

Improving the EIA Survey Data Quality on Alternative-Fueled Vehicles Using Cognitive and Other Methods

Author: Howard Bradsher-Fredrick¹

I. Introduction

This report puts forward recommendations for improving the quality of Energy Information Administration (EIA) data related to alternative-fueled vehicles (AFVs). Due to increasing interest in AFV data from customers both internal and external to EIA, it is all the more important to collect quality data concerning AFVs. Data important to EIA include the number, type, and location of AFVs in use, alternative transportation fuel (ATF) consumption by AFVs, and average annual vehicle miles traveled (VMT) for AFVs.

EIA is also concerned with reconciling discrepancies between EIA data collections and outside AFV data sources. While this comparative approach has clear limitations, it can be useful in raising problematic issues about specific features of each data collection. Section 2 includes a discussion of ATF data sources, reasons for discrepancies between the sources, and the difficulties faced collecting ATF consumption data from respondents. Section 3 includes a discussion of the sources of AFV counts, discrepancies in AFV counts, and the lack of VMT data available related to AFVs. Section 4 identifies areas for improving current EIA AFV data collections and suggests methods EIA could use to collect data beyond the scope of current surveys. Also included is a general outline of a cognitive testing methodology for eliciting information from respondents concerning their record-keeping practices and their ability to answer survey questions regarding the characteristics of their AFVs and ATF consumption.

II. Alternative Transportation Fuel Consumption Data

Sources Within EIA

Currently, two EIA surveys collect alternative transportation fuel (ATF) data as related to alternative-fueled vehicles (AFVs); the EIA-886, *Alternative Transportation Fuels and Alternative Fueled Vehicles Annual Survey*, and the EIA-176, *Annual Report of Natural and Supplemental Gas Supply and Disposition*. The EIA-886 survey collects ATF consumed by the AFV fleet of an organization during a calendar year. The EIA-176

survey collects data on the amount of natural gas delivered to consumers for vehicle fuel use during a calendar year.

At the company level, comparisons between the ATF data collected by the two EIA surveys cannot be made because each survey targets a different respondent base. The EIA-886 is sent to end users of ATFs, while the EIA-176 is sent to natural gas pipeline companies, distributors, storage operators, and plant operators, rather than the actual end user of the ATF. Also, the EIA-176 does not make a distinction between whether the natural gas fuel delivered is compressed natural gas (CNG) or liquefied natural gas (LNG).

However, at an aggregate level, comparisons between EIA-176 data and EIA-886 data are possible. The following three sub-sections present comparisons for natural gas consumption, for consumption by Federal agencies, and for consumption at the U. S. level.

Natural Gas Comparisons

The EIA publication *Natural Gas Annual* provides a summary of natural gas delivered to customers tabulated by State from data collected on the EIA-176. *Natural Gas Annual 1998* reported that 5,079 million cubic feet, or 45.5 million gasoline-equivalent gallons (GEG), of natural gas were delivered to consumers for vehicle fuel use in 1998, up from 39.6 million GEG in 1997. The EIA-886 showed 46.1 million GEG of natural gas consumed for vehicle fuel use for 1998, while natural gas consumption for 1997 could not be calculated. While these differences are relatively slight (1.3%), reasons can be cited for more significant data differences. It should be noted that the objectives to be achieved by the two surveys are different. Thus, the emphases of the two surveys can create differences in the data values. The primary emphasis of the EIA-176 is to track fuel volumes as these move through the system, while the primary emphasis of the EIA-886 is to identify the number, type and characteristics of alternative-fuel vehicles in actual use.

Natural gas consumption volumes reported on the EIA-886 for the year 1998 were obtained from 339

¹The author would like to thank Amy Jo Wheeler-Melvin and Billy Rush of Decision Analysis Corp. for their analytical and administrative aid in completing this report.

respondents. This figure represents 69.5 percent of the 488 respondents reporting natural gas vehicles. These 339 respondents reported 33,464 natural gas vehicles. The reported EIA-176 natural gas GEG volume is lower than the EIA-886 natural gas GEG volume. Since over thirty percent of the EIA-886 respondents with natural gas vehicles did not report fuel consumption, it appears that EIA-176 natural gas GEG volume should be greater than reported.

With respect to the EIA-176, some volumes of natural gas delivered for use as vehicle fuel were being reported as fuel delivered to commercial consumers where refueling facilities exist and ATF consumption is not separately metered from space heating consumption. Thus, in some cases consumers were unable to distinguish vehicle consumption from consumption for other purposes. Additionally, data on natural gas used by utilities for their own fleets may not be captured in the EIA-176 survey but would be included in the EIA-886 survey.

Comparisons Between Federal Agencies

Considering data at the Federal level, 16 Federal agencies reported 3.6 million GEG of ATF consumed on the EIA-886 survey for 1998. In addition, EIA develops estimates of ATF consumption through its estimates of AFV counts. For 1998, EIA estimated approximately 5.2 million GEG of ATF consumed by Federal agencies. The U.S. Postal Service, the largest Federal user of AFVs, comprised over 93 percent of the 3.6 million GEG of ATF reported on the EIA-886.

U. S. Comparisons

Although EIA's estimate of 324.8 million GEG of ATFs consumed during 1998 takes into account the number of non-dedicated on-road AFVs, ATF consumption estimates may be greater than actual consumption. While some organizations are required to use and acquire AFVs as specified under the Energy Policy Act of 1992 (EPACT), these organizations are finding it difficult to fuel their AFV fleet with an ATF due to the lack of nearby ATF refueling stations. As a result, it is believed that many non-dedicated AFVs are running primarily on gasoline, rather than an ATF.

Comparison of EIA ATF Data and Other ATF Data Collections

A source of ATF data outside of EIA is the report of the General Services Administration (GSA) entitled *Fiscal Year 1997 Federal Fleet Report*. Data included in the

Federal Fleet Report were submitted by Federal Agencies to GSA on Standard Form 82 (SF-82), "Agency Report of Motor Vehicle Data." The report summarizes data for Federal vehicles both owned and commercially leased for Fiscal Year 1997. Only agencies with fleets of at least 2,000 vehicles (traditionally and alternatively fueled) were required to submit data. The 1997 report lists the most current data presently available from GSA.²

GSA's Federal Fleet Report showed 14 Federal agencies reporting 4.7 million GEG of ATF consumed during Fiscal Year 1997, while the EIA-886 showed 10 agencies reporting 0.3 million GEG for calendar year 1997. Between the two surveys, there were only four common respondents due to the existence of non-respondents on both surveys. 1997 was the first year EIA collected ATF consumption data on the EIA-886. It was also the first year in which GSA collected ATF and AFV data. Because of the new requirement, Federal agencies might have been unprepared to supply ATF data to EIA and GSA, resulting in non-response and incomplete data.

III. Alternative-Fueled Vehicles in Use and Vehicle Miles Traveled Data

Comparison of EIA AFV Data with non-EIA AFV Data Collections

American Public Transit Association (APTA) Transit Vehicle Data Book

APTA collects data from APTA member agencies³ on transit passenger service vehicles owned and leased as of January 1st of the year the data are published. Summary tables for United States transit agencies and fleet data for individual agencies are included. Fleet data listed in the APTA Transit Vehicle Data Book that are important to EIA include total AFVs in an agency's fleet (both active and inactive), vehicle type, fuel type, confirmed orders of vehicles, and potential orders of vehicles.

For the 58 respondents that reported AFV buses on both the EIA-886 and APTA surveys, EIA reported 3,323 AFV buses in use, while APTA reported 3,541 AFV buses in use. Definitional differences on what is

²General Services Administration, *Fiscal Year 1997 Federal Fleet Report*, (Washington, DC, 1997), p. 2.

³APTA acknowledges that a number of AFVs operated by non-member agencies are not reported.

considered a bus for the purposes of each survey account for the difference in AFV counts.

The Federal Transit Administration (FTA) National Transit Database

FTA collects data on all vehicles in use by its member transit agencies throughout the United States. FTA also collects fuel consumption data. Although FTA does not provide breakdowns of conventionally fueled vehicles versus AFVs, their data are useful in helping to recognize that a particular transit agency does use AFVs and the fuel type consumed by the AFVs. Any agency that reports AFV data to FTA that is not on the EIA-886 frame is added to the EIA-886 frame. All data reported by transit agencies on the EIA-886 survey are compared to data reported to FTA. When a transit agency does not report any AFVs on the EIA-886 survey, yet reports ATF consumption on the FTA survey, the respondent is called to determine the reason for AFVs not being reported.

Natural Gas Fuels

RP Publishing's *Natural Gas Fuels* conducts a voluntary annual survey of the largest gas utility companies in North America, collecting the number and percentage of on-road vehicles in the utilities' fleet fueled by natural gas. The data reported in *Natural Gas Fuels* are compared with data reported by respondents on the EIA-886 survey frame.

In 1998, *Natural Gas Fuels* surveyed the 150 largest gas utilities in North America, with 127 U.S. utilities responding to the survey. Of those 127 respondents, 98 also reported NGVs in use on the EIA-886. Those 98 respondents reported 14,570 NGVs in use on the *Natural Gas Fuels* survey, but only reported 12,450 NGVs in use on the EIA-886, a difference of 17 percent. One difference in NGV counts may be due to the timing in reporting of the survey. 1998 data for the *Natural Gas Fuels* survey were reported as of the date the survey was filled out in 1998, while the 1998 AFV data for the EIA-886 were reported as AFVs in use as of December 26, 1998. By the time the calendar year 1998 ended, some NGVs may have been retired from service.

Office of Transportation Technologies (OTT) Fuel Provider and State Government Fleets Alternative Fuel Vehicles Acquisition and Credits Database

OTT is part of the Office of Energy Efficiency and Renewable Energy (EERE) of the U.S. Department of Energy. Under EPACT, State agencies and certain fuel providers must acquire a certain percentage of AFVs

during a model year (September 1st through August 31st) and report this data to OTT. Currently, OTT data are not available to the public. However, EIA has access to their database for use in comparing individual respondent AFV data between the different data collections.

EIA-886 data are compared to OTT data in situations when EIA AFV counts appear to be lower than usual. If there are any major discrepancies in the EIA-886 data and OTT data (e.g., respondents forgetting to report all AFVs in use, reporting vehicle orders on the EIA-886), the respondent is contacted to resolve the issue.

General Services Administration (GSA) Report, Locations of Federal Light Duty Conventional and Alternative Fuel Vehicles by Zip Code, (Washington, DC, May 1998)

This voluntary GSA survey, conducted in conjunction with members of the Interagency Committee on Alternative Fuels and Low Emission Vehicles (INTERFUEL), collected information from Federal agencies on light-duty AFVs and conventional vehicles. Data collected on AFVs include fuel type, number of AFVs in use, and location of the vehicles.

The GSA report showed 23 Federal agencies reported 17,147 light-duty AFVs in use for the first two quarters of fiscal year 1998, while the EIA-886 survey showed 22 Federal agencies reported 17,592 light-duty AFVs in use as of the end of the 1998 calendar year. Of the 23 respondents reporting on the GSA survey, 20 also reported AFVs in use on the EIA-886. These 20 respondents reported 16,474 light-duty AFVs in use on the GSA survey, but reported 17,560 light-duty AFVs in use on the EIA-886, a difference of 6.6 percent.

Also of note is the difference in M85 (a mixture of 85 percent methanol and 15 percent gasoline) and E85 (a mixture of 85 percent ethanol and 15 percent gasoline) AFV counts. For the 20 Federal agencies reporting on both surveys, the GSA report showed 1,593 M85 vehicles and 2,344 E85 vehicles in use for the first quarter of 1998, while the EIA-886 showed 541 M85 vehicles and 4,254 E85 vehicles in use during 1998.⁴

The major difference in AFV counts between the two surveys is most likely due to the timing of when the data

⁴ General Services Administration, "Locations of Federal Light Duty Conventional and Alternative Fuel Vehicles by Zip Code," (Washington, DC, May 1998).

were reported. The GSA report collected data on AFVs in use for the first quarter of 1998, while the EIA-886 collected data on AFVs in use as of December 26, 1998. Between the first quarter and last quarter of 1998, Federal agencies received AFVs purchased in order to meet EPACT requirements, therefore, the EIA-886 had a higher AFV count. Due to various incentives, there was a movement from M85 to E85 vehicles during the course of 1998. The EIA-886 survey captured this phenomenon due to the different reporting date of AFVs in use.

Other differences in AFV counts may be due to some Federal agencies not reporting AFVs at all locations or not reporting leased vehicles. Similar to the different counts in the *Natural Gas Fuels* survey, the difference in AFV counts may be the result of different contacts for the same company reporting different AFV counts for each survey.

General Services Administration's "Fiscal Year 1997 Federal Fleet Report"

Data included in the Federal Fleet Report was submitted by Federal Agencies to GSA on Standard Form 82 (SF-82), "Agency Report of Motor Vehicle Data." This report summarizes data for Federal vehicles both owned and commercially leased for Fiscal Year 1997. Only agencies with fleets of at least 2,000 vehicles were required to submit data. Data collected on AFVs include AFV counts by agency and fuel type, and AFV acquisitions by agency and fuel type. The 1997 report contains the most current data available from GSA.

The Federal Fleet Report showed eight agencies reporting 14,032 AFVs in use for Fiscal Year 1997,⁵ while the EIA-886 showed 12 agencies reporting 11,286 AFVs in use for 1997. For both the Federal Fleet Report and EIA, 1997 was the first year their surveys collected AFV inventory data. Because of the new requirement, Federal agencies may have been unprepared to supply AFV counts, resulting in the low total AFV count for both surveys. Individual agency data cannot be compared between the two surveys due to GSA reporting AFVs leased from GSA as GSA inventory on the Federal Fleet Report.

⁵ General Services Administration, *Fiscal Year 1997 Federal Fleet Report*, (Washington, DC, 1997), p. 47.

⁶ GSA acknowledges that some of the data required to complete the table of AFVs was incomplete, missing or not reported by the agencies in time to publish.

Vehicle Miles Traveled Data Sources

Currently, no EIA survey requests data on average annual miles traveled per vehicle (VMT) specifically for AFVs, nor does EIA publish estimates of VMT data for AFVs. VMT data can be used to determine fuel consumption through estimates of average miles per AFV gallon; this is dependent upon fuel type and vehicle type.

Upon non-response follow-up, respondents are permitted to report total VMT by fuel type on the EIA-886 survey, in lieu of reporting ATF consumption. For 1998, only 1.2 percent of respondents reporting AFVs in use on the EIA-886 survey provided VMT data. The result was that twelve respondents reported 141 AFVs.

IV. Employing the Cognitive Testing Methodology

In this report, data discrepancies related to vehicle counts, alternative fuel consumption, and vehicle miles traveled have been documented. Moreover, the problems contributing to these discrepancies have been identified. While many of these problems cannot be easily resolved, there are some areas of investigation that could bear fruit if pursued at this time.

It is believed that a cognitive interviewing methodology could be effectively employed to determine if recommendations to changes in the EIA-886 survey form should be implemented. Such testing would involve interviewing a sample of respondents and determining whether or not these respondents would be able to provide the requested data accurately, in a timely manner, and without an undue reporting burden.

In this section, various suggestions will be advanced for improving the data collected on the EIA-886 related to alternative-fueled vehicle counts, fuel consumption, or the advisability of surrogate measures for fuel consumption (e.g., VMT). Finally, a listing of the next steps to be taken in developing a cognitive interviewing process is provided.

Suggestions for Collecting and Improving AFV Counts

It should be noted that the following two suggestions for changes in the EIA-886 have already been put forward and implementation is already taking place.

Reduce Amount of Detailed Vehicle Type Data

On the EIA-886, there are 44 different vehicle types grouped into seven vehicle categories: automobiles, vans, pickup trucks, other trucks, buses, other on-road vehicles, and non-road vehicles. EIA could mitigate the problem of classifying AFVs by specific vehicle type and still receive pertinent AFV data by classifying vehicles into a much smaller number of vehicle categories.

Collect Vehicle Make, Model, and Model Year Data

Some EIA-886 respondents have complained that the way EIA asks for AFV data to be reported is much different from how the respondents actually maintain records concerning their fleet. Respondent organizations sometimes have a database with information on a vehicle's make, model, model year, fuel type, vehicle configuration, and Vehicle Identification Number (VIN) for their own informational purposes. However, respondents often have to set up a special database to be sure they complete the EIA-886 properly, yet often become confused by EIA codes, leading to misreported data. As a result, EIA should consider collecting data about the make and model of AFVs in the respondent's fleet. Make, model, and model year data could be employed to compute the associated vehicle type, thus mitigating the need for directly requesting vehicle type data.

Suggestions for Collecting and Improving VMT Counts

The majority of organizations with vehicle fleets maintain records of VMT for vehicle maintenance purposes. Through telephone conversations, conducted during follow-up interviews, some EIA-886 respondents have expressed their belief that it would be easier to provide actual or estimated VMT rather than ATF consumption. There are several methods EIA could use to collect VMT data for AFVs:

1. Collect VMT data on each individual on-road AFV in use by an organization. Since organizations usually maintain records of VMT for each vehicle, organizations should be able to report these data.
2. Collect total VMT for each vehicle type category (e.g., automobiles, vans, pickups). GSA collects data in this fashion on Form SF-82, "Agency Report of Motor Vehicle Data."
3. Collect the average estimated VMT for each vehicle type category.

Suggestions for Collecting and Improving ATF Consumption Data

Currently, EIA-886 respondents are requested to provide ATF consumed by all vehicles. As mentioned previously, some respondents find it difficult to provide ATF consumption. Another method for capturing ATF data would be to request ATF purchases for use in their vehicle fleet if actual ATF consumption data could not be provided.

Further Steps EIA Can Take to Improve Data Collections

EIA has been employing a paper survey (the EIA-886) in order to obtain ATF volumes and AFV counts. However, other survey media are available which could advance the objectives of the data collection. One of these is the telephone survey. Telephone surveys are usually effective when requesting minimal information from a respondent, whereas paper surveys are useful for collecting larger amounts of detailed data. Paper surveys, such as the EIA-886, allow respondents to take time to assess questions and gather needed data, and are usually accompanied by a set of instructions in case the respondent has any problems answering questions on the survey.

It should be pointed out that for the purposes of the EIA-886 survey, the paper format is probably most appropriate. It would be impractical for EIA to conduct the EIA-886 via the telephone considering the large number of respondents and the level of detail being requested. However, EIA might consider conducting a telephone survey to collect basic ATF, AFV, and VMT data.. Moreover, a telephone survey may be practical for surveying a limited number of small fleet operators.

In order to verify that EIA is receiving quality AFV counts from organizations that are surveyed for the EIA-886, EIA could conduct a telephone survey asking a sample of EIA-886 respondents how many AFVs are in their fleet. Data from the telephone survey could be compared to the total AFV count that respondents report on the EIA-886.

EIA should consider their respondent base as a factor in determining the amount and type of data that should be collected from respondents. For the two years EIA has been collecting AFV counts and ATF consumption, it has been found that it is very difficult to identify local government agencies and private companies (excluding fuel providers) with AFVs. Due to the minimal data EIA is receiving from private companies, EIA might consider

targeting niche areas in private industry that are increasing their use of AFVs, such as airports and taxicab companies in metropolitan areas.

Further Areas of Investigation for Cognitive Interviewing

EIA staff have been discussing the use of cognitive testing in determining if any new survey questions and terminology employed were interpreted accurately by a sample of EIA-886 respondents. Cognitive testing could also be useful in determining whether or not alternative survey media (e.g., a supplemental telephone survey) could be usefully employed.

This cognitive testing would involve investigating a number of issues. Issues have been raised concerning the appropriate reporting units (e.g., MCF, GEGs) to be requested for ATF consumption. These issues involve whether or not these units are understandable and useful in submitting data, considering the record-keeping practices of the respondents. Issues were also raised regarding whether or not various terminology have been fully understood by respondents. Some of this terminology relates to the fueling configuration of the vehicle (i.e., Dual-, Bi-, Tri-, Flexi-Fueled, and Dedicated).

Issues have been raised regarding whether or not respondents have been able to ascertain from records the portion of time (or portion of mileage) vehicles which could run on either conventional or alternative fuels have actually been run on the alternative fuels. Some data discrepancies have resulted from differences in the

reporting periods on the surveys investigated in this report. Respondents may maintain their records according to a schedule that makes it difficult to adjust to the reporting period being requested by EIA. Therefore, it would be useful in the cognitive testing to identify the record-keeping cycles of respondents in order to adjust EIA-886 data collections accordingly.

Next Steps

In order to implement the recommendation of employing cognitive testing, a number of steps will need to be followed.

1. Identify the cogent characteristics of interest of the establishments who have submitted the EIA-886 survey form in the past (e.g., Federal versus State versus private organizational entity, large versus small fleet, CNG versus LPG versus M85 AFVs).
2. Identify establishments possessing the characteristics of interest.
3. Identify appropriate contact persons at each of these establishments.
4. Develop a protocol for use during the interview, eliciting relevant information from the respondent related to the areas of interest (e.g., data availability, data formats, units of measurement, understandability of terminology).
5. Arrange appointments.