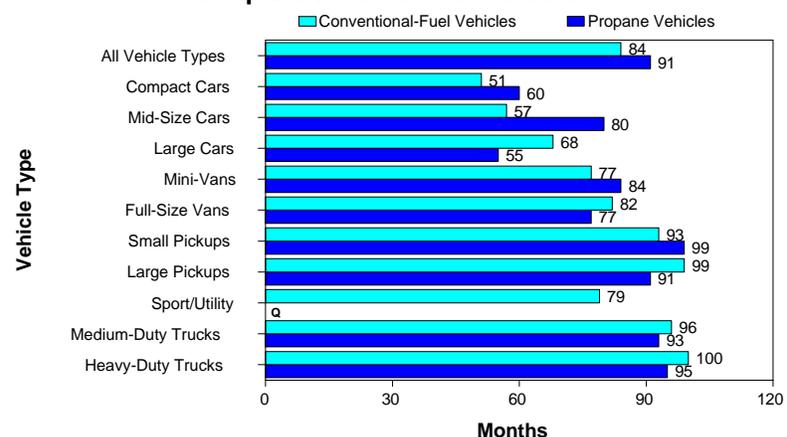
## Fleet Vehicle Replacement Cycles

Replacement cycles refer to the amount of time (or other measure) a company keeps its vehicles before retiring and/or replacing them. A company may retire or replace a vehicle after a certain number of months or after the vehicle has been driven a certain number of miles. In these surveys, respondents could provide replacement cycle data in months, miles, or both.

### Propane Provider Survey

The average months-based cycle for conventional-fuel vehicles in propane provider fleets was 84 months, although propane vehicles were in service for an average of 91 months (Figure 3.5.2). The average miles-based cycle for conventional-fuel vehicles (216,482 miles) was higher than for propane vehicles (179,866 miles) (Figure 3.5.3). Analysis of the miles-based cycles for the individual vehicle types reveals that this was completely due to the miles-based cycle for the heavy-duty trucks. The miles-based replacement cycle for conventional-fuel heavy-duty vehicles

**Figure 3.5.2. Months-Based Replacement Cycles for Propane Provider Fleet Vehicles**

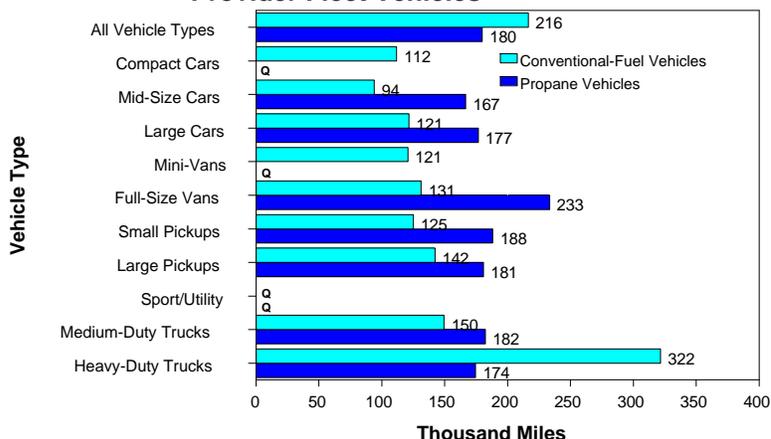


Q = Data withheld because fewer than three companies are represented.  
 Source: Energy Information Administration, Office of Energy Markets and End Use, Form EIA-885, Propane Provider Fleet Survey.

was nearly twice that of the propane heavy-duty vehicles. This is most likely because the conventional-fuel heavy-duty vehicles travel longer distances than the heavy-duty vehicles fueled by alternative fuels, but the miles traveled data (discussed below) for light-duty vehicles are much more similar.

Analysis of the replacement cycle data reported by the respondents to the Propane Provider Fleet Survey reveals that there is a discrepancy within the reported data. The propane providers reported that approximately 6 percent of their fleet vehicles were planned for retirement in 1994. If 1994 was a typical year for vehicle retirements, then about 100 percent of the fleet vehicles would have been retired and replaced every 17 years. However, data indicate that the typical reported replacement cycle for vehicles is approximately every 7 years. The data collected in the survey cannot positively explain this discrepancy, but possible explanations can be offered. One explanation is that nearly half of all retirements and/or replacements are unplanned; that is, although only 6 percent of the vehicles are planned for retirement at the beginning of a given year, another 6 percent may be retired or replaced due to vehicle condition or other unforeseen circumstances. Four respondents reported that they did not retire their vehicles on a cycle, but rather they retired or replaced them when the condition of the vehicle dictated that it was necessary. Another possible explanation is that 1994 was an abnormal year for retirements, and in a normal year, twice that many vehicles tend to be retired or replaced.

**Figure 3.5.3. Miles-Based Replacement Cycles for Propane Provider Fleet Vehicles**



Q = Data withheld because fewer than three companies are represented.  
 Source: Energy Information Administration, Office of Energy Markets and End Use, Form EIA-885, Propane Provider Fleet Survey.

## Natural Gas Supplier Survey

The replacement cycles for fleet vehicles reported by the natural gas suppliers indicated that fleet vehicles tended to be replaced more often in natural gas supplier fleets than in propane provider fleets. On average, vehicles are replaced after about 6 years of use or after 94,530 miles have been traveled, slightly less than the average replacement cycles for the vehicles in propane provider fleets. A possible explanation may be that propane provider fleets contain more medium-duty and heavy-duty vehicles, which tend to be replaced less often than the light-duty vehicles that are more prominent in natural gas supplier fleets.

There also appears to be a small discrepancy between the planned vehicle retirements and the reported replacement cycles among natural gas suppliers. The natural gas suppliers reported that they planned to retire approximately 12 percent of their fleet vehicles in 1994. Using the same logic as with the propane provider fleet data, one could conclude that the entire fleet is replaced approximately every 8 years. However, the natural gas suppliers reported that the average replacement cycle for their fleet vehicles is about 6 years. In addition to the possible explanations provided with the propane provider fleet data, another reason for the discrepancy could be that the suppliers report the replacement cycles that the company would like to adhere to, but, due to budgetary or other constraints, those cycles cannot be met and fleet vehicles are actually kept in service longer than the replacement cycles indicate. However, none of the possible explanations provided in this report can be confirmed using the data collected on the fuel provider surveys.

## Fleet Vehicle Fuel Storage Capacity

One of the most prominent drawbacks of alternative-fuel vehicles is that the vehicles cannot be driven as far between refuelings as conventional-fuel vehicles. Additional fuel tanks are often placed in the vehicles in order to provide additional fuel. Information on fuel storage capacity was collected only from the propane providers.

The survey data reveal that the propane vehicles indeed had more fuel storage capacity than the conventional-fuel vehicles. The average fuel storage capacity for dedicated vehicles in the light-duty category was approximately 91 percent higher for propane vehicles than for conventional-fuel vehicles. The difference between multifuel vehicles and conventional-fuel vehicles was much smaller. For the multifuel light-duty vehicles, the average fuel storage capacity for propane was only approximately 22 percent higher than the storage capacity for conventional fuels in conventional-fuel vehicles. This may be due to the fact that in multifuel vehicles, capacity is needed for both propane and gasoline or diesel. Meaningful comparisons between the reported propane and conventional fuel storage capacities for the medium- and heavy-duty vehicles cannot be made, because these vehicles are often fueled from the large delivery tanks they carry, which can hold thousands of gallons of propane.

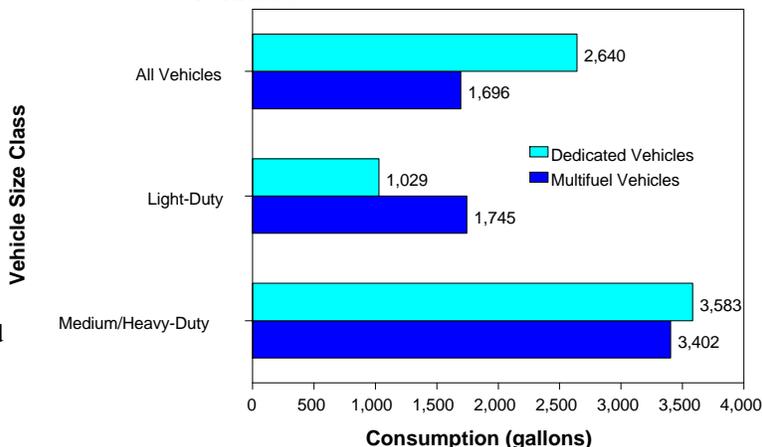
## Fleet Vehicle Fuel Consumption

### Propane Provider Survey

Of the three fuels that are significantly represented in propane provider fleets (gasoline, diesel, and propane), the most heavily consumed per vehicle is diesel (6,512 gallons per vehicle per year). Diesel fuel is used, for the most part, in the heavy-duty trucks that tend not only to travel long distances, but also to achieve low fuel economies--even though diesel is more efficient than gasoline for similar vehicle types. Gasoline tends to be the least consumed fuel, with dedicated

gasoline vehicles only consuming an average of about 1,100 gallons per vehicle per year. Multifuel AFV's consume an average of another 200 gallons of gasoline per vehicle per year. Annual consumption of propane per vehicle was about 2,640 gallons in dedicated propane vehicles and 1,696 gallons in multifuel vehicles. As expected, the largest consumers of propane were the medium-duty and heavy-duty trucks. The dedicated medium-duty and heavy-duty propane vehicles consumed an average of 3,583 gallons of propane per vehicle per year, while the multifuel vehicles consumed 3,402 gallons per vehicle per year. Although over all vehicle types the dedicated vehicles tended to be heavier consumers per vehicle of propane than the multifuel vehicles, among just light-duty vehicles, the multifuel propane vehicles consumed about 70 percent more per vehicle per year than the dedicated propane vehicles (Figure 3.5.4).

**Figure 3.5.4. Annual Propane Consumption per Vehicle by Vehicle Size Class for Propane Provider Fleet Vehicles**



Source: Energy Information Administration, Office of Energy Markets and End Use, Form EIA-885, Propane Provider Fleet Survey.

### Natural Gas Supplier Survey

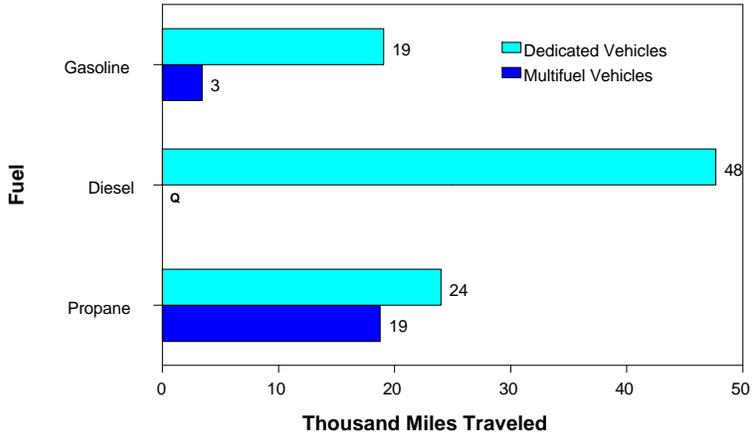
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# Fleet Vehicle Miles Traveled

## Propane Provider Survey

In the analysis of annual vehicle miles traveled, the diesel vehicles tended to stand out. On average, over all vehicle types, the diesel vehicles traveled twice as far per year than the next closest category, dedicated propane vehicles, averaging slightly less than 48,000 miles per year per vehicle. Dedicated gasoline vehicles traveled about 20,000 miles per year, and approximately 3,500 additional miles were traveled on gasoline in multifuel AFV's (Figure 3.5.6). Because little gasoline was consumed in multifuel vehicles and multifuel vehicles traveled relatively few miles on gasoline, one can conclude that the multifuel propane vehicles operated by propane providers were more likely to run on propane than gasoline. Overall, the propane vehicles traveled an average of about 21,000 miles per year per vehicle. The dedicated propane vehicles (23,997 miles per year) do tend to travel slightly more in a year than the multifuel propane vehicles (18,768 miles per year).

**Figure 3.5.6. Annual Vehicle Miles Traveled per Vehicle on Gasoline, Diesel, and Propane by Vehicle Technology for Propane Provider Fleet Vehicles**

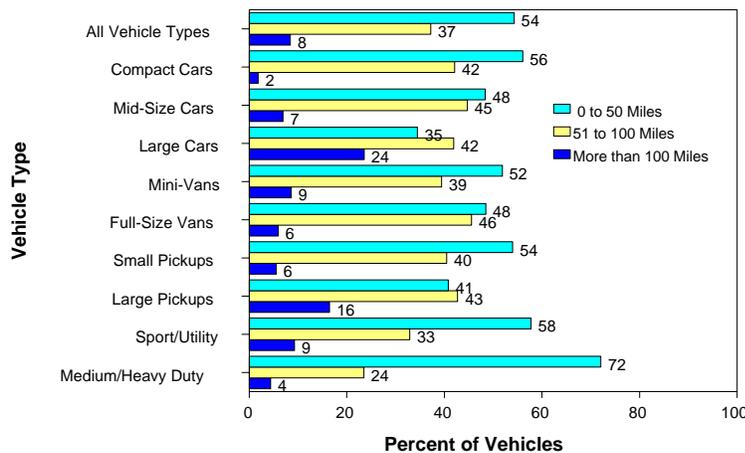


Q = Data Withheld because fewer than three companies are represented.  
 Source: Energy Information Administration, Office of Energy Markets and End Use, Form EIA-885, Propane Provider Fleet Survey.

## Natural Gas Supplier Survey

Natural gas supplier fleet vehicles tended not to travel long distances on a daily basis. Miles traveled data were collected from the respondents to the Natural Gas Supplier Fleet Survey in the form of ranges of daily miles traveled. Nearly all fleet vehicles (92 percent) traveled between 0 and 100 miles per day on average. The vehicles that traveled more miles in a day tended to be large passenger cars and large pickup trucks (Figure 3.5.7).

**Figure 3.5.7. Daily Miles Traveled by Natural Gas Supplier Fleet Vehicles**



Source: Energy Information Administration, Office of Oil and Gas, Form EIA-176 Schedule B, Natural Gas Supplier Fleet Survey.

## Fleet Vehicle Operating Costs

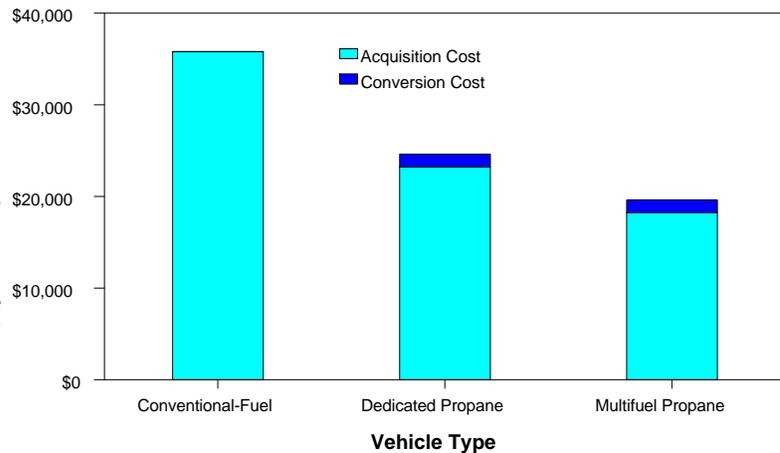
Proponents of alternative-fuel vehicles often cite lower operating costs as a benefit of these vehicles, so the Propane Provider Survey asked respondents about their vehicle operating costs. The Natural Gas Supplier Fleet Survey did not include these questions.

Operating costs were separated into three types of costs: vehicle acquisition costs, costs to convert vehicles to an alternative fuel, and maintenance costs. Data on acquisition costs and conversion costs were collected in dollars, and data on maintenance costs were collected as a comparison between conventional-fuel vehicles and alternative-fuel vehicles; that is, the respondents were asked to report if the maintenance costs for a particular alternative-fuel vehicle were more or less than a comparable conventional-fuel vehicle and by what percentage.

No clear trend appears between conventional-fuel vehicle acquisition costs and the cost to acquire propane vehicles. For example, the costs were about equal for large pickup trucks; for medium-duty trucks (8,501 to 26,000 lbs. GVW), the conventional-fuel vehicles were acquired for less than the dedicated propane vehicles; and for heavy-duty trucks (more than 26,000 lbs. GVW), the costs to acquire conventional-fuel vehicles were significantly higher than the costs to acquire propane vehicles. On average, for all vehicle types, the acquisition costs for conventional-fuel vehicles (\$35,802) tended to be 73 percent higher than the cost to acquire propane vehicles (\$20,736) (Figure 3.5.8). The majority of this difference can be attributed to the difference between acquisition costs for propane vehicles and for conventional-fuel heavy-duty vehicles. The differences for the other vehicle types are not nearly that great. The large difference in the heavy-duty vehicle category cannot be explained without further information, but one possible explanation is that the heavy-duty propane vehicles tend to be just slightly more than 26,000 lbs. GVW, whereas the conventional-fuel heavy-duty vehicles are very large vehicles weighing substantially more than 26,000 lbs. This explanation would be consistent with the finding that the acquisition costs for heavy-duty propane vehicles tend to be very close to the acquisition costs for medium-duty propane vehicles.

The cost to convert vehicles from a conventional fuel to an alternative fuel was fairly stable over the various vehicle types, ranging from around \$1,200 to just under \$1,800. The most costly conversion appeared to be the conversion of a large passenger car (\$1,783) to a dedicated AFV, and the least expensive conversion tended to be that of medium-duty trucks to multifuel vehicles (\$1,150). Conversion to a dedicated AFV tended to cost slightly more than conversion to a multifuel vehicle, with the difference averaging \$100 to \$150 (Figure 3.5.8).

**Figure 3.5.8. Propane Provider Fleet Vehicle Acquisition and Conversion Costs**



Source: Energy Information Administration, Office of Energy Markets and End Use, Form EIA-885, Propane Provider Fleet Survey.

One of the many benefits of AFV's promoted by the industry is that they are more economical to maintain because the engines tend to have fewer moving parts and the fuels burn cleaner. The data from the Propane Provider Fleet Survey seem to confirm this. The respondents report that the maintenance costs for their propane vehicles are less than for their conventional-fuel vehicles across all vehicle types. The difference between the two types of vehicles is slightly greater for dedicated vehicles (5.7 percent) than for multifuel vehicles (4.4 percent).

## 3.7 Data Quality

### Propane Provider Fleet Survey

Unlike the Electric Utility Fleet Survey and the Natural Gas Supplier Fleet Survey, the Propane Provider Fleet Survey was conducted as a sample survey and, therefore, the data collected are subject to sampling and nonsampling error. However, the sampling error will affect only portions of the data collected. The data that were collected from the top 35 providers, but not the 100 sampled companies, are not subject to sampling error because that part of the survey was a census.

#### Nonsampling Error

Nonsampling errors are errors of the survey process and include both random errors and systematic errors or biases. The magnitudes of nonsampling biases cannot be estimated from the sample data. Thus, avoidance of systematic biases is a primary objective of all stages of survey design. Subsequent to conducting a survey, problems of unit nonresponse and item nonresponse need to be addressed. The treatment of these types of errors in the Propane Provider Fleet Survey are discussed below.

#### Unit Nonresponse

Unit nonresponse is the type of nonresponse that occurs when no data are available for a survey respondent. Most unit nonresponse occurs when a respondent is unavailable or refuses to cooperate. There was one instance of unit nonresponse in the top 35 providers portion of the Propane Provider Fleet Survey that was accounted for using a simple weight adjustment. One respondent among the top 35 providers was also a respondent to the Natural Gas Supplier Fleet Survey. In order to prevent duplication of the data collection and to reduce burden on the respondent, that particular provider was released from the Propane Provider Fleet Survey. The remaining 33 responding providers were given a weight of  $34/33 = 1.03$  to account for the nonresponding provider. Within the sample portion of the survey, there was 100 percent response.

#### Imputation for Item Nonresponse

There were three variables on the Propane Provider Fleet Survey that required imputation due to item nonresponse. Those variables were fuel storage capacity, vehicle fuel consumption, and vehicle miles traveled (VMT). For fuel storage capacity, the hot-deck procedure was used to impute for missing responses. In hot-decking, when a certain response is missing for a given respondent, another respondent, called a donor, is randomly chosen to furnish its reported value for that missing item. The donated value is then assigned to the nonrespondent company.

Due to the complex nature of consumption and miles-traveled data, it was determined that the hot-deck procedure would not be adequate. Therefore, missing responses for consumption and miles traveled were derived using nonmissing data items for the nonrespondent companies along with data from outside sources. The outside data used were average fuel economies (in miles per unit of fuel) for each fuel and each vehicle type. For those companies that did not report consumption data, but did report VMT, the missing consumption data were imputed by dividing the reported VMT by the appropriate fuel economy estimate.

If a respondent did not report either consumption or VMT, a more complicated derivation was necessary. First, an average VMT per vehicle was computed from all reported values for each fuel and vehicle type. Consumption was then imputed as gallons per vehicle by dividing the appropriate average VMT per vehicle by the appropriate fuel economy estimate. There were two respondents who were unable to report the consumption data by vehicle type, but were able to provide the total consumption of each fuel. For these two respondents, the consumption was first imputed as described; the ratio was adjusted using the reported total consumption. The ratio was computed by dividing the reported

total consumption by the sum (over all vehicle types) of imputed consumption. Once the consumption was imputed, those newly imputed data were used to impute VMT by multiplying the imputed consumption by the appropriate fuel economy estimate.

## Sampling Error

The random differences between the survey estimate and the true population value that occur because of the particular sample that was selected are known as sampling errors. The average sampling error, averaged over all possible samples, should be zero. Although the sampling error is nonzero and unknown for the particular sample chosen, the sample design permits sampling errors to be estimated. The typical magnitude of the sampling error is measured by the “standard error” of the estimate. Standard errors in this report are given as percents of their estimated values, that is, as relative standard errors (RSE’s).

For a given survey statistic, Y, the relative standard error, RSE(Y) is computed as follows:

$$S_h^2 = \frac{\sum_i (Y_i - \bar{Y}_h)^2}{n_h - 1}$$

$$\sigma = \sqrt{\sum_h \left(\frac{N - n}{n}\right) N_h S_h^2}$$

$$RSE = \left(\frac{\sigma}{Y}\right) * 100$$

where,

n	=	total sample size
n <sub>h</sub>	=	sample size in stratum h
N	=	total population size, and
N <sub>h</sub>	=	population size in stratum h.

For this survey, there were four strata representing the four Census regions. The propane provider frame, omitting the top 35 providers, was separated into these four strata before the sample of 100 companies was selected. The top 35 providers did not contribute to sampling error because they were in the sample with certainty. However, for determining RSE’s, the contribution of the top 35 providers was kept in the denominator. RSE’s for applicable tables are included in the “3.6 Detailed Tables” section.

## Electric Utility Fleet Survey

Because the Electric Utility Fleet Survey was conducted as a census survey, the data collected are not subject to sampling error. However, as with all surveys, non-sampling errors can occur. These types of errors cannot be estimated using sample data. No adjustments for either unit or item nonresponse were performed on the data collected in the Electric Utility Fleet Survey.

## Natural Gas Suppliers Fleet

Because the Natural Gas Supplier Fleet Survey was conducted as a census survey, the data collected are not subject to sampling error. However, as with all surveys, non-sampling errors can occur. These types of errors cannot be estimated using sample data.