April 1999 • NREL/TP-540-25929

Technical Report

Perspectives on AFVs: State and City Government Fleet Driver Survey

M. Whalen, L. Eudy, and T. Coburn

World Wide Web: http://www.afdc.doe.gov

National Renewable Energy Laboratory

1617 Cole Boulevard
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Executive Summary

This survey collected information from state government and city government fleet drivers who operate light-duty alternative fuel vehicles (AFVs). The survey posed questions related to AFV use, fuel use and availability, and performance. Surveys were completed with 468 state government fleet drivers, from 44 of the 50 states. In all, 403 surveys were completed with city government fleet drivers from 39 different cities across the country.

Responses were collected from drivers of original equipment manufacturer vehicles fueled by compressed natural gas (CNG), alcohol (ethanol or methanol), electricity, and gasoline, and aftermarket conversions fueled by CNG or liquefied petroleum gas (LPG). Among the state government respondents, the most commonly reported AFVs were alcohol-fueled vehicles, followed very closely by CNG conversions and LPG conversions. Drivers of CNG conversions dominated the city government responses. About 19% of the responses in both the state and city government groups were from drivers of gasoline-only vehicles.

Access to alternative fuels continues to be an issue for many of these AFV drivers. Between 50% and 60% of the AFV drivers indicated that an alternative fuel station was within a reasonable distance, with most drivers defining a reasonable distance as within 5 miles. In addition, among drivers of bi-fuel and flexible-fuel vehicles, alternative fuel is not always the fuel of choice, with some 55% to 60% of these drivers indicating that they use the alternative fuel 50% or more of the time. State government AFV drivers were most likely to use a public station to refuel; city government AFV drivers were nearly equally divided between using public, private, and on-site fuel stations. Most AFV drivers expressed no concerns about refueling their vehicles.

In general, both AFV and gasoline vehicle drivers tended to be satisfied with the overall performance of their vehicles. Dedicated CNG and alcohol-fueled vehicles received the most “very good” and “excellent” ratings among the AFVs. Just over half the drivers reported that their AFVs are about the same overall as similar gasoline vehicles. Drivers of alcohol-fueled AFVs overwhelmingly reported that their vehicles are about the same or better than similar gasoline vehicles.

The drivers’ responses about specific performance problems, maintenance, acceleration, and range generally indicate that these AFVs compare reasonably well to similar gasoline-only vehicles. AFV drivers reported a higher incidence of complaints than did drivers of gasoline vehicles, but most complaints came from drivers of aftermarket conversion AFVs. Most of the AFV drivers indicated there was no difference in the frequency or types of maintenance —scheduled or unscheduled—for their vehicles. Most of the AFV and gasoline vehicle drivers rated acceleration as average or better than average. Nearly all

of the small number of poor acceleration ratings received were from drivers of AFVs. Although vehicle range is not an issue among many AFV drivers, it is a concern for drivers of dedicated CNG AFVs and among some drivers of electric AFVs.

In general, AFVs appear to meet the service application needs of most of the drivers surveyed, and tend to compare well to similar gasoline vehicles. In fact, more than half of these AFV drivers would recommend an AFV to other drivers. Because they believe operating AFVs is better for the environment and may help to improve air quality, many of these state and city government drivers are willing to use AFVs despite concerns about access to alternative fuels and some lingering vehicle performance issues.

Introduction

In an effort to reduce national dependence on imported oil and to improve urban air quality, the U.S. Department of Energy (DOE) is promoting the development and deployment of alternative fuels and alternative fuel vehicles (AFVs). To support this activity, DOE has directed the National Renewable Energy Laboratory (NREL) to develop and conduct projects to evaluate the performance and acceptability of light-duty AFVs compared to similar gasoline vehicles. As part of this effort, NREL has undertaken a number of evaluation projects, including conducting surveys with fleet managers and drivers of AFVs in state and local government fleets.

For this survey report, light-duty vehicle drivers employed by state and local governments were interviewed as a follow-up to previous surveys conducted with fleet managers operating AFVs in state and local government fleets, and with federal fleet vehicle drivers. The results from both surveys have been summarized and reported previously (Whalen et al., 1999 and Whalen and Coburn, September 1997). The surveys were developed to collect information on AFVs related to fuel use, fuel availability, vehicle performance, maintenance, and acceptability from those who are actually operating the AFVs. This report summarizes the results from the survey of state and local government fleet vehicle drivers.

AFVs Used In U.S. Fleets

Currently, under the Energy Policy Act (EPAct), state governments and fuel providers are mandated to include a certain percentage of AFVs in their new vehicle purchases. In 1998, 50% of federal and 25% of state government fleet vehicle purchases were required to be AFVs. In addition, 70% of fuel provider fleet vehicle purchases were required to be AFVs. The current mandates do not include municipal and private fleets, but many of these fleets are voluntarily seeking to include AFVs in their fleets in anticipation of future requirements, or as part of local efforts to improve air quality. The Energy Information Administration (EIA) estimates that there are more than 400,000 AFVs operating in fleets across the United States (EIA, 1997). Of these AFVs, it is estimated that more than 328,000 are light-duty vehicles (LDVs). The LDV classification includes sedans, pickup trucks, and some passenger/cargo vans, and is generally applied to a vehicle with a gross vehicle weight up to 8,500 lb. Nearly 75,000 of these light-duty AFVs are being operated in state and local government fleets, and an additional 230,000 are being operated in private fleets. These vehicles are located throughout the country and are used in a variety of different applications.

The AFVs in the light-duty fleets can be grouped by the alternative fuel used: compressed natural gas (CNG), liquefied petroleum gas (LPG, often referred to as propane), methanol (M85), ethanol (E85), and electricity (ELEC). CNG vehicles can be any of three different types—dedicated original equipment manufacturer models (CNG-OEM), which run only on CNG; aftermarket conversions (CNG-CON), which are generally bi-fuel, but can be dedicated; and bi-fuel OEM models (CNG-BI). The bi-fuel vehicles can run on either CNG or gasoline, but not on both at the same time. LPG vehicles include both aftermarket conversions (the vast majority of LPG vehicles) and a limited number of bi-fuel OEM vehicles. As with CNG vehicles, bi-fuel LPG vehicles can be operated on LPG or gasoline, but again, not on both at the same time. The ethanol and methanol vehicles are flexible-fuel models from the OEMs. Flexible-fuel means that the vehicles can operate on any combination of their respective alternative fuel and gasoline, up to a blend of 85% alternative fuel and 15% gasoline. The electric vehicle category includes both OEM vehicles and gasoline vehicles converted to operate on electricity.

According to EIA estimates (EIA, 1997), LPG vehicles are the most numerous AFV type used in state/local government and private fleets—estimated to represent 60% and 77% of AFVs, respectively, in these fleets. The next most common AFV type is a CNG-fueled vehicle, estimated to make up 22% of state/local government fleet AFVs. E85, M85, and electric vehicles each represent less than 10% of the AFVs in these fleets.

Other AFV Surveys

Other AFV-related surveys have been conducted in recent years, each with differing objectives and approaches. DOE's EIA has conducted several surveys to collect information on AFVs and alternative fuel use (EIA 1996, 1997). The EIA surveys focused on estimating the numbers and types of AFVs in use, the consumption of alternative fuel, and the number and types of AFVs available. EIA relied heavily on secondary sources for much of its data, including government agencies (federal, state, and local) and energy suppliers.

A survey was conducted in 1996 with federal fleet vehicle drivers who were operating AFVs (Whalen and Coburn, September 1997). This survey was designed to collect information about in-service vehicles from drivers who are actually operating AFVs. It also sought some comparative information from drivers of similar gasoline vehicles. The current survey is very similar, but the target population consists of vehicle drivers in state and local government fleets.

Survey Development, Implementation, and Data Analysis

This survey is a follow-up to the previous survey with drivers of U.S. federal fleet vehicles, but state and city fleet vehicle drivers were interviewed for this survey. Respondents to a companion fleet managers' survey were asked to provide names of drivers. The population of state and city fleet vehicle drivers is functionally and geographically diverse, with no single comprehensive list of names available. A detailed contact list of appropriate state and local government vehicle drivers was developed based in part on lists provided by participants in the fleet manager survey. Additional fleet managers who did not participate in the fleet manager survey were also contacted to expand the list. Many of the fleet managers were not willing to provide names of drivers to be contacted, but they were willing to distribute copies of the questionnaire to their drivers and then to return the completed questionnaires.

The development of the contact list and distribution of the questionnaire targeted drivers in all 50 states (for the state government survey), and in 44 selected cities (for the local government survey). In all, a list of more than 6,600 drivers was developed, with more than 10,000 additional copies of the questionnaire distributed. In the case of the constructed contact list, drivers were randomly selected, with some effort made to choose participants in areas where alternative fuels were known to be available. No attempt was made to stratify the sample in advance according to AFV type, model, make or manufacturer of vehicle, although such information was collected from each respondent. It was not possible to maintain control over the randomness of driver selection in the cases where fleet managers distributed the survey form themselves.

After evaluating the survey resources and the estimated population size, a target sample size of 1,000 state vehicle drivers and 968 local government vehicle drivers was established. The goal was to complete interviews with 20 drivers from each state and to complete interviews with 22 drivers from each city included in the survey design. Both the contact rate via telephone and the response rate via mail were low, and the target number of surveys was not reached. In fact, because of the difficulty in identifying appropriate drivers (some locations were unwilling to participate), no surveys were completed in 6 of the 50 states and 5 of the 44 cities. There were, however, 9 states in which more than 20 drivers completed the questionnaire and 5 cities in which more than 22 drivers completed the questionnaire. In total, 871 drivers (state and city) were interviewed or completed surveys. The drivers interviewed included 468 state government and 403 local government vehicle drivers. All completed surveys were included in the detailed data analysis.

The sample size in this survey is still sufficient to maintain an overall margin of error of slightly above 3% at 95% confidence. The margin of error was estimated to be about 4% at 95% confidence for the state government driver results, and nearly 5% for the city government driver results. The margins of error associated with percentages or proportions of other subgroups of the population may be higher, as a result of smaller effective sample sizes.

NREL personnel developed the survey questionnaire, which included questions about AFV acceptability, fuel use, and subjective vehicle performance. The survey included the same questions asked of federal fleet drivers during an earlier survey (Whalen and Coburn, September 1997), along with several new questions. The new questions sought additional feedback on vehicle service, vehicle maintenance, and fuel availability. The survey was conducted from December 1997 through May 1998.

The staff of Petroleum Information-Dwights, a subcontractor to NREL, conducted the interviews and mailed the questionnaires. All survey responses were recorded on an individual survey form (by either an interviewer or by the respondent), and tabulated for subsequent analysis.

The general approach to the analysis of the survey data involved use of cross-tabulations and contingency tables, with survey data subdivided into appropriate groupings. Descriptive statistics (such as means, percentages, and standard deviations) were also compiled. Formal tests of statistical significance were performed to assess differences between categories and groups, where appropriate. Some of the results of such tests are reported (usually in the form of Chi-square statistics and associated probabilities) in appropriate sections of this report. All data analyses were conducted using the JMP statistical software from the SAS Institute.

The primary grouping for analysis purposes involved subdivision by the type of vehicle driven by the respondents. Seven hundred seven (81.2%) of the responses were from drivers of AFVs, and the rest were from drivers of gasoline-only vehicles. The analysis placed considerable emphasis on understanding the differences associated with vehicle type. Because only a few respondents identified their vehicle type as CNG-BI or M85, we decided to group these responses with other appropriate responses. The CNG-BI and CNG-CON responses were grouped and are presented as CNG-CON throughout the analysis results, and the E85 and M85 responses were grouped and presented as alcohol throughout the analysis results. Both the state and city responses were grouped this way.

The state government data were also analyzed and compared by census region (Northeast, Midwest, South, and West) to determine if any regional differences in responses would appear. In addition, the local government data were analyzed according to whether the city/area is a participant in the DOE's Clean Cities Program. Clean Cities is a locally based government/industry partnership coordinated by DOE. The program focuses on expanding the use of alternatives to gasoline and diesel fuel. No target numbers by AFV type were established in advance, as it was desired to ascertain which of the AFV types are most commonly operated in fleets across the country.

Respondent and Fleet Characteristics

Figures 1 and 2 summarize the number of surveys completed in each state and city (see tables in Appendix A for distribution by vehicle type). Surveys were completed in 44 of the 50 states, with the highest number of responses, 54, completed by drivers in West Virginia. The final analysis included responses from 39 of the 44 selected cities, with the maximum number of responses, 44, from Denver.

The cities were selected to geographically represent the country, and to include cities of different sizes. Of the selected cities, 19 of 39 were designated as, or were participants in, city or regional Clean Cities programs as of September 30, 1997. The city sizes are defined by population as follows: large, greater than 500,000 people; medium, from 200,000 to 500,000 people; and small, less than 200,000 people. The survey encompassed 12 large cities, 14 medium cities, and 13 small cities, equally divided between Clean Cities and other cities.

As part of the questionnaire, drivers were asked to identify their vehicle by fuel(s) used. Figure 3 shows the number of respondents whose vehicle type was alcohol (includes E85 and M85 vehicles), CNG-CON (includes aftermarket conversions and bi-fuel OEM vehicles), CNG-DED, electric, gasoline, or LPG.

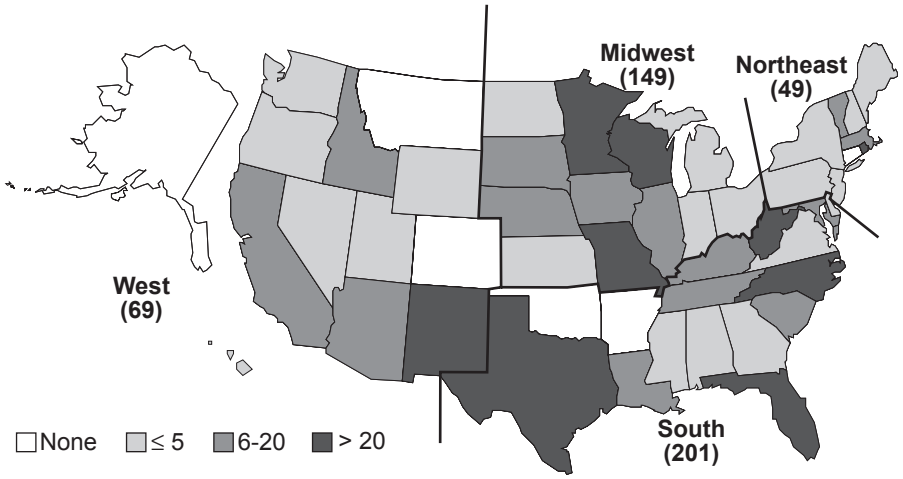


Figure 1. Distribution of state government respondents (census region boundaries are shown). Regional totals are shown in parentheses.

Figure 2. Distribution of city government respondents

Among state government drivers, 134 (28.7%) identified the vehicle they drive at work as a CNG model, followed by 110 (23.5%) identifying alcohol-fueled models, 106 (22.6%) identifying LPG models, 87 (18.6%) indicating gasoline models, and 31 (6.6%) indicating electric models. Among respondents with CNG models as the vehicle they drive, drivers with bi-fuel or aftermarket conversions (CNG-CONs) predominated, with 108 of the total 134 CNG responses.

When evaluated by census region (see Figure 4a), some differences in distribution of reported vehicle type can be seen. In the South and the Northeast, CNG vehicles (all types) were the AFV type reported most often (36.3% and 69.4% of respondents, respectively). In the West, the most commonly reported AFV types were LPG vehicles (33.3%). Alcohol-fueled AFVs, specifically E85, were the dominant AFV type (55.0%) reported by the state fleet drivers in the Midwest.

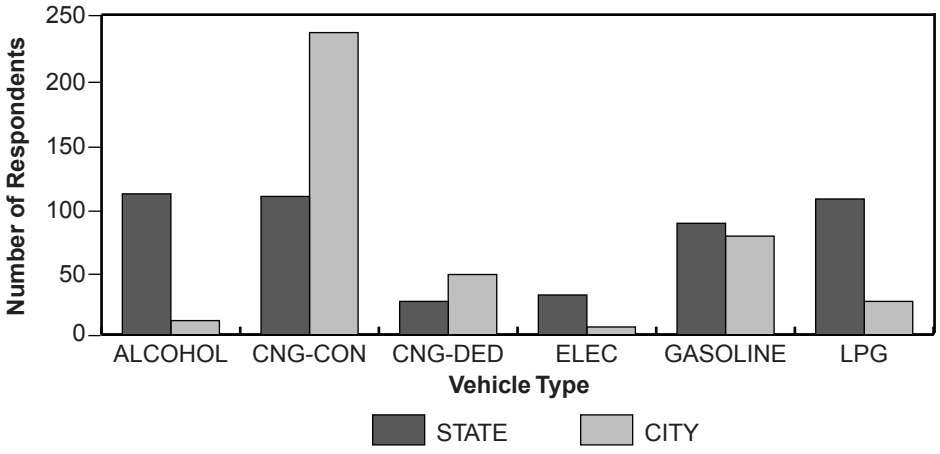


Figure 3. Total number of state and city government survey responses by vehicle type

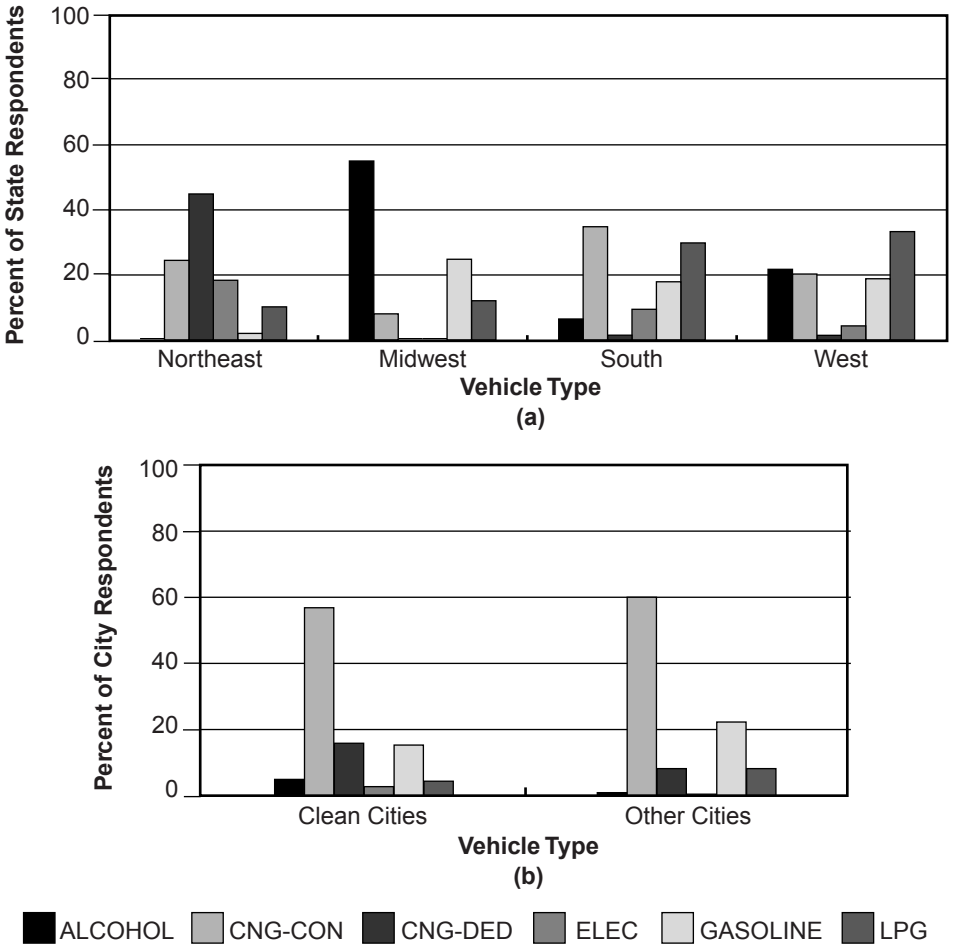


Figure 4. Distribution of responses by vehicle type: (a) state drivers by region and (b) city drivers by city type

The distribution of city government driver responses by vehicle type (see Figure 3) was somewhat different than that of the state drivers. Two hundred eighty three of the 403 (70.2%) responses were from drivers who identified their vehicle as CNG-fueled. This is followed by 19.1% indicating gasoline-only models, 6.5% indicating LPG models, 2.7% responding alcohol (E85 or M85) models, and 1.5% saying electric vehicles. When grouped by Clean Cities and other cities (see Figure 4b), there was little difference in the distribution by vehicle type.

The vehicles on which the drivers provided responses represented a number of different makes and models. Among state government drivers, the highest percentage reported driving Ford products (59.4%) with products of General Motors and Chrysler representing lesser percentages (27.4% and 12%, respectively). For city government drivers, the highest percentages reported driving General Motors or Ford products (40.7% and 39%, respectively), with a lesser percentage identifying Chrysler products (19.6%). Of the state government drivers, 47.6% provided responses about sedans, followed by 34.8% responding about pickups, 16% responding about vans or minivan and the small remainder responding about sport-utility vehicles (SUVs). Among city government drivers, 53.6% provided responses about pickups, 23.6% about sedans, 19.6% about vans or minivans, and the remainder about SUVs. At least among these respondents, the style of AFVs driven by state and city government workers was quite different.

There was some additional segregation according to vehicle type and style among the vehicles reported on by the state drivers. For example, nearly 47% of the sedans were E85 models; some 69% of the vans and minivans and 42.3% of the pickups were LPG models. For all vehicle styles reported by the city government drivers, CNG-CON was the most common vehicle type (ranging from 51% of the vans up to 62.5% for the sedans).

Most vehicles (80.7% identified by the state government drivers, and 64% of those identified by city government drivers) were model year 1994 or newer (see Figure 5a and 5b). All vehicles reported to be 1990 or older were conversions (CNG-CON, LPG, or electric) or gasoline-only vehicles. Other than aftermarket conversions, AFVs were not available before 1991. Among these state and city government respondents, the distribution of vehicle age is quite different. This difference between the vehicle age difference is statistically significant at greater than the 99% confidence level ($\chi^2 = 55.2$, d.f. = 8, $\alpha < .001$). The city government respondents tend to operate older vehicles than the state government drivers.

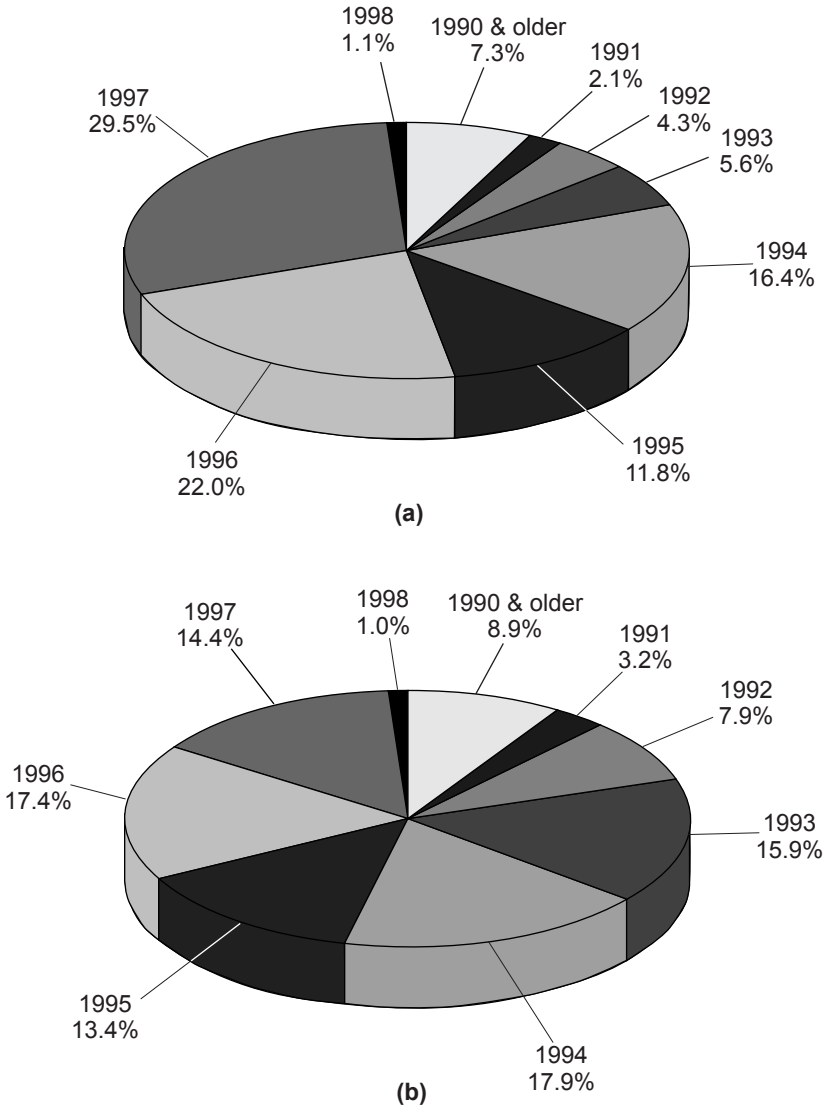
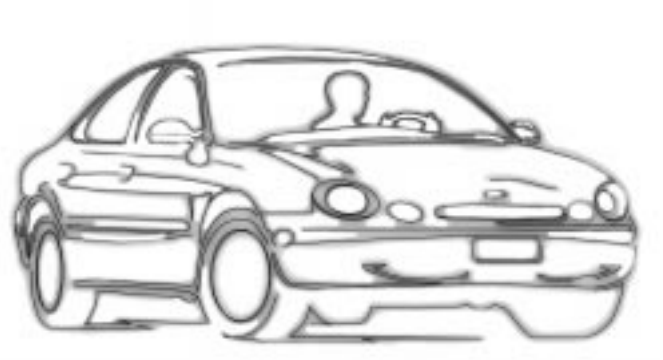


Figure 5. Percentage of vehicles by model year: (a) 468 state responses and (b) 403 city responses



Results: Vehicle Use, Performance, and Acceptability

The use and incorporation of AFVs into fleets has increased over the last several years, mostly as a result of mandates under EPAct. The survey results presented in the following sections provide information on the experiences of a number of drivers of state and local government fleet vehicles who are operating AFVs during the course of conducting their work. For comparison purposes, information was also collected from drivers operating similar gasoline-only fleet vehicles. Most of the graphs and tabulations presented summarize all responses by fleet type—state or city government. Additional information is presented by region (state government responses) or by city type (Clean Cities or other cities), where interesting differences were uncovered (also see Appendix B for more detailed results from the regional and city type analyses).

Vehicle Use

Most survey respondents (81% of state government drivers and 87.8% of city government drivers) reported that they are assigned the vehicle they drive, and they are not given a choice of vehicles. These results are in reasonable agreement with results of responses from state and city government fleet managers who were asked a similar question in a related survey (Whalen, et al., 1999).

Figures 6, 7, and 8 summarize the drivers' responses about their driving characteristics (analysis revealed no statistically significant differences in the distribution of responses presented in Figures 6, 7, or 8). Between 60% and 65% of all state and city respondents (AFVs and gasoline vehicle drivers combined) reported having driven their vehicle for 1 year or longer (see Figure 6a and 6b). The typical number of miles driven per week had about the same distribution for state and city government drivers, and was similar for operating an AFV or a gasoline vehicle (see Figure 7a and 7b). The distribution of the percent of highway driving was about the same for AFVs and gasoline vehicles, but the results reveal differences between state and city fleet vehicle use. In the case of state vehicles, most drivers (55.9% of drivers of AFVs and 65.5% of drivers of gasoline vehicles) indicated that more than 50% of their driving is on the highway. As might be expected, most city fleet drivers (80.7% for AFVs and 75.3% for gasoline vehicles) reported that less than 50% of their driving is on the highway.

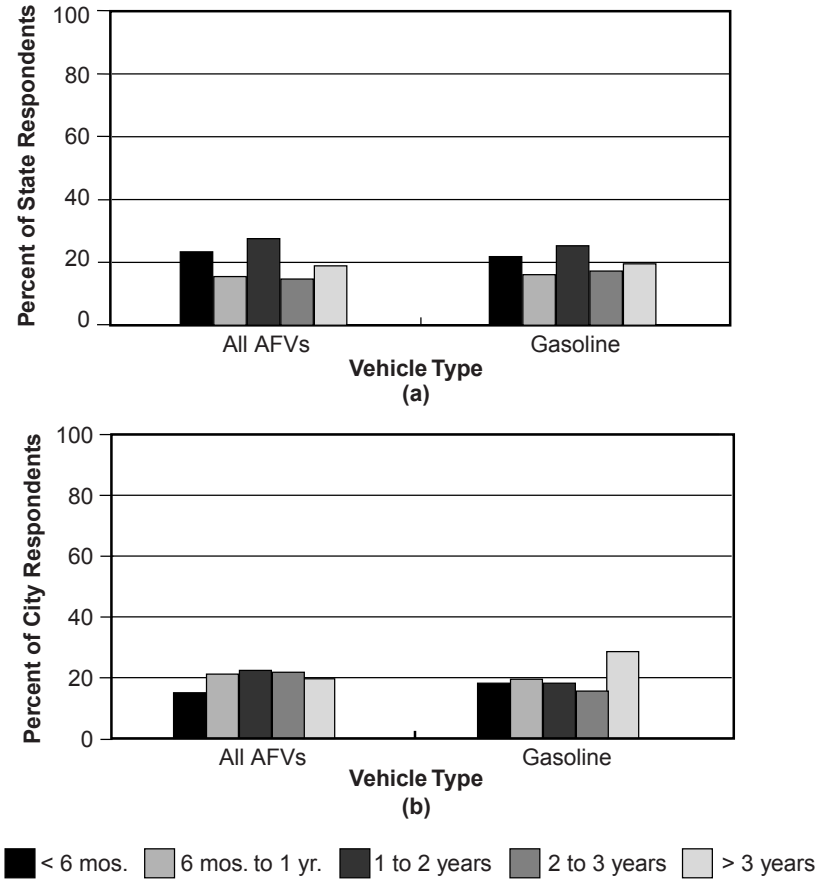


Figure 6. Percentage distribution of length of time respondents had driven their vehicles: (a) state drivers and (b) city drivers

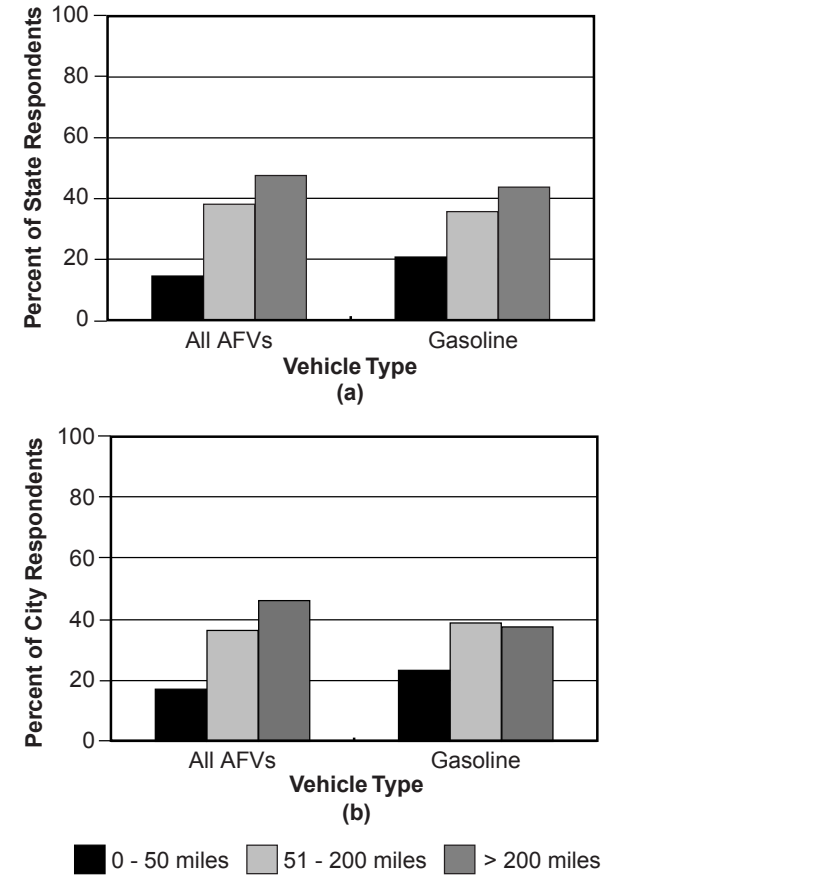


Figure 7. Percentage distribution of respondents' weekly mileage accumulation rates: (a) state drivers and (b) city drivers

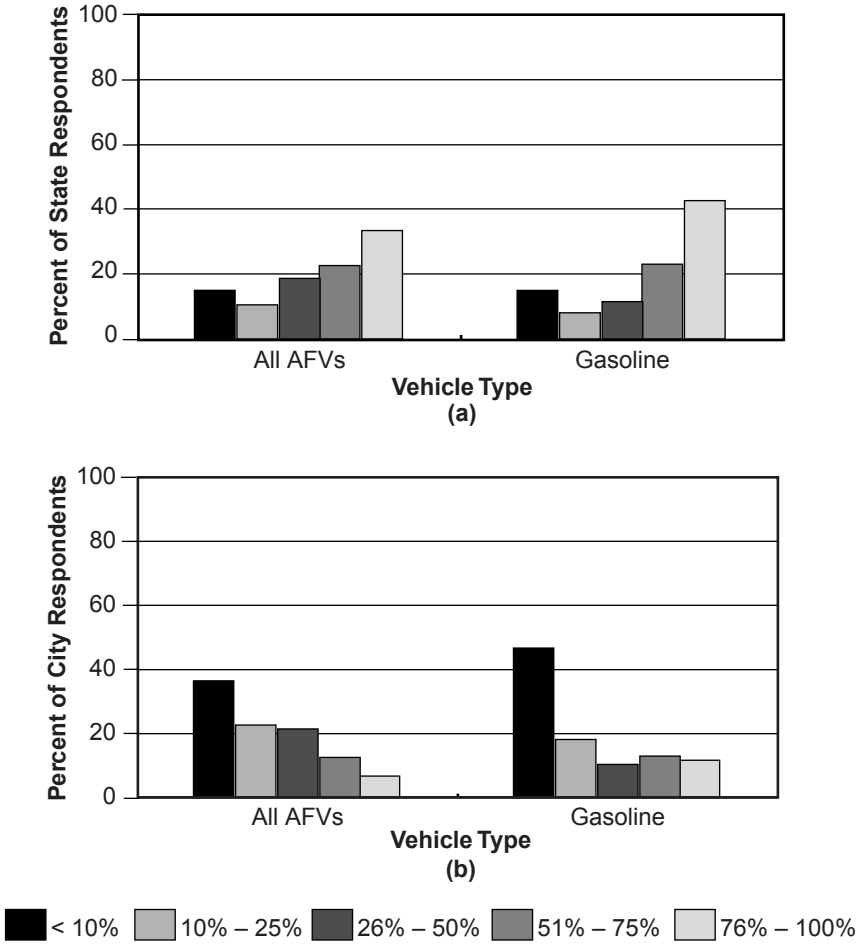


Figure 8. Percentage distribution of respondents' highway driving rates: (a) state drivers and (b) city drivers

Fuel Use and Availability

Nearly 85% of both state government and city government vehicle drivers indicated that they refuel their own vehicles. This is somewhat lower than the 93% of federal government drivers who reported being responsible for refueling their vehicles during a previous study (see Whalen and Coburn, September 1997). However, it still indicates that these drivers are generally familiar with fueling and fuel availability.

Drivers of bi-fuel and flexible-fuel AFVs (alcohol, CNG-CON, and LPG vehicles) were asked what percentage of time they use alternative fuel. Table 1 summarizes the results by percent use of alternative fuel. Overall, 56.5% of state government drivers of flexible- and bi-fuel vehicles reported using alternative fuel more than 50% of the time; the corresponding percentage of city government drivers was 59.3%. These results are similar to those from the previous survey with federal fleet drivers, in which nearly 55% of flexible- and bi-fuel vehicle drivers indicated they refuel with alternative fuel more than 50% of the time (note the federal fleet survey did not include responses about LPG vehicles).

Table 1. Distribution of AFV driver responses about percent of time alternative fuel is used in the vehicle

Percent of Time Alternative Fuel Used	Distribution of Responses on Alternative Fuel Use in Vehicles Fueled by*					
	Alcohol		CNG		LPG	
	State Drivers (%)	City Drivers (%)	State Drivers (%)	City Drivers (%)	State Drivers (%)	City Drivers (%)
0	17.3	9.1	21.3	3.4	4.7	0
1 to 25	18.2	0	10.2	9.3	6.6	11.5
26 to 50	8.2	9.1	23.2	29.2	20.8	23.1
51 to 75	1.8	0	4.6	7.2	16.0	0
76 to 99	24.5	18.2	14.8	20.4	23.6	19.2
100	30.0	63.6	25.9	30.5	28.3	46.2
Total	100	100	100	100	100	100

*Includes only responses from drivers of bi-fuel and flexible-fuel vehicles

The responses from the state government drivers indicates that use of alternative fuel more than 50% of the time varies by vehicle type: 67.9% of those operating LPG vehicles, 56.3% of those operating alcohol-fueled vehicles (E85 or M85), and 45.3% of those operating CNG-CON AFVs responded this way. Similarly, among city government drivers, 81.8% of those operating alcohol-fueled vehicles, 65.4% of those operating LPG AFVs, and 58.1% of those operating CNG AFVs reported using alternative fuels more than 50% of the time. In the companion survey, most state and city government fleet managers (89.9% and 86.8%, respectively) reported that the AFVs in their fleets are usually operated (50% or more of the time) on the alternative fuel. Although the responding drivers and fleet managers are not necessarily from the same fleets, the drivers' responses may more accurately reflect level of use of alternative fuel in these vehicles, because most of them indicated that they fuel their own vehicle.

When the drivers' responses about alternative fuel use in flexible- and bi-fuel vehicles are grouped by region for the state government data and by city type for the city government data, some differences appear (see Figure 9a and 9b). All state government drivers operating flexible- and bi-fuel vehicles in the Northeast indicated that they use alternative fuel 75% or more of the time; more than 30% of these drivers in both the Midwest and West reported 100% use of alternative fuel. It is worth noting that only 34.7% of the AFVs in the Northeast were bi- or flexible-fuel compared to from 71% to 76% of the AFVs reported on from the other regions. The highest percentage of drivers reporting no use of alternative fuel in their AFVs was in the South (approximately 26% of respondents). Among the city government drivers, nearly 45% of those in Clean Cities indicated 100% use of the alternative fuel, compared to about 24% of those in the other cities. Less than 5% of respondents in each city type reported no use of alternative fuel in their AFVs.

The drivers were questioned about the availability of alternative fuel in the area where they do most of their driving. Nearly 70% of the state and 80% of the city government drivers indicated that an alternative fuel station is reasonably nearby. State and city driver responses by AFV type

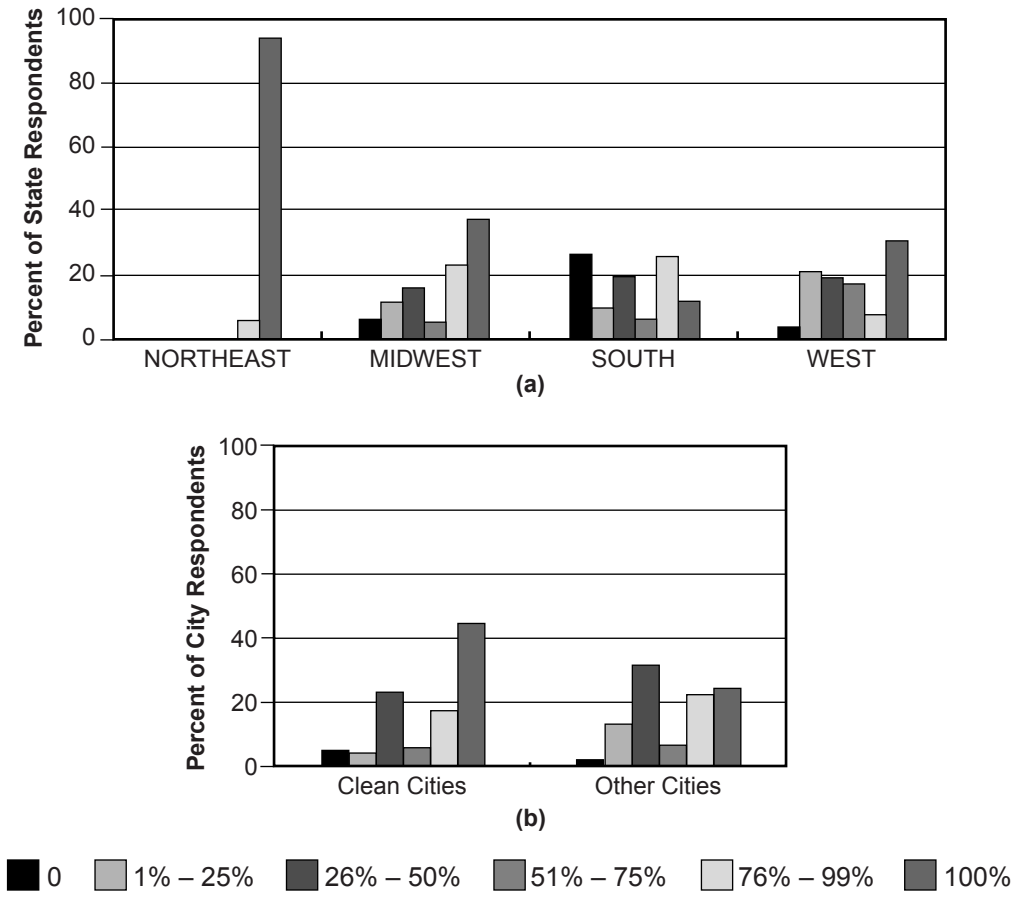


Figure 9. Percentage of time alternative fuel is used in bi- and flexible-fuel vehicles: (a) state drivers by region and (b) city drivers by city type

are summarized in Figure 10a and 10b, respectively. Statistical analysis indicated a significant difference (at greater than 99% confidence level, $\chi^2 = 37.1$, d.f. = 4, $\alpha < .001$) in the distributions by AFV type for the state responses, although no such difference was found in similar analysis of the city government responses. Among the state government vehicle drivers, the rate of responses of "no fuel available nearby" exceeded more than 40% among state government drivers of CNG-DED and alcohol-fueled AFVs. Among city government respondents, those driving alcohol-fueled AFVs have the most ready access to their alternative fuel. Alternative fuel stations were reported to be reasonably close to 50% or more of state and at least 60% of city government drivers for all AFV types. These results were similar to those reported in the companion fleet manager survey (Whalen, et al., 1999). No differences in these distributions were uncovered for either the state or city drivers when responses were grouped by region or city type.

In a related question, AFV drivers were asked the type of fueling station they used most often to refuel their vehicles. Specifically they were asked whether they used an on-site, a public, or a local private station. Figure 11 (a and b) summarizes the responses. The most common response from state government drivers was that public stations are used most often (48.4% of responses), followed by local private stations (32.6% of responses), and on-site stations (18.9% of responses). The responses from city government drivers were nearly equally divided by fuel station type, with 35.4% reporting

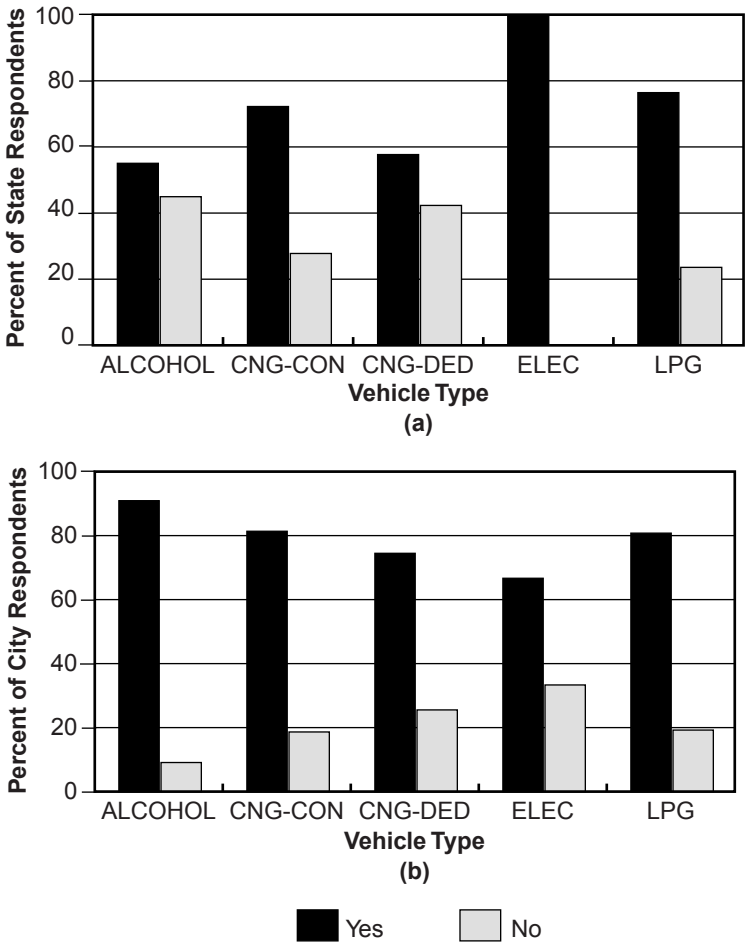


Figure 10. Percentage distribution of driver responses to "is there an alternative fuel station nearby?" by vehicle type: (a) state drivers and (b) city drivers

public stations, 33.2% reporting on-site stations, and 31.4% saying they use private stations. These results are somewhat different than those reported by the state and city fleet managers. Both state and city government fleet managers reported that their AFVs are fueled more than 50% of the time at public stations. Because the drivers interviewed were not necessarily from the same fleets as the fleet managers providing responses, it is not surprising to see some differences in the response rates.

Grouping the AFV fuel station responses by region or city type did reveal some additional information (see Figures B-9 and B-10 in the appendix). More state government drivers in the West reported use of public stations than in the other regions (66% compared to from 44% to 46% in the other regions). More city government drivers in Clean Cities also reported use of public stations than in the other cities (43% compared to 28%). This may indicate Clean Cities, and the western states in general, have developed more extensive public alternative fuel infrastructures.

When asked how close a station needed to be for them to think it was convenient, 36.6% of state government respondents and 48.3% of city government respondents indicated stations had to be within 1 mile.

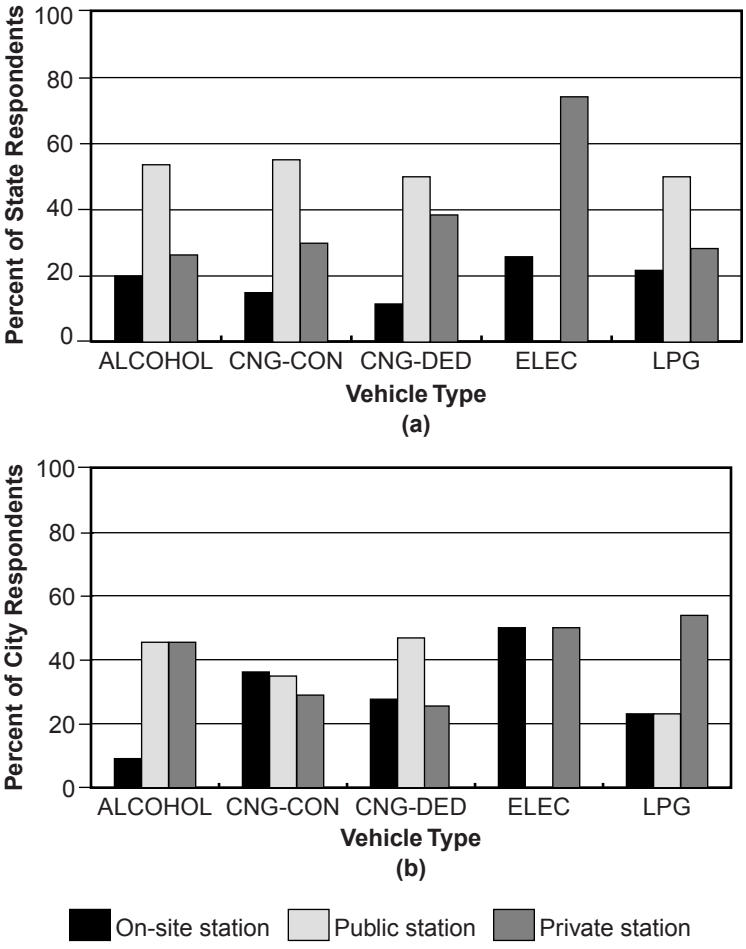


Figure 11. Percentage distribution of AFV driver responses about the type of fueling station typically used, by vehicle type: (a) state drivers and (b) city drivers

On the other hand, almost all respondents (93.4% of state and 91.4% of city government drivers) indicated that a station must be within 5 miles to be convenient. All respondents indicated that a refueling station had to be within 10 miles to be convenient.

Most AFV drivers (81% of state government respondents and 85% of city government respondents) had no personal concerns about refueling their vehicles. Only 73 of the state drivers and 50 of the city drivers indicated any concerns about refueling with an alternative fuel. Of the concerns that were reported, many were related to the safety of refueling, the availability of fuel, or the smell of the fuel.

Vehicle Performance

In addition to questions about vehicle use and fueling experiences, drivers were also asked about the driveability and performance of their vehicles. The major findings from the analyses of their responses are discussed below.

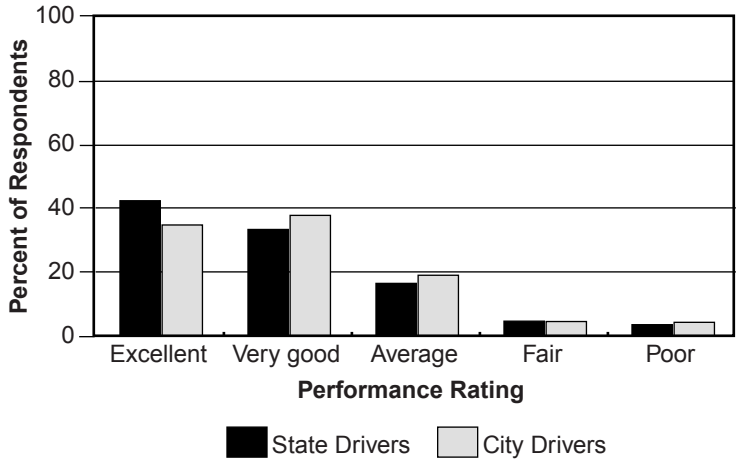


Figure 12. Percentage distribution of state and city respondents' ratings of overall performance of their vehicles

Overall Evaluation

Drivers were asked to provide an overall evaluation of the performance of their vehicles. The rating choices included excellent, very good, average, fair, and poor. Drivers generally rated vehicle performance better than average, with 75.5% of state and 72.3% of city government drivers rating performance as very good or excellent (see Figure 12). Statistical analysis did not reveal any significant difference in the distribution of performance ratings of the state and city government drivers.

Drivers' overall vehicle performance ratings varied by vehicle type. Figure 13 (a and b) shows, on a percentage basis, how the state and city government drivers of the various vehicle types rated their vehicles. Among the state drivers, 96.2% of CNG-DED drivers rated overall performance as excellent or very good, followed by 86.2% of those driving gasoline vehicles, 85% of those operating alcohol-fueled AFVs, 71.8% of those operating CNG-CON vehicles, 60.2% of those operating LPG AFVs, and 58% of those operating electric vehicles. Similarly among city government drivers, 90.9% of those operating alcohol AFVs rated performance as very good or excellent, compared to 85.1% of drivers of CNG-DED vehicles, 80.8% of drivers of LPG vehicles, 79.2% of drivers of gasoline vehicles, 66.7% of drivers of electric vehicles, and 65.8% of those operating CNG conversions.

Statistically significant differences in the distribution by type were found for both the state government ($\chi^2 = 64.9$, d.f. = 15, $\alpha < .0001$) and city government ($\chi^2 = 38.0$, d.f. = 15, $\alpha = .0009$) responses. Generally, smaller percentages of respondents rated alcohol-fueled vehicles' performance as fair or poor; a higher percentage of respondents rated CNG-CON vehicles and LPG (only among state government drivers) vehicles as fair or poor. No significant differences were seen in the distribution when the state driver responses were grouped by region or the city driver responses were grouped by city type.

Comparing AFVs to Similar Gasoline Vehicles

Drivers of AFVs were asked how their vehicles compare to similar gasoline vehicles, and drivers of gasoline vehicles were asked how their vehicles

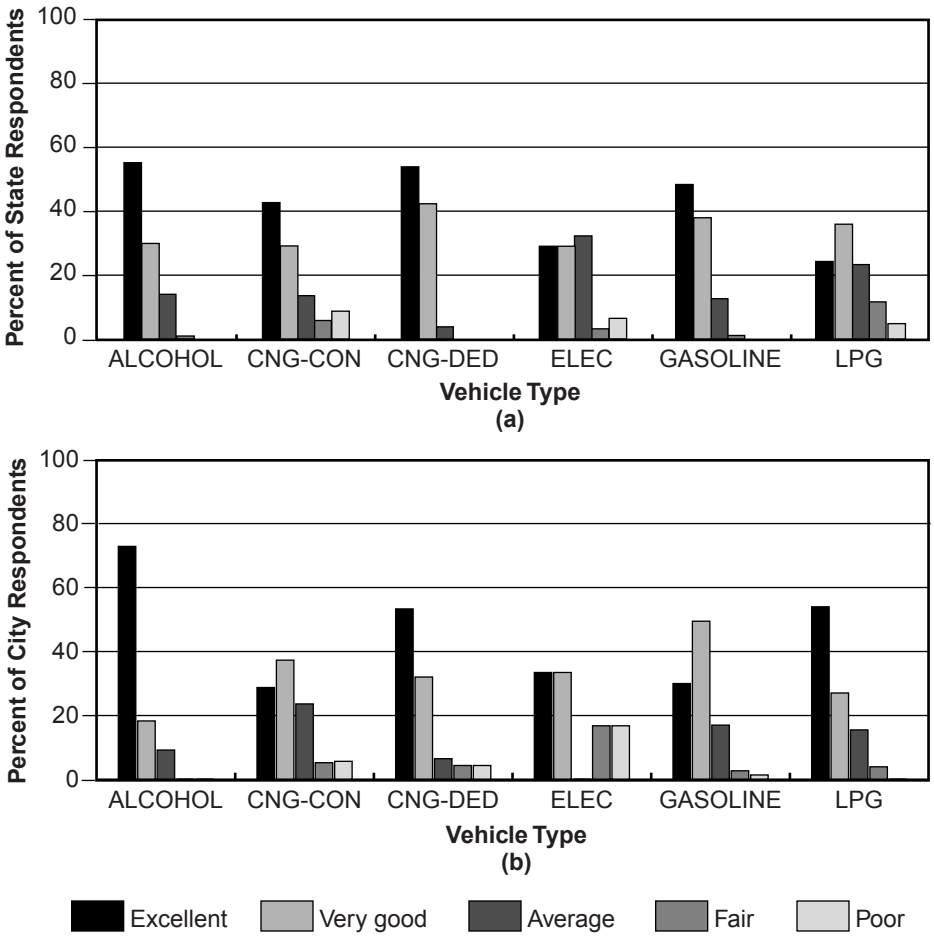


Figure 13. Percentage distribution of respondents' ratings of overall vehicle performance, by vehicle type: (a) state drivers and (b) city drivers

compare to similar AFVs. The results for the state drivers and city drivers are summarized in Figure 14a and 14b, respectively. The most common response from both state and city government drivers was "the vehicles are about the same." Among those operating gasoline vehicles, 84.8% of the state and 66.7% of the city government drivers responded this way; among AFV drivers, 58.6% of the state and 49.2% of the city government drivers responded this way. Of the gasoline vehicle drivers, about 15% from state government and 28% from city government responded that their vehicles are better in comparison to similar AFVs. AFV drivers were not as optimistic, with only 11.7% of state and 8.8% of city AFV drivers responding that their vehicles are better in comparison to gasoline vehicles. Few gasoline vehicle drivers (none from states and 5.5% from cities) reported that their vehicles do not compare well to similar AFVs; 29.6% of state government and 42% of city government AFV drivers indicated that their vehicles do not compare well to similar gasoline vehicles. It is important to note that 10.5% of state government and 3% of city government AFV drivers, and 47% of state government and 53% of city government gasoline vehicle drivers did not provide a response to this question. Generally, the non-responding AFV drivers had only driven their vehicles on gasoline, and the gasoline drivers had never driven an AFV. These drivers, then, did not feel they had a basis for comparison.

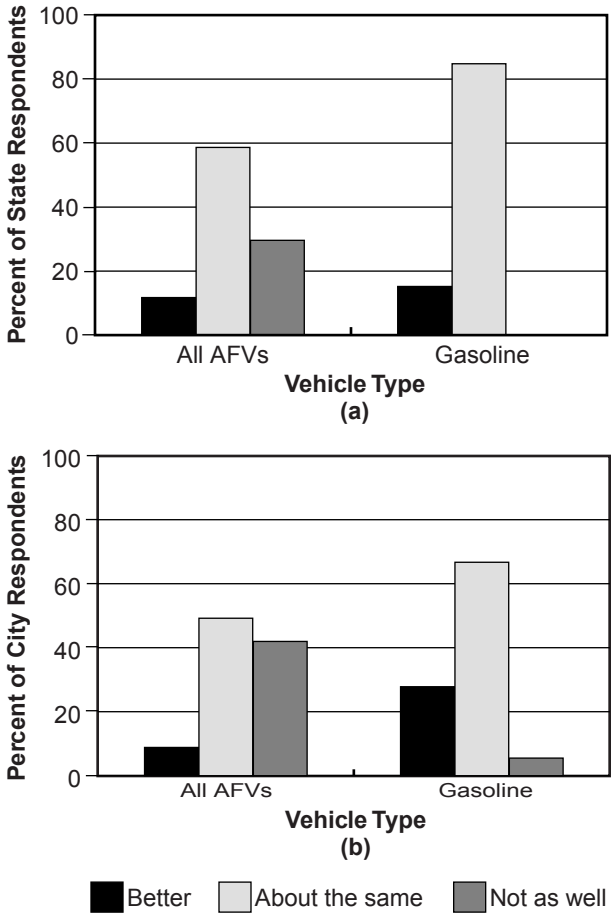


Figure 14. Percentage distribution of driver responses to "how does your vehicle compare to a similar gasoline or alternative fuel vehicle?" (a) state responses and (b) city responses

Figure 15 (a and b) shows the state and city responses on how AFVs compare to similar gasoline vehicles by AFV type. Higher percentages of state and city government drivers of alcohol-fueled AFVs said their AFVs are the same as similar gasoline vehicles (78.5% and 100%, respectively) than did drivers of other AFV types. Among drivers who reported their AFVs to be better than gasoline vehicles, the highest percentage of such reports came from drivers operating electric vehicles (30% of state and 33% of city government drivers of electric vehicles). Most reports of AFVs not comparing well to similar gasoline vehicles came from state government drivers of LPG vehicles and city government drivers of CNG-CON vehicles (43.8% and 52.4%, respectively).

AFV Performance

The drivers were asked whether they had experienced any of eight specific performance-related problems with their AFVs in the last month. The numbers of state and city government drivers reporting specific complaints are tabulated in Tables 2 and 3, respectively. The data in these tables are presented in two ways: the total number of reports of each of the eight specific performance-related complaints by vehicle type and by the total number of drivers reporting these complaints. Nearly 23% percent of the state and 35% of the city government drivers reported at least one of the performance complaints. The most commonly reported complaints from both state and city government drivers was vehicles "lacking power," being

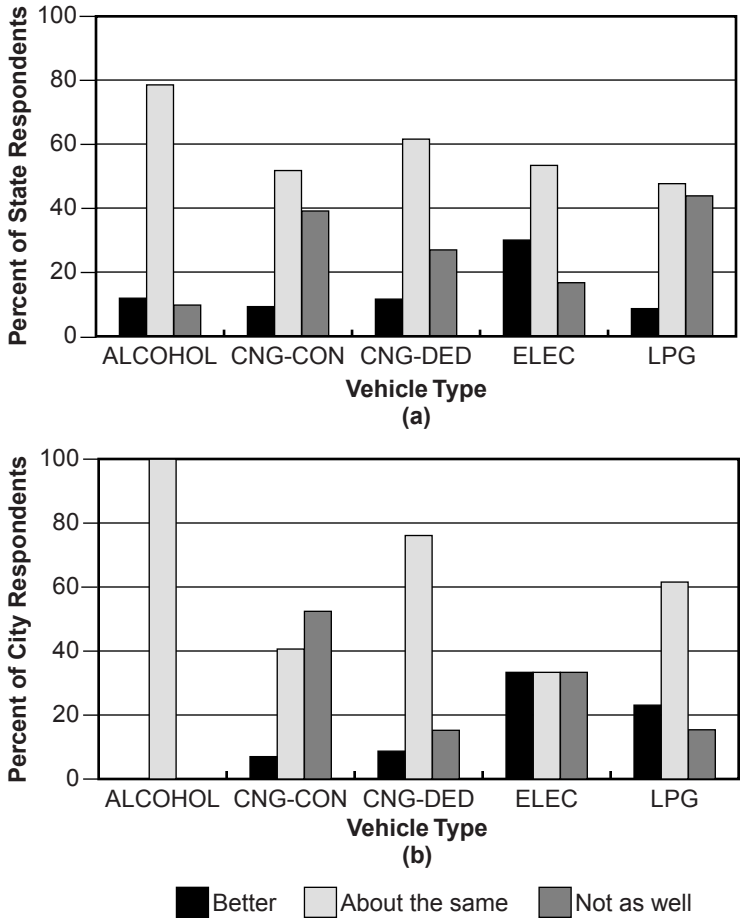


Figure 15. Percentage distribution of AFV driver responses to "how does your vehicle compare to a similar gasoline vehicle?" by vehicle type: (a) state responses and (b) city responses

"hard to start," or "hesitating." On a percentage basis, state government drivers operating LPG vehicles and city government drivers operating CNG-CON vehicles reported the most complaints. The lowest percentage of complaints was reported by drivers operating gasoline-only vehicles in state fleets and alcohol-fueled vehicles in city fleets. Grouping the state by census region (see Table 4) indicates that the highest percentage of respondents reporting complaints was in the West. Grouping the city responses by city type (see Table 5) reveals that a higher percentage of drivers in the "other" cities had complaints than drivers in the Clean Cities. Among city government drivers, those from Clean Cities may have more experience with, or more information about, AFVs, which may partly explain why there was a smaller percentage of complaints about AFVs in these cities.

Overall, both the state and city government drivers reported a considerable number of performance-related complaints about AFVs. The number of drivers reporting vehicle performance problems was markedly higher than the results seen in a previous survey (Whalen and Coburn, September 1997). In that survey, just over 7.5% of federal fleet drivers reported complaints; whereas in the present survey, 22.6% of the state government drivers and 34.7% of the city government drivers reported complaints. One possible reason for this difference is the disparity in the composition of the fleets. Most respondents in the federal fleet survey reported that their AFVs were OEM models, whereas most of the city and state fleet respondents indicated their AFVs were CNG or LPG conversions. In spite of the differences in the

Table 2. Specific performance-related complaints reported, and the number of state drivers reporting complaints (by vehicle type)

Performance-Related Problem	Vehicle Type													
	CNG-CON		CNG-DED		Alcohol		ELEC		Gasoline		LPG		Total	
	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
Hard to start	13	13.5	0	0.0	8	34.8	0	0.0	1	10.0	28	22.4	50	19.6
Stall after starting	9	9.4	0	0.0	2	8.7	0	0.0	1	10.0	13	10.4	25	9.8
Stall in traffic	12	12.5	0	0.0	1	4.3	0	0.0	0	0.0	9	7.2	22	8.6
Poor idle	10	10.4	0	0.0	3	13.0	0	0.0	1	10.0	13	10.4	27	10.6
Hesitation	16	16.7	0	0.0	4	17.4	0	0.0	1	10.0	20	16.0	41	16.1
Lack of power	23	24.0	0	0.0	2	8.7	1	100.0	2	20.0	21	16.8	49	19.2
Engine ping	3	3.1	0	0.0	0	0.0	0	0.0	1	10.0	0	0.0	4	1.6
Check engine light on	10	10.4	0	0.0	3	13.0	0	0.0	3	30.0	21	16.8	37	14.5
Total	96	100	0	100	23	100	1	100	10	100	125	100	255	100
State Drivers Reporting Complaints														
Number	33 of 108		0 of 26		14 of 110		1 of 31		5 of 87		53 of 106		106 of 468	
%	30.6		0.0		12.7		3.2		5.7		50.0		22.6	

Table 3. Specific performance-related complaints reported, and the number of city drivers reporting complaints (by vehicle type)

Performance-Related Problem	Vehicle Type													
	CNG-CON		CNG-DED		Alcohol		ELEC		Gasoline		LPG		Total	
	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
Hard to start	42	13.1	5	26.3	0	0.0	1	10.0	1	8.3	2	33.3	51	13.9
Stall after starting	48	15.0	0	0.0	0	0.0	1	10.0	1	8.3	0	0.0	50	13.6
Stall in traffic	38	11.9	0	0.0	0	0.0	1	10.0	0	0.0	0	0.0	39	10.6
Poor idle	27	8.4	4	21.1	0	0.0	1	10.0	1	8.3	0	0.0	33	9.0
Hesitation	44	13.8	4	21.1	0	0.0	2	20.0	2	16.7	1	16.7	53	14.4
Lack of power	68	21.3	1	5.3	0	0.0	2	20.0	3	25.0	1	16.7	75	20.4
Engine ping	15	4.7	2	10.5	0	0.0	1	10.0	2	16.7	0	0.0	20	5.4
Check engine light on	38	11.9	3	15.8	0	0.0	1	10.0	2	16.7	2	33.3	46	12.5
Total	320	100	19	100	0	100	10	100	12	100	6	100	367	100
City Drivers Reporting Complaints														
Number	115 of 236		10 of 47		0 of 11		2 of 6		9 of 77		4 of 26		140 of 403	
%	48.7		21.3		0.0		33.3		11.7		15.4		34.7	

Table 4. Specific performance-related complaints reported, and the number of state drivers reporting complaints (by region)

Performance-Related Problem	Reports by Region									
	Northeast		Midwest		South		West		All	
	No.	%	No.	%	No.	%	No.	%	No.	%
Hard to start	1	50.0	17	27.4	21	15.3	11	20.4	50	19.6
Stall after starting	0	0.0	3	4.8	16	11.7	6	11.1	25	9.8
Stall in traffic	0	0.0	2	3.2	17	12.4	3	5.6	22	8.6
Poor idle	0	0.0	7	11.3	16	11.7	4	7.4	27	10.6
Hesitation	0	0.0	8	12.9	21	15.3	12	22.2	41	16.1
Lack of power	1	50.0	13	21.0	23	16.8	12	22.2	49	19.2
Engine ping	0	0.0	3	4.8	1	0.7	0	0.0	4	1.6
Check engine light on	0	0.0	9	14.5	22	16.1	6	11.1	37	14.5
Total	2	100	62	100	137	100	54	100	255	100
State Drivers Reporting Complaints										
Number	2 of 49		34 of 149		49 of 201		21 of 69		106 of 468	
%	4.1		22.8		24.4		30.4		22.6	

Table 5. Specific performance-related complaints reported, and the number of city drivers reporting complaints (by city type)

Performance-Related Problem	City Type					
	Clean Cities		Other Cities		All Cities	
	No.	%	No.	%	No.	%
Hard to start	23	19.3	28	11.3	51	13.9
Stall after starting	15	12.6	35	14.1	50	13.6
Stall in traffic	15	12.6	24	9.7	39	10.6
Poor idle	12	10.1	21	8.5	33	9.0
Hesitation	14	11.8	39	15.7	53	14.4
Lack of power	24	20.2	51	20.6	75	20.4
Engine ping	5	4.2	15	6.0	20	5.4
Check engine light on	11	9.2	35	14.1	46	12.5
Total	119	100	248	100	367	100
City Drivers Reporting Complaints						
Number	49 of 183		91 of 220		140 of 403	
%	26.8		41.4		34.7	

percentages of drivers reporting complaints in the two surveys, one common finding is that a higher percentage of drivers operating converted AFVs (CNG-CON or LPG) reported complaints than drivers of other vehicle types. It is also important to note that in the previous survey an attempt was made to balance the number of respondents among the vehicle types; no attempt was made to achieve such a balance in this survey.

Vehicle Maintenance

Drivers were asked whether more or different scheduled maintenance was required on their AFVs. Most respondents (85.8% of state and 90.2% of city government drivers) indicated that no different or additional scheduled maintenance was required on their AFVs. Figure 16 (a and b) shows the results by AFV type for both the state and city driver government drivers. The differences among the AFV types were not significant for either group. Grouping the state government driver responses by region and city government driver responses by city type, respectively, did not reveal any differences in the distribution of the responses. These results are in close agreement with the results from the state and city fleet manager survey results (Whalen, et al., 1999).

AFV drivers were also asked about the frequency and types of unscheduled maintenance, with the results summarized in Figure 17 (a and b). As in the case of the scheduled maintenance results, most interviewees (85.8% of state and 87.1% of city government drivers) reported no difference in the types or frequency of unscheduled maintenance for their AFVs. However, the differences in the distribution of responses by AFV type were significant at 95% confidence level. Among state government drivers, there were reports of differences in unscheduled maintenance for each AFV type, with nearly 35% of electric and 19% of LPG vehicle drivers reporting differences. For city government drivers, only drivers of CNG-CON and LPG vehicles reported differences in unscheduled maintenance. The reason for the differences in the reported unscheduled maintenance for state and city government drivers is not clear.

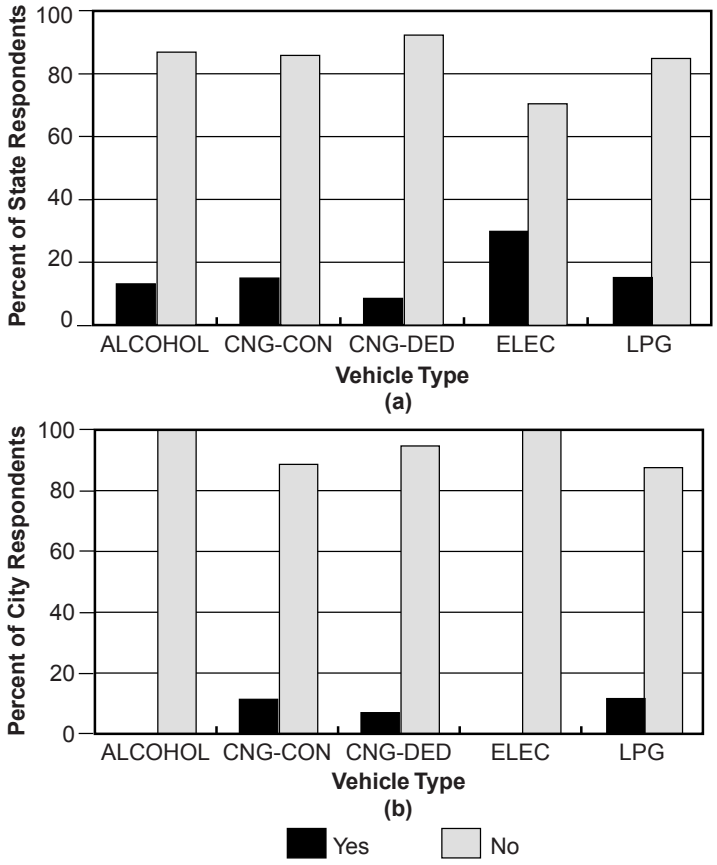


Figure 16. Percentage distribution of AFV driver responses about whether their vehicles require additional or different scheduled maintenance than similar gasoline vehicles, by vehicle type: (a) state drivers and (b) city drivers

When the unscheduled maintenance responses from state drivers were grouped by region, some regional differences were observed (see Figure B-17 in Appendix B). Compared to the total state government drivers responding, proportionally more from the South reported differences in unscheduled maintenance (20.7% responded this way). Similarly, grouping city driver responses concerning unscheduled maintenance by city type revealed that a higher percentage of respondents from "other" cities reported that their AFVs required more or different unscheduled maintenance (see Figure B-18) than did drivers from Clean Cities. It is worth noting that the drivers from the South region and the "other" cities also reported more performance-related vehicle complaints (as described in the previous section).

Vehicle Acceleration

All drivers were asked to rate the acceleration of their vehicles. The rating options ranged from excellent to poor. The results are summarized in Figure 18 (a and b) for the state government and city government drivers, respectively, with all responses about AFVs grouped together. The distributions of responses showed somewhat similar trends. Overall, 45.2% of state and 45.6% of city AFV drivers rated the acceleration of their vehicles as very good or excellent, compared to 41.2% of state and 48% of city gasoline vehicle drivers. Differences can be seen in the percentage distributions among the other ratings. For example, a higher percentage of gasoline

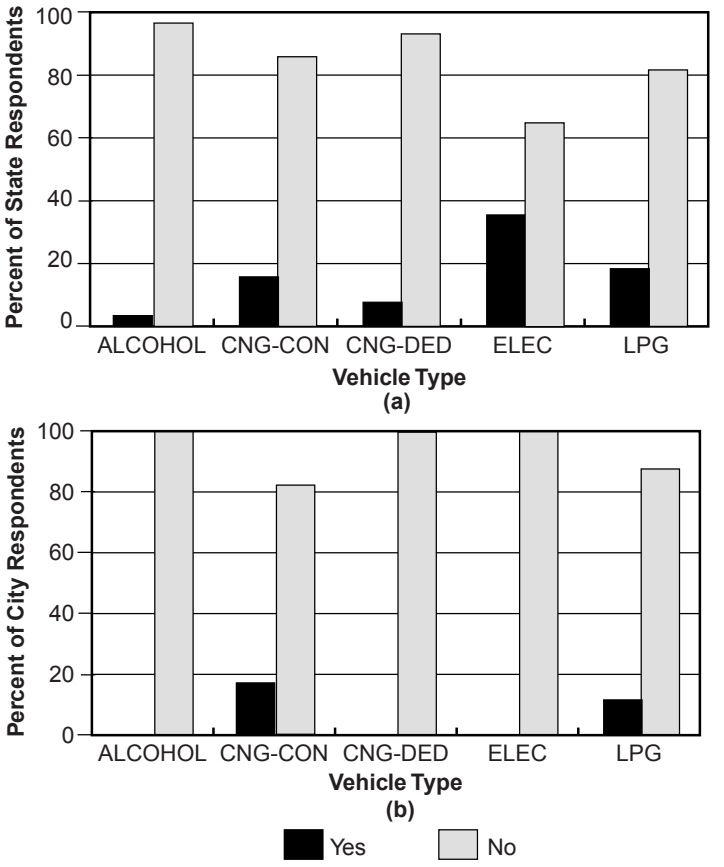


Figure 17. Percentage distribution of AFV driver responses about whether their vehicles require additional or different unscheduled maintenance than similar gasoline vehicles, by vehicle type: (a) state drivers and (b) city drivers

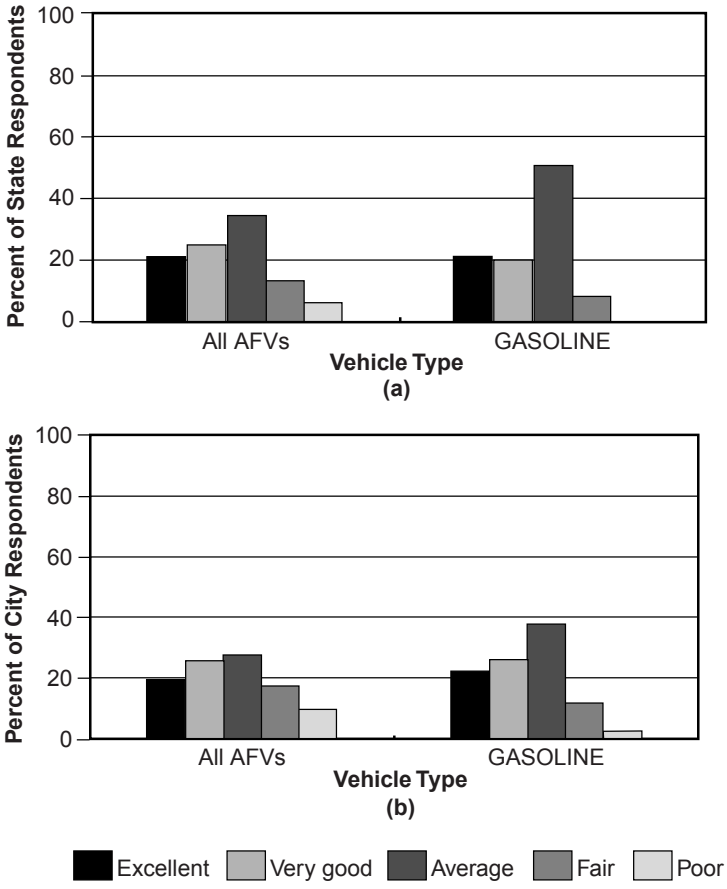


Figure 18. Percentage distribution of responses to "how would you rate your vehicle's acceleration?" (a) state drivers and (b) city drivers

vehicle drivers (50.6% of state and 37.7% of city responses) than AFV drivers (34.4% of state and 27.5% of city responses) rated acceleration of their vehicle as average. Also, although less than 10% percent of all respondents rated acceleration as poor, most of the poor ratings were from AFV drivers.

The state and city government responses concerning acceleration, summarized by vehicle type, are presented in Figure 19 (a and b). The highest percentages of responses of very good or excellent were among alcohol and dedicated CNG vehicle drivers, both state and city. The most common rating given by drivers of gasoline vehicles was average (50.6% of state and 37.7% of city responses). The percentage of poor ratings was highest among drivers of CNG conversions and electric vehicles, both for state and city government drivers. Among both state and city drivers, a higher percentage of positive acceleration ratings (very good and excellent) were reported by drivers of CNG-DED vehicles than (65.4% of state drivers and 70.2% of city drivers) by drivers of CNG-CON vehicles (43.2% of state drivers and 37.6% of city drivers).

Grouping these data by region (state government responses) and city type (city government responses) revealed no significant difference in distributions of responses by vehicle type.

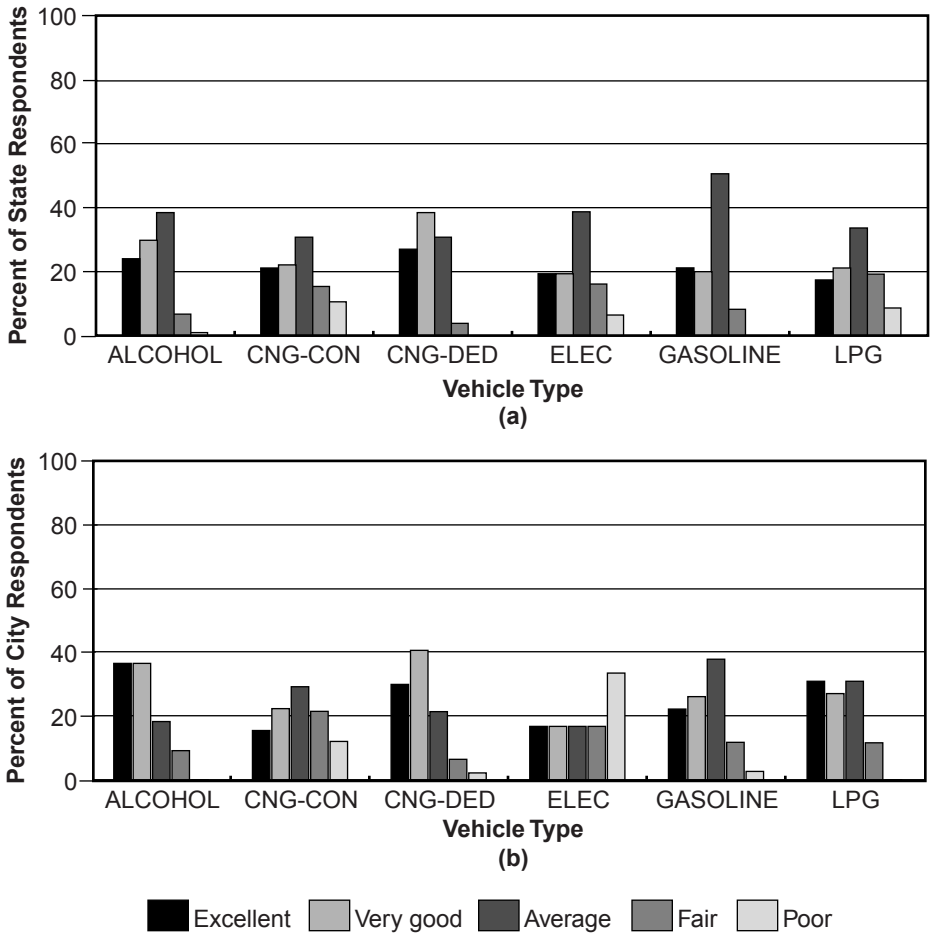


Figure 19. Responses to "how would you rate your vehicle's acceleration" by vehicle type: (a) state drivers and (b) city drivers

Vehicle Range

Drivers were also asked how satisfied they were with their vehicles' range on a single tank of fuel. The state and city government drivers' responses, whether acceptable, marginal or not acceptable, are summarized in Figure 20 (a and b). There were clear differences in the distributions of the responses by vehicle type. More than 50% of both state and city government drivers of alcohol, CNG-CON, LPG, and gasoline vehicles responded that vehicle range is acceptable. The most common response from state and city government drivers of dedicated CNG vehicles (42.3% of state responses and 44.7% of city responses) was that vehicle range was unacceptable. This result is not new or surprising because the range of dedicated CNG vehicles has been an issue since they were first introduced, and the auto manufacturers continue to work to improve range in dedicated CNG vehicles. Among electric vehicle drivers, most state government respondents (54.8%) indicated that range was marginal; half the city government respondents (50%) indicated range was unacceptable. Because limited range is probably the major shortcoming of electric vehicles, vehicle manufacturers are likely to continue to work closely with users to place these vehicles in appropriate short-range applications until improvements in range can be attained.

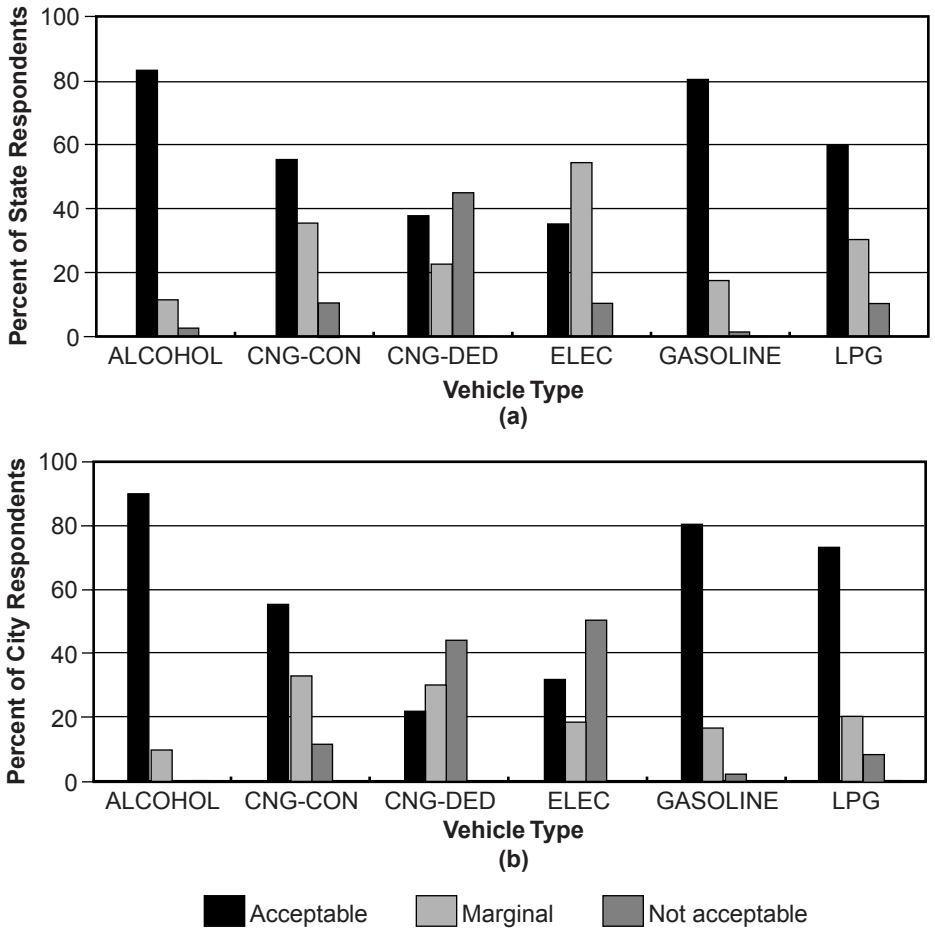


Figure 20. Percentage distribution of driver responses to "how satisfied are you with the range of your vehicle?" by vehicle type: (a) state drivers and (b) city drivers

Comparison of Selected Responses from Drivers of CNG-CON and CNG-DED Vehicles

AFV users and purchasers are interested in how different CNG vehicle types compare. The table below summarizes selected responses from both state and city government drivers of CNG-CON and CNG-DED vehicles. Items for which each vehicle type had more favorable feedback are highlighted in the table. In this survey, more favorable feedback was received from drivers of CNG-DED vehicles in all performance categories, except vehicle range.

Response Items	Survey	CNG-CON	CNG-DED
Number of responses	State	108	26
	City	236	47
Percentage of responses	State	23.1%	5.6%
	City	58.6%	11.7%
Use alternative fuel 50% or more of the time	State	45.3%	NA
	City	58.1%	NA
Responses that alternative fuel is available nearby	State	72.2%	57.7%
	City	81.4%	74.5%
Responses that overall performance is better than average	State	71.8%	96.2%
	City	65.8%	85.1%
Responses that acceleration is better than average	State	43.3%	65.4%
	City	37.6%	70.2%
Percentage of drivers reporting vehicle performance-related complaints (*none reported)	State	30.6%	0%*
	City	48.7%	21.3%
Responses that range is acceptable	State	54.6%	34.6%
	City	55.1%	23.4%
Responses of satisfied or leaning toward satisfied overall with vehicle	State	64.7%	73.1%
	City	57.7%	63.8%
Recommend AFV to others	State	52.8%	57.7%
	City	55.5%	70.2%
Responses of no difference in scheduled maintenance	State	85.9%	92.3%
	City	88.9%	93.6%
Responses of no difference in unscheduled maintenance (*no responses of differences)	State	85.1%	92.3%
	City	83.4%	100%*

Overall Satisfaction

Both state and city government drivers were questioned about their overall satisfaction level with the vehicles they drive at work. They were specifically asked to think about performance, convenience, and any other factors that they thought were significant. The responses are summarized in Figure 21 by state and city, and by vehicle type for state and city responses. Overall, 70.3% of state and 64.4% of city government drivers reported being very satisfied or leaning toward satisfied with their work vehicle (see Figure 21a). Less than 12% of the state and 16% of city government drivers indicated they are dissatisfied or leaning toward dissatisfied with their vehicles. As might be expected, there were some differences in the distribution of responses by primary AFV type.

Figure 21 (b and c) presents a summary of the state and city government driver responses, respectively, by vehicle type. There were some differences in distribution of state and city government driver responses by vehicle type. The greatest variations were in the percentages of the most extreme ratings of very satisfied and dissatisfied. On a percentage basis, the most common response from all drivers, regardless of vehicle type, was very satisfied. Among state government drivers, 69.4% of those operating gasoline vehicles reported being very satisfied, compared to 50.9% of those operating alcohol vehicles, 41.9% of those operating electric vehicles, 41.2% of those operating CNG-CON vehicles, 38.5% of those operating CNG-DED vehicles, and 31.4% of those operating LPG vehicles. For city government drivers, 48.6% of those operating gasoline vehicles reported being very satisfied overall, compared to 81.8% of those operating alcohol vehicles, 66.7% of those operating electric vehicles, 61.5% of those operating LPG vehicles, 38.3% of those operating CNG-DED vehicles, and 32.9% of those operating CNG-CON vehicles. Only one driver of a gasoline vehicle reported being dissatisfied; about 5% of state AFV drivers and about 7% of city AFV drivers reported being dissatisfied.

Analysis of the state government driver responses grouped by region did not reveal a statistically significant difference in the distribution of responses. Similarly, analysis of city government drivers responses grouped by Clean Cities and other cities did not reveal any differences that were statistically significant.

Following the inquiry about overall satisfaction with their vehicles, drivers were asked what one issue influenced them most in their ratings. Drivers who were dissatisfied or leaning toward dissatisfied most commonly reported poor vehicle performance, vehicle range, and limited fuel availability as influencing their responses. The most common response from drivers who were very satisfied or leaning toward satisfied was good performance or lack of problems with the vehicle.

Finally, drivers of AFVs were asked whether or not they would recommend a vehicle that operates on an alternative fuel to other drivers. Approximately 56% of the state government and 62% of the city government AFV drivers

responded that they would recommend an AFV to other drivers. These findings are somewhat lower than results of a previous survey in which 71% of federal fleet drivers indicated they would recommend AFVs to other drivers (Whalen and Coburn, 1997).

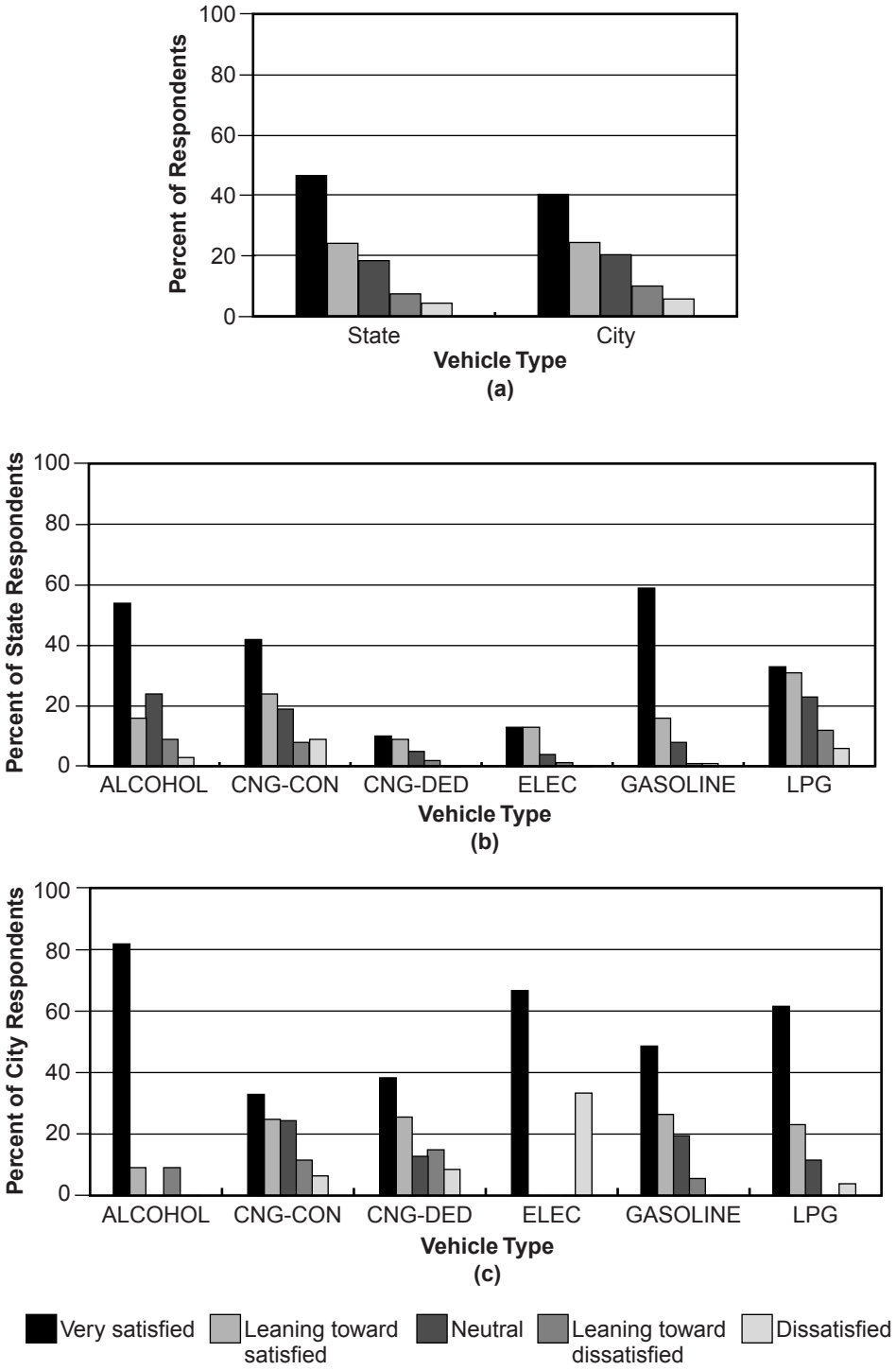


Figure 21. Percentage distribution of ratings of overall satisfaction with the vehicles: (a) by state or city, (b) state responses by vehicle type and (c) city responses by vehicle type

The responses to whether state and city AFV drivers would recommend one to others are summarized by vehicle type in Figure 22 (a and b). The highest percentage of drivers who would recommend AFVs, among both state and city government respondents, were those operating electric vehicles. With the exception of state government drivers who operate LPG vehicles, more drivers of all other vehicle types indicated they would recommend AFVs to other drivers.

Drivers were then asked to identify the single most important reason why they would or would not recommend an AFV. Among both state and city respondents who would recommend AFVs, the most common reasons cited were based on the belief that AFVs are good for the environment or would help to improve air quality. Many of these drivers also reported their AFVs performed well. Among the drivers who *would not* recommend an AFV, the most common reasons reported were limited fuel availability, vehicle performance problems, and some safety concerns.

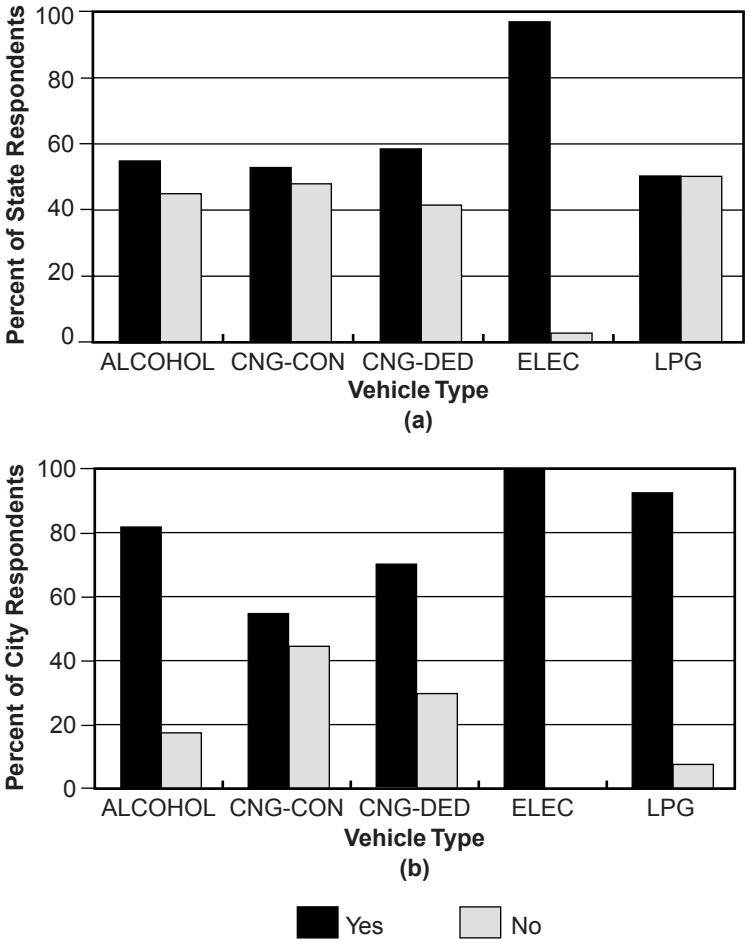


Figure 22. Percentage distribution of AFV driver responses on whether they would recommend an AFV to other drivers, by vehicle type: (a) state drivers and (b) city drivers

Summary

As a result of improving vehicle technology, increasing vehicle production by the OEMs, and changing government regulations, light-duty AFVs continue to be added to fleets—particularly federal, state, and local government fleets.

This survey focused on documenting real-world experiences from fleets currently operating AFVs. In particular, drivers' perspectives on use, acceptability, and performance of AFVs being operated by state and local government fleets across the country were sought. Randomly selected drivers from states and cities provided candid feedback on the AFVs they operate in performing their jobs. For the most part, the responses were favorable.

The types of AFVs being operated by state and city government fleets include dedicated, bi-fuel, and flexible-fuel vehicles, and are a mix of OEM products and vehicles converted in the aftermarket. Aftermarket conversions, both CNG and LPG, are apparently more prevalent among the state and city fleets than they were in the previous federal fleet survey (Whalen and Coburn, September 1997), where 51.3% of state government and 76.7% of city government drivers indicated that they operate converted AFVs.

The alternative fuel is not always the fuel of choice for drivers of bi-fuel and flexible-fuel vehicles. Overall, less than 60% of state and city government drivers of these vehicles reported using the alternative fuel more than 50% of the time. Although the drivers responding are not necessarily from the same fleets as the state and city fleet managers who responded to a previous survey (Whalen et al. 1999), it is interesting to note that the fleet managers reported much higher rates of alternative fuel use than did the drivers. Fifty percent or more use of alternative fuel was reported by 90% of the state fleet managers compared to 56.5% for the drivers, and 87% of the city fleet managers compared to 59.7% for the drivers. Because nearly 85% of the state and city drivers indicated that they refuel their own vehicles, we suspect that the driver responses may more accurately reflect the rate of alternative fuel use.

Most of the drivers polled responded that an alternative fuel station is reasonably nearby. However, based on fuel use reported by drivers of bi- and flexible-fuel vehicles, having stations reasonably nearby does not necessarily result in maximum alternative fuel use. Interestingly, most state and city drivers of AFVs reported a station must be within 5 miles to be convenient. Although a station may be near a base location, it may not be convenient to visit during the normal course of vehicle use.

Many state government drivers use public stations for fueling their AFVs; city government drivers were nearly equally divided between using public stations, on-site stations, and private stations for fueling AFVs. Most AFV drivers had no personal concerns about refueling their vehicles.

Both AFV and gasoline vehicle drivers tended to be satisfied with the overall performance of their vehicles. Most respondents (both state and city) operating dedicated CNG, alcohol, and gasoline-only vehicles rated overall vehicle performance as very good or excellent.

Slightly more than half the AFV drivers reported that their AFVs were about the same overall in comparison to similar gasoline vehicles. About 10% of the state and city AFV drivers reported that their vehicles were better overall compared to similar gasoline vehicles. The highest rate of responses that AFVs compare favorably (about the same or better) came from drivers of alcohol- fueled vehicles, with 90.3% of state and 100% of city government drivers responding this way.

AFV drivers reported more performance-related complaints (on a percentage basis) than drivers of gasoline vehicles. Overall, 23% of state and 35% of city drivers reported experiencing at least one of the eight specific problems with their vehicles during the last month. The most commonly reported complaints were that vehicles "lacked power," were "hard to start," or "hesitated."

Most state and city government AFV drivers reported no difference in the types or frequency of maintenance—scheduled or unscheduled—between their AFVs and similar gasoline vehicles.

Vehicle range was not an issue for most state and city government drivers of CNG-CON, LPG, and gasoline vehicles. However, most drivers of dedicated CNG and electric vehicles reported their ranges as marginal or not acceptable. The service application must be clearly understood when considering the use of these shorter range AFVs such as dedicated CNG and electric vehicles.

Most AFV and gasoline vehicle drivers reported being very satisfied or leaning toward satisfied with the vehicles they drove at work. More than half the state and city AFV drivers would recommend an AFV to other drivers.

The survey results reflect a somewhat mixed view of the performance and acceptability of AFVs from the drivers' perspective. The perceptions that AFVs are good for the environment or help to improve air quality is a commonly cited reason why drivers like AFVs, and would recommend them to other drivers. However, many drivers indicated limited fuel availability, some vehicle performance problems, and some safety concerns as reasons they would not recommend AFVs to other drivers. Expanding fueling infrastructure, continuing to improve vehicles, and perhaps improving driver education may further increase AFV acceptability among vehicle drivers in these state and city government fleets.

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Appreciation is extended to the many vehicle drivers in various state and city government fleets across the country for their willingness to participate in this survey.

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Appendix A: Driver Responses by Vehicle Type and by State or City of Respondents

Table A-1. Number of responses from state fleet vehicle drivers by state and vehicle type

	Vehicle Type								All Types
STATE	CNG-BI	CNG-CON	CNG-DED	E85	ELEC	GASOLINE	LPG	M85	Total
AL				4	1				5
AZ		5					3		8
CA					3			5	8
DE		4					1		5
FL		2			6		13		21
GA		1	1				2		4
HI							1		1
IA				11					11
ID				9		7			16
IL		1		8		5			14
IN		2		1		1			4
KS				3					3
KY		3		4		2	1		10
LA		9							9
MA			8						8
MD	5	2							7
ME					2		1		3
MI		1				1			2
MN				18		20	4		42
MO		7		10			12		29
MS						1			1
NC		2			11	2	6		21
ND				2					2
NE				4		7			11
NH							2		2
NJ		1							1
NM	1	2	1			1	19		24
NV		1							1
NY			1						1
OH						1			1
OR		1							1
PA		1				1			2
RI		10	13				2		25
SC		6	1	1	1		1		10
SD				9					9
TN				4		4			8
TX		8				1	34		43
UT						5			5
VA		2					1		3
VT					7				7
WA								1	1
WI		1		16		2	2		21
WV	11	15	1			26	1		54
WY		4							
TOTAL	17	91	26	104	31	87	106	6	468

Table A-2. Number of responses from city fleet vehicle drivers by city and vehicle type

	Vehicle Type								All Types
CITY	CNG-BI	CNG-CON	CNG-DED	E85	ELEC	GASOLINE	LPG	M85	Total
ALBUQUERQUE, NM*		7			1	2			10
ANCHORAGE, AK			1			8			9
ATLANTA, GA*		2			1	1			4
AUSTIN, TX*			1				3		4
BALTIMORE, MD*		26	11			2			39
BATON ROUGE, LA		21				6			27
BISMARK, ND							1		1
BUFFALO, NY*		1				1			2
CARSON CITY, NV		2							2
CHARLESTON, WV*	2	6							8
CHEYENNE, WY		12				2			14
CHICAGO, IL*		3		7					10
COLUMBUS, OH		4							4
DENVER, CO*		27	11			2	4		44
HOUSTON, TX*		7							7
INDIANAPOLIS, IN		1					1		2
KANSAS CITY, MO	2	1	2			17			22
LANSING, MI		1							1
LITTLE ROCK, AR*		7	6			16			29
LOS ANGELES, CA*		6							6
MADISON, WI		2				1	3		6
MISSOULA, MT*		1							1
NASHVILLE, TN		17				1			18
NORWICH, CT*		4			2	3			9
OAKLAND, CA*							1		1
OKLAHOMA CITY, OK*		4							4
OMAHA, NE		3	11			2			16
PEORIA, IL*				1					1
PHOENIX, AZ		15				1	3		19
PORTLAND, OR*					1				1
PROVO, UT		7							7
RALEIGH, NC	1	1			1	2	5		10
ROANOKE, VA							1		1
SACRAMENTO, CA*								1	1
SAN ANTONIO, TX							4		4
SEATTLE, WA		32							32
ST. PAUL, MN		9	1	2		9			21
SYRACUSE, NY*	1					1			2
TOLEDO, OH		1	3						4
TOTAL	6	230	47	10	6	77	26	1	403

* designated Clean Cities participants as of 9/30/97.

Appendix B: Results Summarized by Region (State) and by City Type (City)

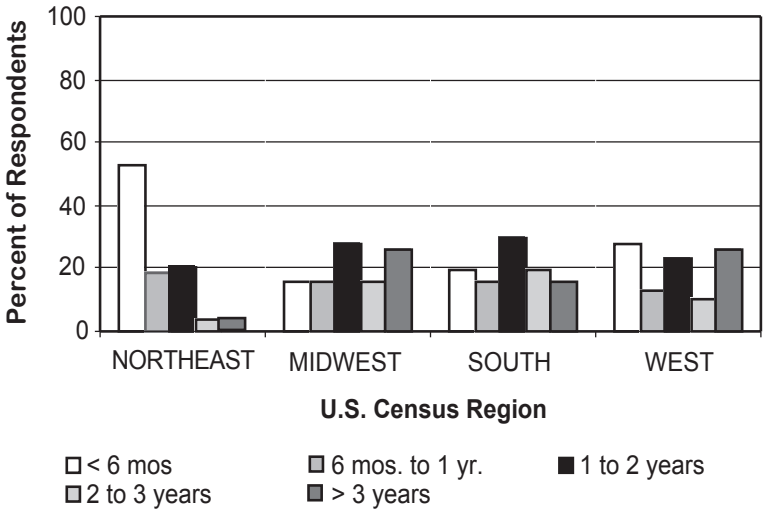

Figure B-1. Percentage distribution of length of time state drivers had driven their vehicles (by region)

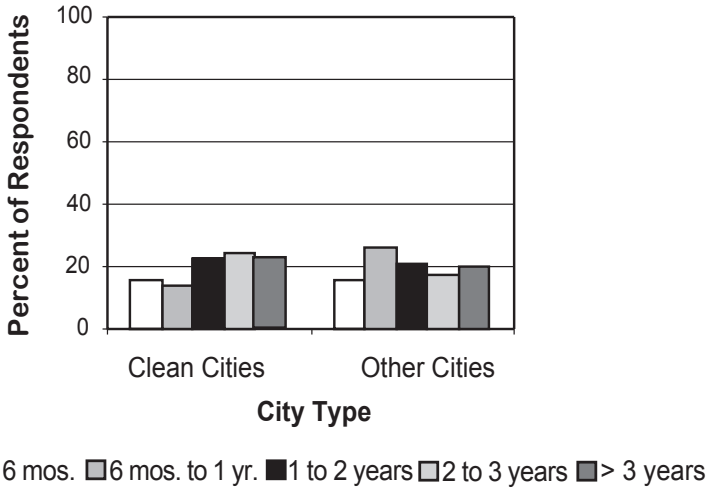

Figure B-2. Percentage distribution of length of time city drivers had driven their vehicles (by city type)

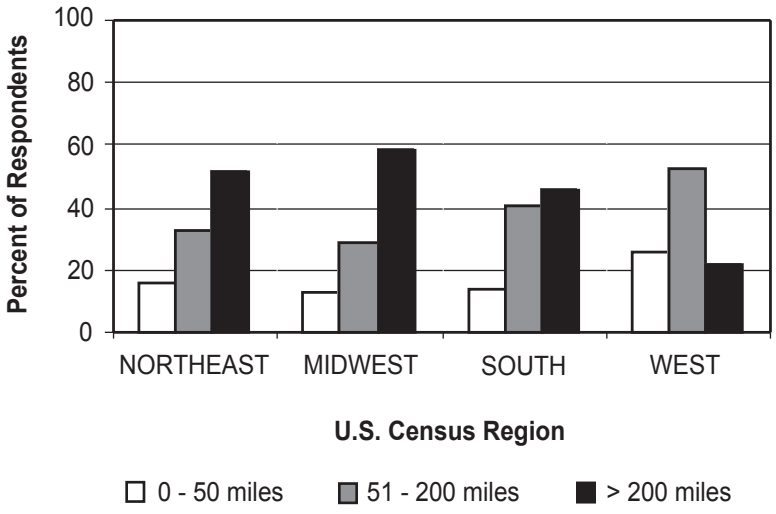

Figure B-3. Percentage distribution of state drivers' weekly mileage accumulation rates (by region)

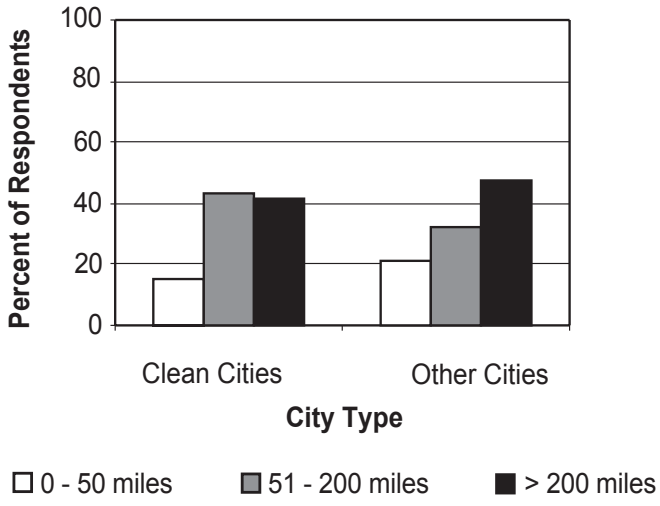

Figure B-4. Percentage distribution of city drivers' weekly mileage accumulation rates (by city type)

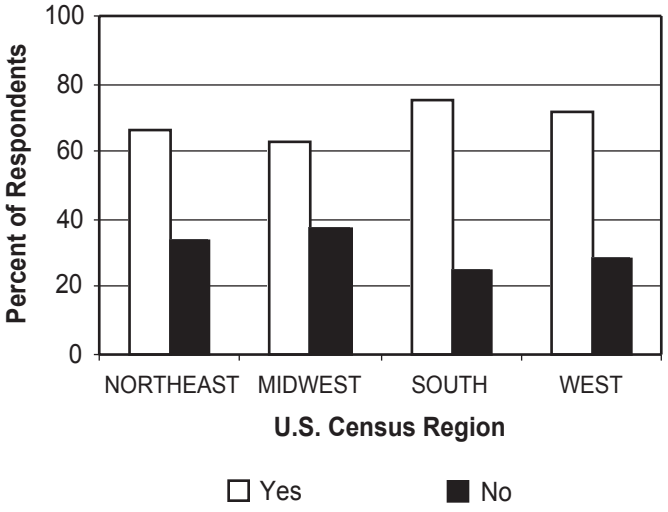

Figure B-7. Percent distribution of state drivers' responses to "is there an alternative fuel station nearby?" (by region)

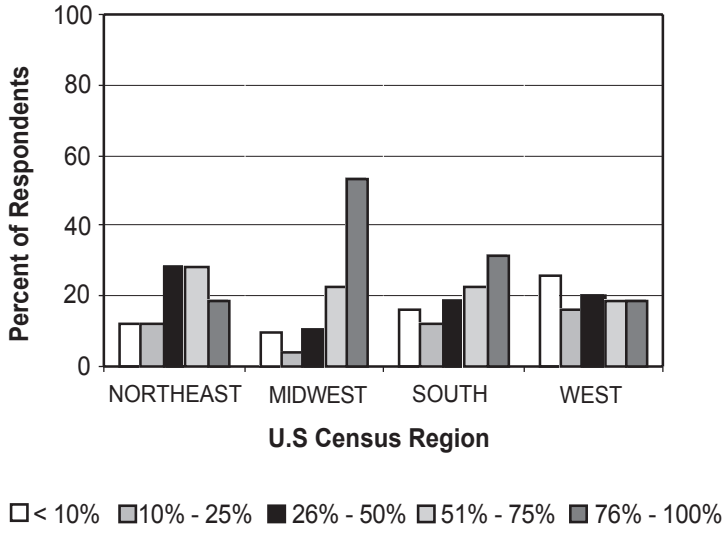

Figure B-5. Percentage distribution of state drivers on highway driving rates (by region)

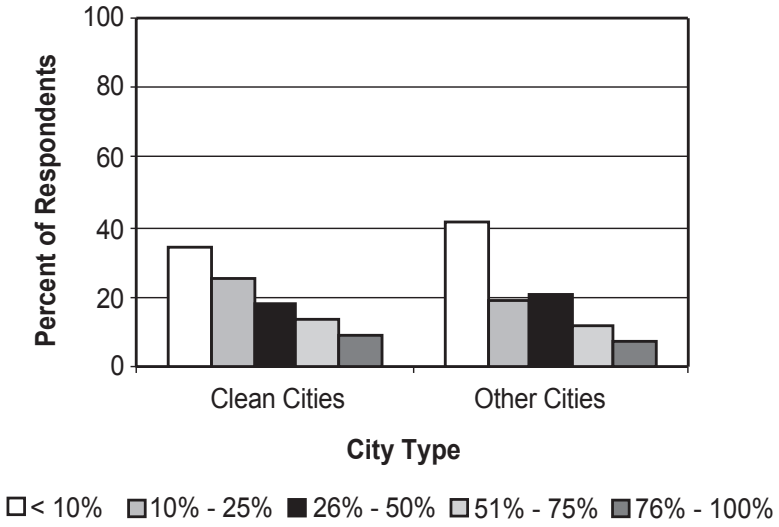

Figure B-6. Percentage distribution of city drivers on highway driving rates (by city type)

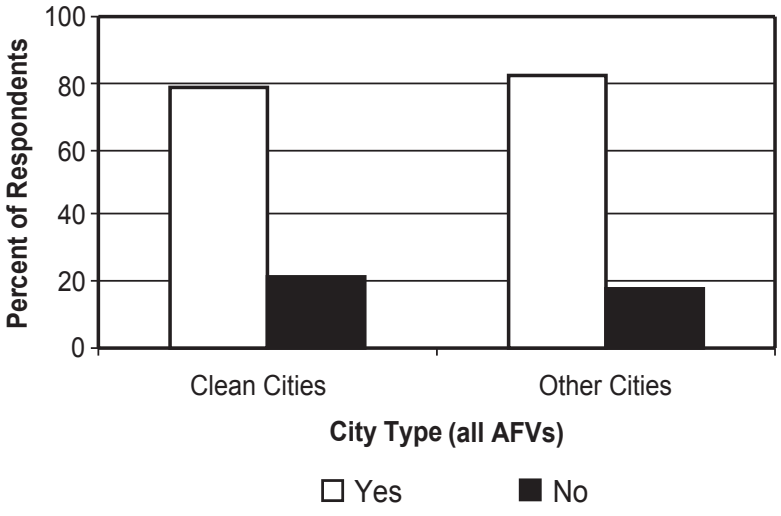

Figure B-8. Percent distribution of city drivers' responses to "is there an alternative fuel station nearby?" (by city type)

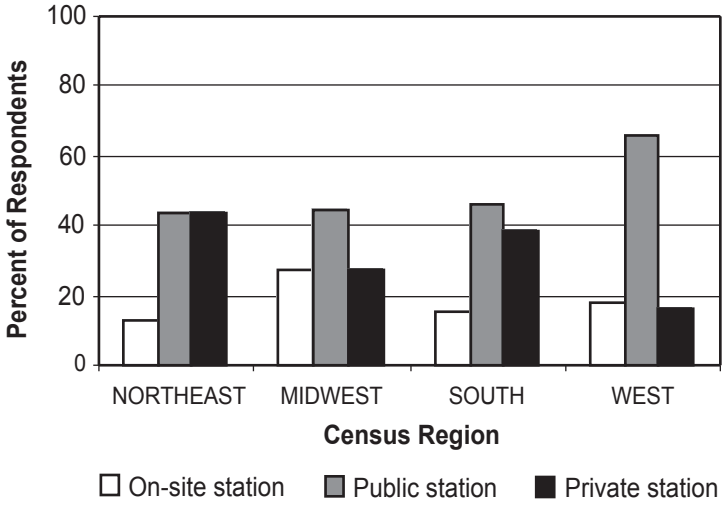

Figure B-9. Percent distribution of state drivers' responses about the type of alternative fuel station typically used (by region)

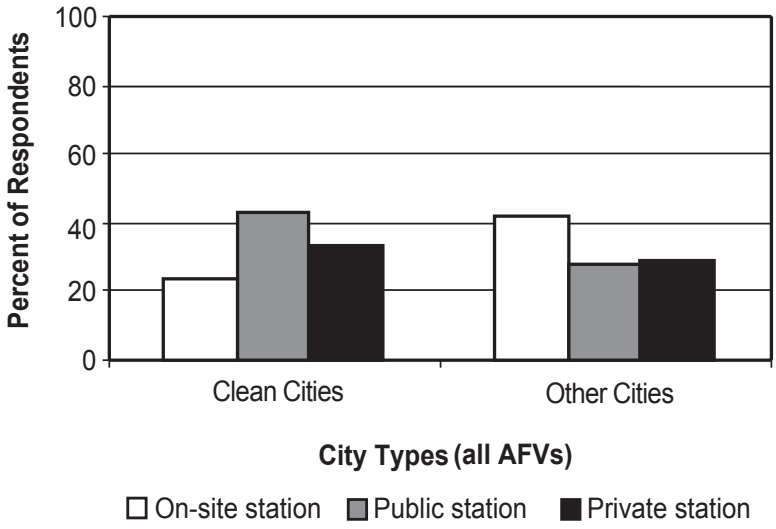

Figure B-10. Percent distribution of city drivers' responses about the type of alternative fuel station typically used (by city type)

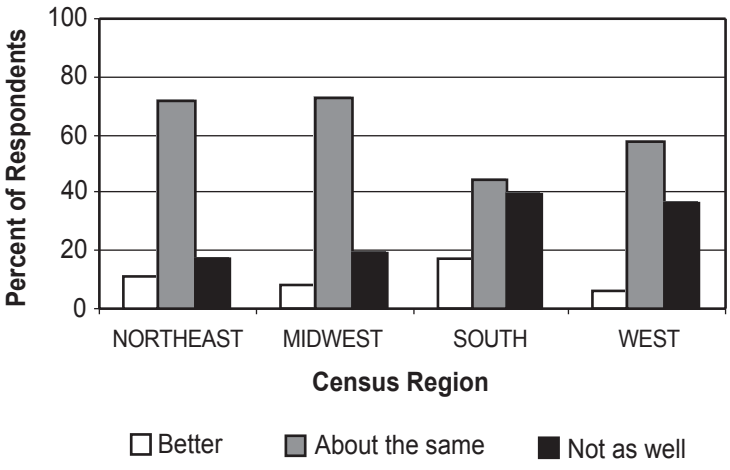

Figure B-13. Percent distribution of state drivers' responses to "how does your AFV compare to similar gasoline vehicles?" (by region)

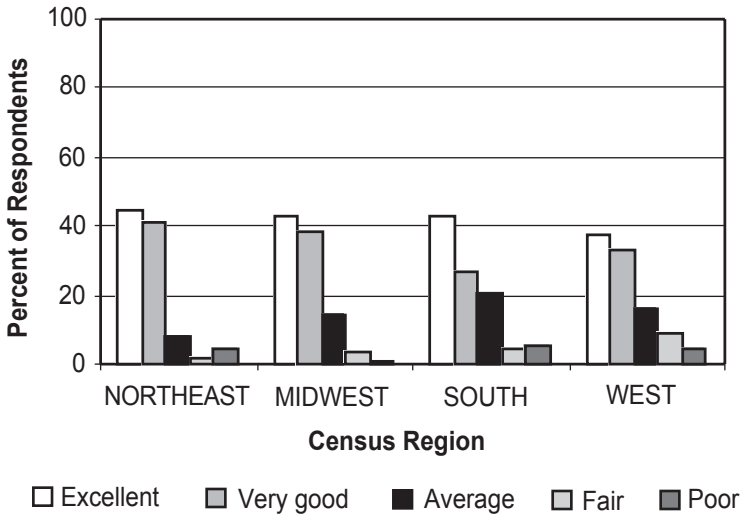

Figure B-11. Percent distribution of state drivers' ratings of overall performance of their vehicles (by region)

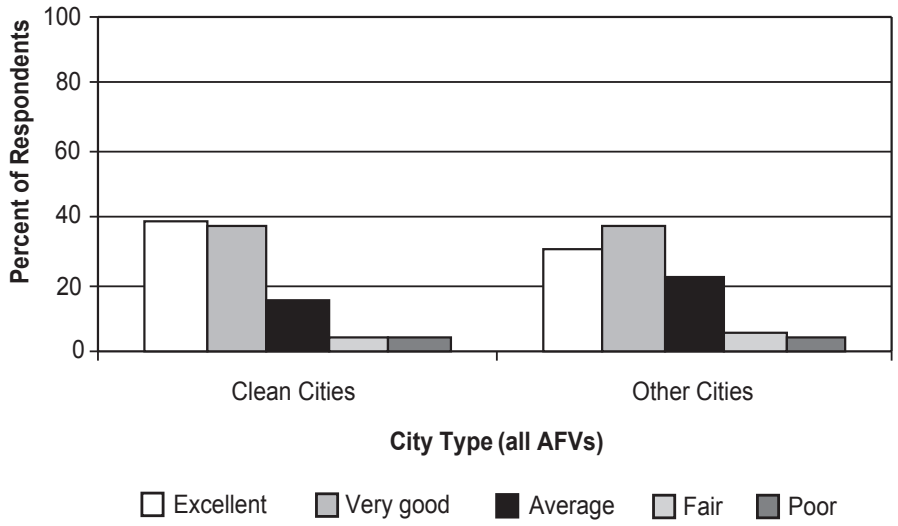

Figure B-12. Percent distribution of city drivers' ratings of overall performance of their vehicles (by city type)

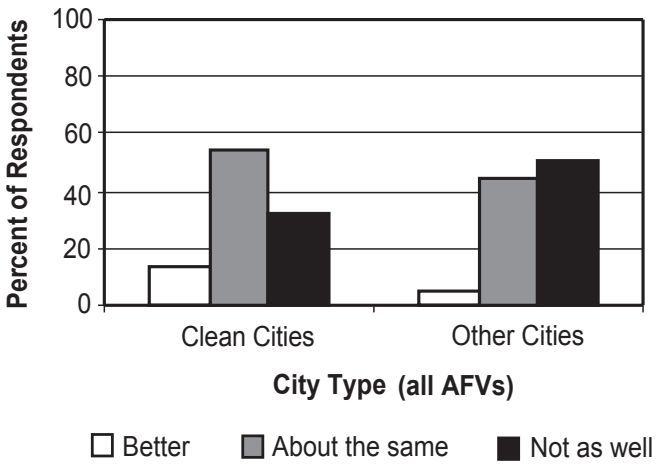

Figure B-14. Percent distribution of city drivers' responses to "how does your AFV compare to similar gasoline vehicles?" (by city type)

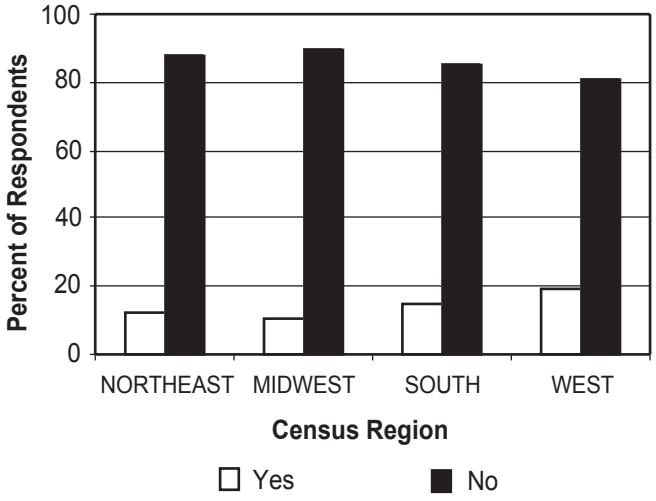

Figure B-15. Percent distribution of state driver responses to "does your AFV require more or different scheduled maintenance than similar gasoline vehicles?" (by region)

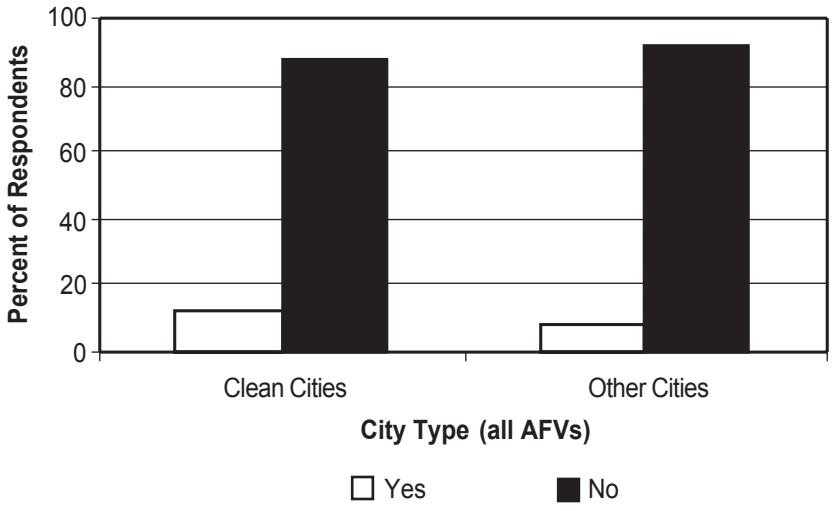

Figure B-16. Percent distribution of city driver responses to "does your AFV require more or different scheduled maintenance than similar gasoline vehicles?" (by city type)

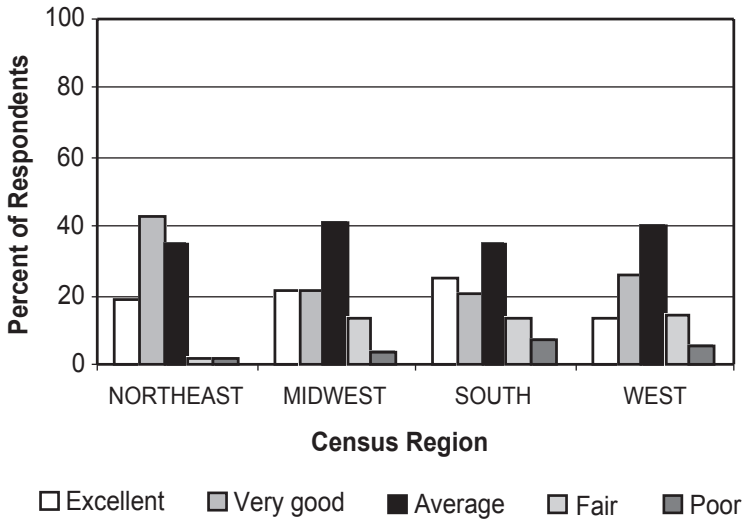

Figure B-19. Percent distribution of state drivers' ratings of the acceleration of their vehicles (by region)

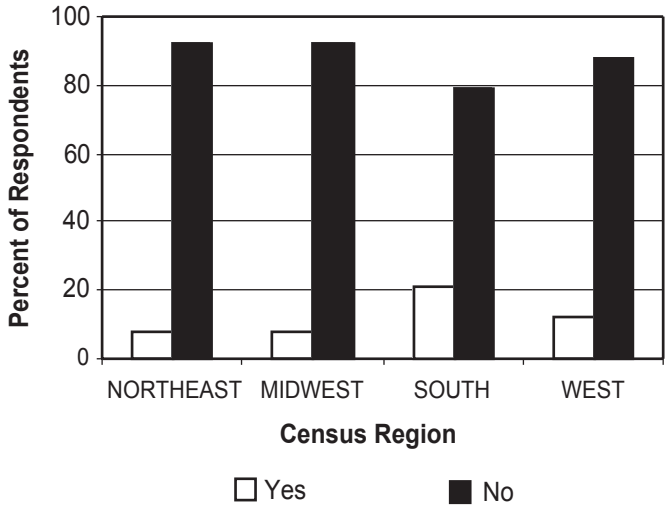

Figure B-17. Percent distribution of state drivers' responses to "does your AFV require more or different unscheduled maintenance than similar gasoline vehicles?" (by region)

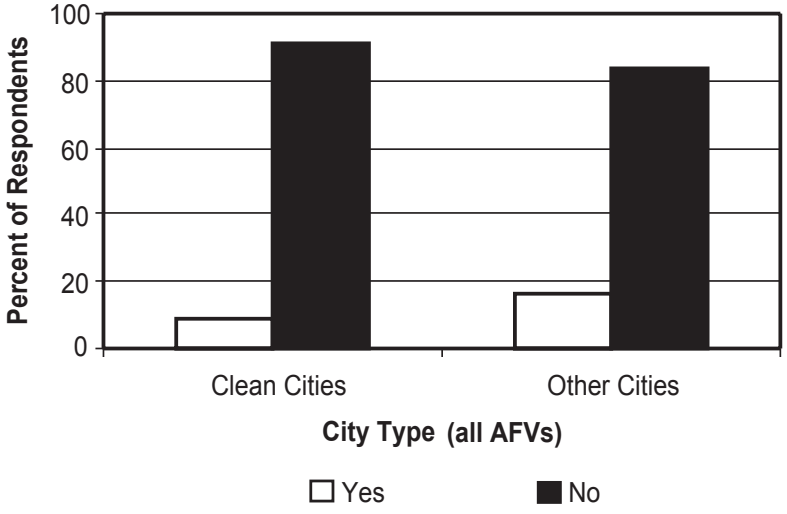

Figure B-18. Percent distribution of city drivers' responses to "does your AFV require more or different unscheduled maintenance than similar gasoline vehicles?" (by city type)

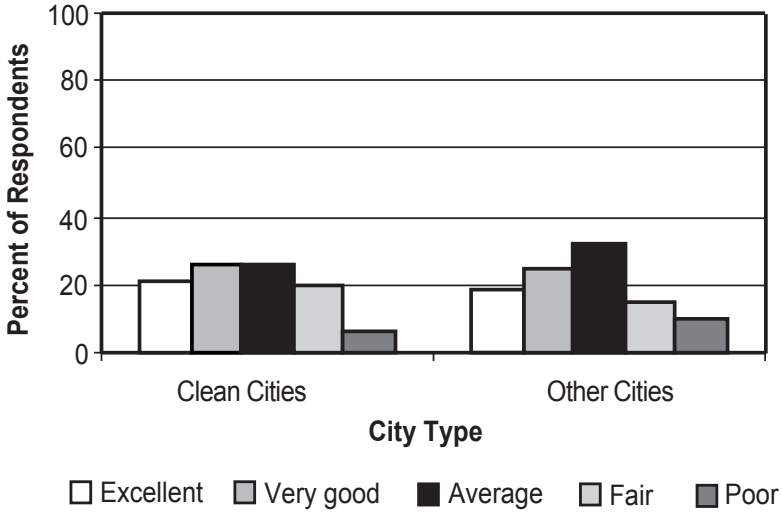

Figure B-20. Percent distribution of city drivers' ratings of the acceleration of their vehicles (by city type)

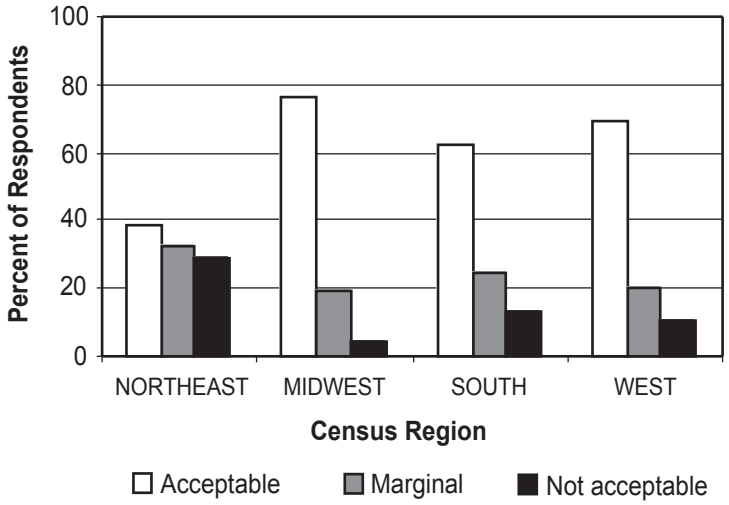

Figure B-21. Percentage distribution of state drivers' ratings of the range of their vehicles (by region)

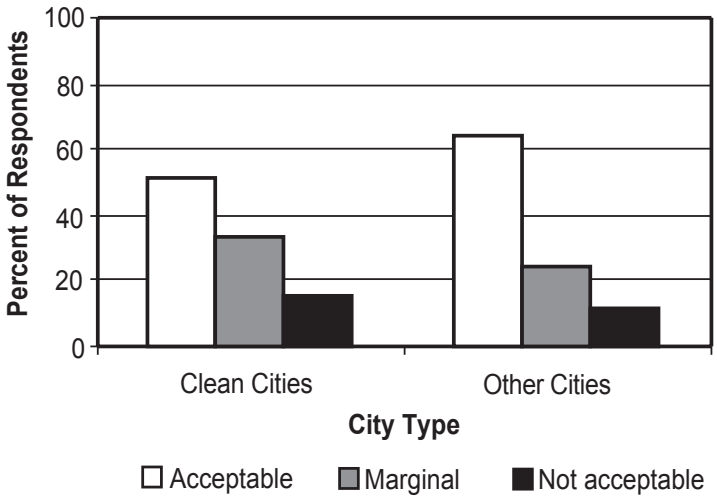

Figure B-22. Percentage distribution of city drivers' ratings of the range of their vehicles (by city type)

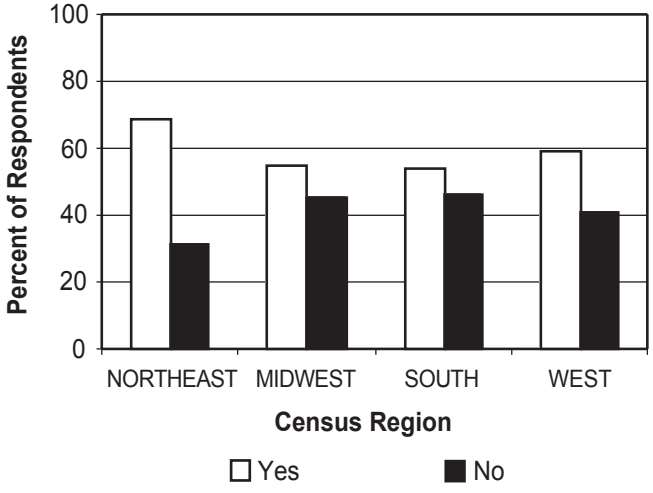

Figure B-25. Percent distribution of state AFV drivers' responses on recommending AFVs to other drivers (by region)

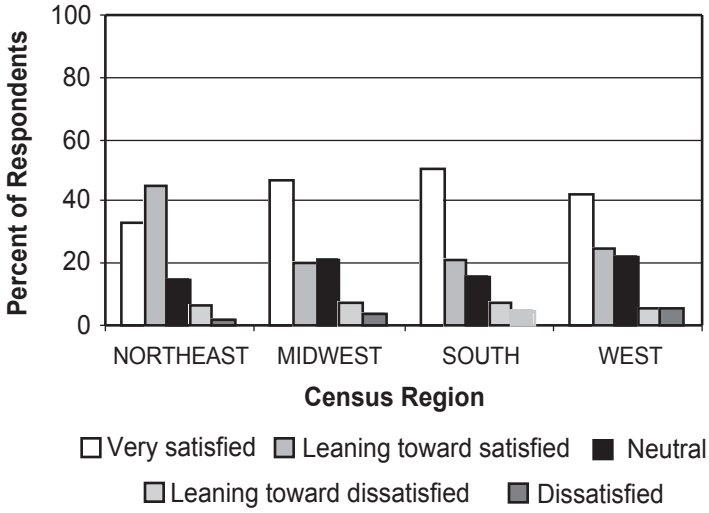

Figure B-23. Percent distribution of state drivers' ratings of overall satisfaction with their vehicles (by region)

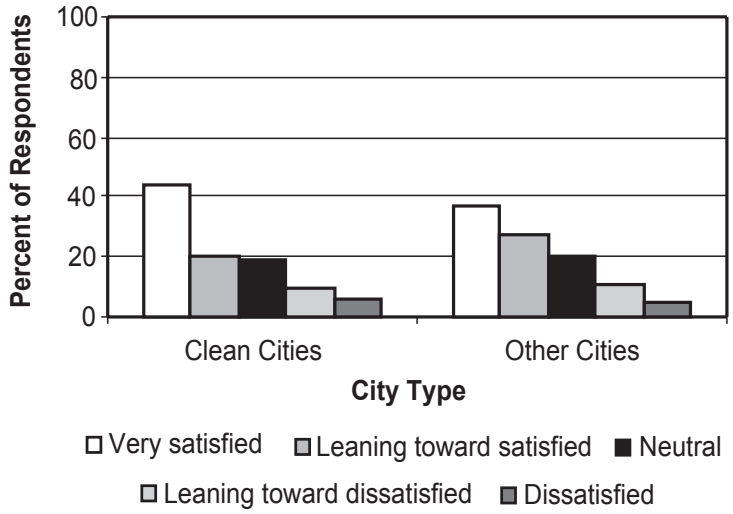

Figure B-24. Percent distribution of city drivers' ratings of overall satisfaction with their vehicles (by city type)

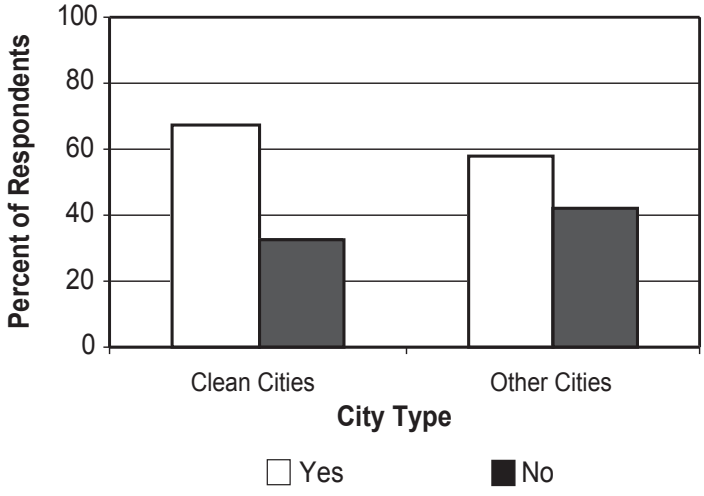

Figure B-26. Percent distribution of city AFV drivers' responses on recommending AFVs to other drivers (by city type)

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13. ABSTRACT (Maximum 200 words)

This survey collected information from state government and city government fleet drivers who operate light-duty alternative fuel vehicles (AFVs). The survey posed questions about AFV use, fuel use and availability, and performance. Surveys were completed with 468 state government fleet drivers, from 44 of the 50 states. In general, AFVs appear to meet the service application needs of most of the drivers surveyed, and tend to compare well to similar gasoline vehicles. In fact, more than half of these AFV drivers would recommend an AFV to other drivers. Because they believe operating AFVs is better for the environment, and may help to improve air quality, many of these drivers are willing to use AFVs despite concerns about access to alternative fuels and some lingering vehicle performance issues.

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