

Revision to Estimates of Alternative Fueled Vehicles in Use and Alternate Transportation

Summary

The Energy Information Administration (EIA) has revised the method used to estimate both the current number of alternative fueled vehicles (AFVs) in use and alternate transportation fuel (ATF) consumption. It has also revised the data table format used to present this information. The method of estimating AFVs in use was revised for 4 reasons:

1. To eliminate confusion between information previously provided about total AFVs in use (estimated) and about the portion of AFVs reported in use by fleets on Form EIA-886.
2. To provide more detailed data and to revise historical data, including using more current data.
3. To make the estimation methodology as consistent as possible with data collected on Form EIA-886.
4. To automate the process and make it easier to customize the value of various estimation parameters to a particular fleet, fuel type, etc.

The discussion of these items will proceed as follows. First is an explanation of the changes to the data resulting from the above activities. Following will be a discussion of the revised methodology. The report will close with a description of the new data tables-why the format changed and what new data is contained in them. While the automation of the estimation process was a significant undertaking, it had very little impact on the actual estimates

themselves and therefore will not be discussed.

Changes in Estimates of AFVs In Use

The changes in the number of AFVs reported in use compared with the estimates of AFVs in use previously published are, at the total level for each fuel, largely the result of data revisions and not methodological changes. Vehicle in use data were revised for the following reasons:

1. Previously, data published for 2003 were preliminary and data for 2004 were "projected." The revised estimates of AFVs in use now include final 2003 survey data. EIA no longer makes year-ahead projections of AFVs in use.
2. Data by vehicle type and weight category were revised due to apparent respondent misclassification of vehicles. One example of misclassification is that several Form EIA-886 respondents originally reported many pick-up trucks as "medium-duty" pickups, when in fact they were actually light duty. Another is that respondents sometimes reported pick-up trucks as "other trucks." These revisions impacted estimates of AFVs in use by weight category and/or vehicle type, but very little for the total number of AFVs in use by fuel. An exception is methanol, which was determined to be no longer in use as a vehicle fuel.
3. The total number of propane (LPG) vehicles estimated in use was reduced as a result of information from the 2002 Census Vehicle Inventory Utilization Survey (VIUS). VIUS surveys trucks,

pick-ups, and vans in private fleets. Historically, Form EIA-886 has not surveyed private fleets other than alternate fuel providers, and most propane (LPG) vehicles are trucks or pick-ups in private fleets. The number of propane (LPG) vehicles that were reported in use between the 1997 and 2002 VIUS surveys dropped considerably.

4. The state distribution of AFVs has changed considerably in some cases.

The "benchmarking" revisions (converting to final survey data and using the VIUS survey) clearly had a major impact on 2004 and 2005 estimates as well. The misreporting problems tend to be similar from one year to the next, so 2004 estimates tend to be revised in a manner similar to 2003. However, revisions due to changing the state distribution of AFVs were not as consistent across the years 2003-2005.

Revisions to the Method of Estimating AFVs in Use and Alternate Transportation Fuel Consumption

Background

When EIA's alternate fuels work began in 1993, the first effort was to develop estimates of the number, type, and geographic distribution of AFVs in use as required in Section 503 of the Energy Policy Act of 1992 (EPACT92). At that time, EIA developed from outside sources estimates of the number of AFVs actually in use during 1992, using external information and a model it developed. This model described AFVs by various physical characteristics (e.g., size), fuel, and fleet ownership group

(e.g., state government, rental car) and was also used to estimate alternate transportation fuel (ATF) consumption by AFVs. As the years passed, the effort to develop an externally derived estimate of AFVs in use decreased and was replaced by making assumptions about growth in AFV use based upon various energy/economic factors and trends in AFV use reported in trade literature and to the DOE Clean Cities Program.

In 1995, EIA fielded its first survey of companies that supply AFVs¹, and in 1998 EIA first surveyed selected segments of U.S. fleets for AFVs in use, as described previously. Eventually, it became clear that EIA's Form EIA-886 data provided the best available knowledge base of AFV information and should be incorporated in a formal way into the estimation process, replacing its reliance upon external estimates from the mid-1990s and the subsequent series of growth factors. This suggested integrating the estimation method and the survey tool. This was accomplished by automating the calculation of AFV estimates using EIA survey data (and its structure) as the baseline and applying the existing estimation modeling assumptions in an automated fashion. Doing so not only greatly decreased manual manipulations and calculations, but it also made it much easier to modify model parameter values to reflect specific information known about various user groups, fuel types, etc. It also greatly facilitated comparing estimates of fuel consumption with actual ATF consumption reported by AFV users on Form EIA-886.

Revised Methodology Summary

EIA surveys all producers of AFVs but collects survey data only on AFVs used by Federal and State governments, alternate fuel providers, and transit companies. Therefore, the fleets for which EIA does not collect data on AFVs in use are local government fleets and private company fleets (except for alternate fuel providers). The revised model "imputes" estimates of vehicles in use for these fleets (combined) based on reported AFV supplier and user data from Form EIA-886.

The revised method for estimating total AFVs in use is designed to use only the prior year's estimates of AFVs in use, along with current year survey data, to develop estimates for the current year. The only exception to this is that developing estimates of vehicle retirements requires knowing the vintage of all AFVs in use the prior year. The revised procedure therefore requires EIA to establish a base year manually of AFVs in use which the revised model could use. Because EIA has only published preliminary 2003 and "projected" 2004 data until now and to establish a 3-year historical revised set of data, EIA chose 2003 as the base year. Thus, EIA has used the new method to revise estimates of AFVs in use and ATF consumption for 2003 and 2004. Estimates of AFVs in use and ATF consumption for 2005, which are being published for the first time, were also developed using the revised method.

Estimating AFVs in Use for 2003

To understand the method used to revise 2003 AFV and fuel consumption estimates, it is necessary to understand the gap between the scope of firms that

EIA surveys and the whole universe of AFV users.

As mentioned previously, EIA surveys both the suppliers and users of alternative fueled vehicles (AFVs), with the objective of being able to provide information on the number, type, and geographic distribution of AFVs in use as well as alternate transportation fuel (ATF) consumption by fuel regionally. It is relatively easy to survey AFV suppliers (original equipment manufacturers and converters), which number between 50 and 100. Fleets that use AFVs, however, could easily number in the tens of thousands nationwide.²

Therefore, EIA collects data from only the fleet groups described previously--Federal and State governments, alternate fuel providers, and transit companies--to determine AFV usage characteristics and fuel consumption, as described below. The gap between the number of AFVs covered by the EIA AFV supplier and user surveys (after adjusting for retirements) is those that are in use by local governments and private fleets. The number of these AFVs are being "imputed" in the sense that: 1) the number is not known precisely, because while the supply of AFVs is well known, retirements must be estimated; and 2) they are being assigned a geographic location (generally) based upon the distribution of AFVs in use for which EIA collects survey data. The reason the geographic location of these vehicles must be assigned by EIA is that vehicle suppliers do not generally know the State into which their vehicles are sold.³

It is important to note that EIA has always estimated AFVs in use by

municipal governments and private fleets. The original EIA model estimated state and municipal government vehicles combined and private fleets separately. This model had to be modified when information became available from Form EIA-886 on use of AFVs in state government fleets. As mentioned previously, the revised model now uses the same categories as are used for collecting vehicle in use data on Form EIA-886.

General Method

Following is the general method used to estimate AFVs in use.

- 1. Estimate the U.S. total number of AFVs in use by summing the vehicles made available (as reported by suppliers) through the current year (2003) and subtracting an annual estimate of vehicles retired.⁴ (Exceptions: propane (LPG) and ethanol vehicles. See items 2. and 3. under "Details and Exceptions.") This calculation is done for each level of detail, i.e. fuel type, vehicle type, and vehicle configuration.⁵*
- 2. Determine the number of AFVs in use for surveyed user groups for the current year. The EIA-886 user survey collects AFVs in use by State government, alternate fuel provider, and transit fleets. The Federal Automotive Statistical Tool (FAST) provides information on Federal AFVs in use.*
- 3. Subtract AFVs in use calculated in Step 2 from the total AFVs estimated in use for the given data year (from Step 1). The result is the number of AFVs estimated to be in use in market sectors other than those surveyed on the EIA-*

886 survey. These sectors are local governments (except for transit operations) and private businesses (except for alternate fuel providers), and are referred to as the "Other Local Government and Private" sector.

4. Allocate AFVs in use in the "Other Local Government and Private" sector to States. The calculation is performed by developing the percentage of AFVs in use in each State, by fuel and vehicle type, for all user types canvassed on the EIA-886 and the FAST survey. This percentage is applied to the total "Other Local Government and Private" AFV estimate to allocate the unsurveyed vehicles according to location.

The result is an estimate for 2003 of all AFVs in use by location (State) at the same level of detail for which data is collected on the EIA-886 and FAST surveys.

Details and Exceptions

1. Survey data characteristics - Because AFVs, except for E85 flexible-fueled vehicles, are operated almost exclusively in fleets, EIA surveys only fleets to determine AFVs in use. However, EIA currently covers only State governments, alternate fuel providers (electricity, natural gas, and propane), and transit companies on its EIA-886 survey of AFVs in use. Together with the Federal AFV data from the FAST system, EIA estimates that it collects information on about one-third of all AFVs in use; the remaining two-thirds are presumed to be in use by local governments and other private fleets. This percentage varies widely by fuel and vehicle type.

2. *Calculating AFV supply* - In 1995, EIA began collecting data on alternative fueled vehicles made available (including conversions and original equipment manufacturing). For all alternate fuels except propane, this vehicle supply information forms the basis for the overwhelming majority of the available alternate fueled vehicles estimated to be still in use. A large number of propane (LPG) vehicles were built prior to 1995 and, thus, were not captured by the EIA-886 supplier survey. Because propane (LPG) AFVs are almost exclusively medium- and heavy-duty vehicles, which often have fleet life spans of over 20 years, a large number of pre-1995 propane (LPG) vehicles were believed to still be in use until recently.

Therefore, EIA has a good estimate of the total population of non-propane (LPG) AFVs supplied that are likely still in use by simply summing all reported AFVs supplied and subtracting out estimated retirements. For propane (LPG) vehicles, EIA separately estimated an inventory of vehicles in use as of the end of 1997. To these estimates are added the number of propane (LPG) vehicles supplied according to the EIA-886 supplier survey since 1998. The propane (LPG) vehicle retirement schedule is then applied to this estimate to determine the final estimate of propane (LPG) vehicles in use. The reason for using 1998 instead of 2003 as the base year is that for propane (LPG) vehicles, some reliable information was available from the 1997 Census Vehicle Inventory and Use Survey, which covers private trucks.⁶ The vast majority of propane-fueled vehicles are private fleet trucks.

3. Flexi-fueled vehicles-- Flexi-fueled vehicles in the United States can operate on any ethanol/ gasoline blend containing no more than 85% ethanol and are designated as "E85" vehicles.⁷ The procedure for estimating the number of E85 vehicles in use is slightly different from that used to estimate the number of AFVs operating on other alternate fuels. The number of E85 vehicles estimated to be in use by fleets is calculated as 5 percent of the total number of E85 vehicles supplied (less retirements). The remaining E85 vehicles are considered to be sold to the public generally where most of them are assumed to be used as conventional gasoline vehicles.

4. Level of detail, AFV suppliers-- estimates are made according to the following characteristics:⁸

a. Fuel type. Fuel types are: propane (LPG), compressed natural gas (CNG), liquefied natural gas (LNG), ethanol (E85), and hydrogen. Formerly, EIA estimated the number of methanol-fueled vehicles, but methanol is not currently used as an on-road vehicle fuel.

b. Vehicle type. A vehicle's type is a function of both its "curb weight" and its body style. Examples of distinct body types are: subcompact automobile, light-duty pick-up truck, medium-duty pick-up truck, medium-duty truck, and large transit bus.

c. Engine configuration. An engine is either "dedicated," meaning that it operates on a single fuel, or non-dedicated. A non-dedicated engine may operate on more than one fuel at a single time or operate on more than one fuel, but only at separate times. A flexi-fueled vehicle is a type of non-dedicated engine.

d. User group, i.e., fleet classification of

the vehicle owner/operator. Examples are State governments, electricity providers.

5. Level of detail, AFVs in use, in addition to the level of detail used to classify AFVs supplied, AFVs in use are classified according to State in which the vehicle is located.

Estimating 2003 Alternate Transportation Fuel Consumption

Alternate fuel consumption was calculated using the following five basic inputs:

1. Estimated Alternative-Fueled Vehicles In Use: Calculated as previously described.
2. Estimated Vehicle Miles Traveled (VMT): Average annual vehicle miles traveled for AFVs at the "in use" level of detail (i.e., fuel/vehicle type/engine configuration type/State). However, in most cases VMT was not varied at this level of detail but only according to user group and vehicle type.
3. Estimated Vehicle fuel efficiency: Represented as Miles-per-Gallon (MPG) on Conventional Fuel (i.e., gasoline or diesel) for each in use level of detail.
4. For non-dedicated vehicles, EIA estimated the percentage of consumption that is alternative fuel, based upon both estimates developed in 1992 at the outset of EIA's AFV information program and limited information recently obtained on fuel use from the EIA-886 user survey.

5. Fuel energy content: Represented as Thousands of Btu (kBtu) per Native Unit of Fuel: By neat (i.e., pure) replacement fuel. The native units used are gallons (M85, M100, E85, E95, LPG, and LNG), therms (CNG), and kWh (electricity).

The following is a description of the six-step approach to estimate total annual fuel consumption.

1. Alternative Fueled Vehicles Categorization. The level of detail for AFVs "in use" is as described above.
2. Estimation of Vehicles Miles Traveled (VMT). The average annual VMT values known from conventional fleets were used as the starting point for the VMT assigned to each AFV in use level of detail. The conventional fleet VMT estimates are known only according to vehicle type.

In most cases, VMT was not varied by State, but only according to user type and vehicle type. For example, Federal and State governments may use AFVs in quite different ways due to fuel availability or policies for AFV use.

In some instances, the annual VMT values of conventional vehicles were revised downward to reflect the less intensive use of AFVs when compared to conventional vehicles. Average VMT is lower for AFVs than for conventional vehicles for some types due to differences in vehicle classification and issues of choice. "Choice" factors that reduce AFV utilization relative to conventional vehicles include the following:

- More frequent refueling because of lower heat content of alternative fuels

- Range restrictions because of limited fuel availability
- Higher maintenance needs and increased incidence of mechanical failures
- Operator perceptions (when choice is available, fleet and vehicle operators may drive conventional vehicles more often than AFVs because of their perceptions of safety, cost, perceptions are correct).

In other instances, the annual VMT values of conventional vehicles were adjusted to reflect information about AFV use that was collected on the EIA-886 survey or from other outside sources.

3. Estimation of Fuel Efficiency

The efficiencies in miles per gallon of gasoline were determined for all vehicle categories. The annual MPG values known from conventional fleets were used as the starting point for the MPG assigned to each AFV "in use" level of detail ((i.e., fuel/vehicle type/engine configuration type/State).⁹ The conventional fleet MPG estimates are known only according to vehicle type, so they are occasionally varied. As more data about the efficiency of alternative fuel vehicles have become available, these have been incorporated into the estimates. For instance, the EPA's Fuel Economy Guide has begun including some types of AFVs, and this information is sometimes used to adjust conventional MPG rates.

4. Vehicle Miles Traveled and Fuel Consumption Adjustments for Dedicated and Non-Dedicated Vehicles

Dedicated vehicles were assumed to be fueled exclusively by alternate fuels; therefore, no adjustment was necessary. However, non-dedicated AFVs may consume both alternate and traditional fuels. Flexible-fuel vehicles using ethanol, for example, do not necessarily consume 85-percent ethanol and 15-percent gasoline at all times. To obtain the net amount of alternative fuel used by vehicles with non-dedicated engines, their VMT values were multiplied by the percentage of mileage each vehicle type is thought to use the alternate fuel.

5. Estimating Fuel Consumption

The net adjusted annual VMT (from step 4) was divided by miles per gallon to determine alternate transportation fuel consumption in gasoline-equivalent-gallons.

6. Conversion to Alternate Transportation Fuel Consumption in Native Units

Fuel consumption in gasoline-equivalent gallons was converted to native units (gallons for propane (LPG) LNG, and E85, therms for CNG, and KWH for electricity.) A conversion factor for each fuel was computed by dividing the higher heating value (HHV) of gasoline by the higher heating value of the alternative fuel. For several AFV types, the conversion factors were adjusted because the effective total fuel cycle of ATF consumption per mile of travel is higher than commonly thought. Consumption of ATFs is almost always estimated by assuming that Btu-equivalent amounts of ATF and traditional fuel produce the same VMT. This assumption is not strictly accurate because of venting of fuel vapor during

refueling and maintenance, leakage of gaseous fuels from fuel lines and storage cylinders, engine efficiency differences, and vehicle weight differences. Although natural gas utilities, transit bus facilities, fleet owners, and related industry members are not generally able to isolate and quantify these factors, the net effect is lower miles per Btu for most AFVs than for conventional vehicles. The adjusted conversion factors were then multiplied by the alternative fuel consumption value (from step 5) to determine alternative fuel consumption in terms of native units.

Estimating 2004 and 2005 Alternative Fueled Vehicles In Use

Once 2003 estimates of AFVs were developed, these were updated with 2004 EIA-886 data for both total vehicles supplied during 2004 and vehicles in use for the surveyed user groups, as well as an estimate of vehicles retired during 2004. Creating 2005 estimates of AFVs in use followed a similar process as used for 2004, except that for 2005 estimates, issues regarding the classification of vehicles (see below) were largely resolved by recontacting form EIA-886 respondents.

Revised Data Tables-Structure and Content

The new data tables for estimates of AFVs in use and alternate transportation fuel consumption were designed to achieve two objectives:

1. Provide additional detail about AFVs in use; and
2. Increase the understanding of the table contents

Providing Additional Detailed Data

The new data tables for estimates of AFVs in use and alternate transportation fuel consumption were designed to achieve two objectives:

1. AFVs in use by fuel type and detailed vehicle type (e.g., compact automobile) (Table V6)
2. AFVs in use by fuel type, major vehicle type, and engine configuration (i.e., dedicated or nondedicated) (Table V7)
3. A summary table by user group of AFVs in use (Table V8)
4. AFVs in use by fuel type and user group (Table V9)
5. For each fuel type, AFVs in use by User Group and State (Tables V10-V15)

Tables showing many of the above categorizations were published previously, but only with form EIA-886 data (see following section). Note that the current data tables no longer show estimates at the Census 4-region level.

Regarding alternate transportation fuel consumption data, information was previously published only at the U.S. total level by fuel type, as well as by weight category and Census region. Now, consumption data is available for every categorization for which AFVs in use is shown.

Increasing the Understanding of Alternative Fuels Data Tables

Since the inception of EIA's alternate fuels survey in 1995, EIA has presented

separate data tables for: a. estimates of the total population of AFVs and total ATF consumption; and b. data collected about AFVs in use from Form EIA-886. This was done to ensure that users did not confuse reported EIA-886 survey data, which is gathered from only a portion of the total U.S. fleet population (excluding privately owned vehicles), with information originally developed apart from the survey data via a model designed to estimate the number of AFVs in use by all fleets.¹⁰

However, this division of data presentation appeared to create ambiguities as to the content of each set. Furthermore, as time passed, the process of estimating the use of AFVs in all U.S. fleets changed because instead of relying on historical externally derived estimates of AFVs in use in a base year, plus other assumptions, EIA by 2005 had 10 years of information on all AFVs supplied and 7 years of information on AFVs in use by Federal¹¹ and State governments, alternate fuel providers,¹² and transit companies. As a result, EIA over the years had modified the data used to

model total AFVs in use by relying increasingly on form EIA-886 data, thus further blurring the distinction between

published "estimates" of AFVs and published "data." Making the situation even more complicated was the fact that the original model used to estimate total AFVs in use used a rather different set of fleet and vehicle categories from those reported on Form EIA-886.

As a result, EIA decided to revise its data presentation when it revised its methodology and automated the process. Data tables now reflect a totally integrated picture of AFVs in use, beginning with the total U.S. picture and then decomposing the total into various parts. Footnotes on each table describe which parts of the table are derived from the survey data and which are estimated.

1 Companies that supply AFVs include both those that are original equipment manufacturers and those that convert vehicles that operate on conventional fuels to operate on an alternate fuel.

2 In 1994, EIA estimated that in Atlanta, GA alone there were 4,000 fleets having 10 or more vehicles.

3 Frequently, suppliers sell vehicles to leasing companies, who in turn send them to dealers or end users.

4 Estimates of vehicles retired are developed for each year of AFVs that have been reported supplied on Form EIA-886.

5 For most vehicle types, AFV retirements are estimated according to the same schedule as their non-AFV counterparts. For example, a CNG automobile is assumed to have the same life as a gasoline-powered auto. For a

limited number of vehicle types, sufficient alternative information was available to permit EIA to override the conventional-equivalent vehicle retirement schedule. Information on default retirement rates was obtained from prior editions of the Transportation Energy Data Book, Tables 3.8, 3.9, and 3.10, published by the Oak Ridge National Laboratory. See <http://cta.ornl.gov/data/index.shtml>.

6 The VIUS survey defines a "truck" as including vans, pick-ups, sport utility vehicles (SUVs), and larger trucks. However, VIUS separately estimates "light-duty" trucks (vans, pick-ups, and SUVs) and other medium- and heavy-duty trucks. EIA also used the results of the 2002 VIUS survey to further adjust the "inventory" of pre-1995 propane (LPG) trucks in use, resulting in a lower number.

7 In the 1990's, a few heavy-duty E95 vehicles were built that were dedicated ethanol vehicles. None have been built since, and the number of these believed to still exist is so few that EIA no longer tracks them.

8 A complete listing of all characteristic descriptions is provided at the end of this document.

9 Baseline information on MPG was obtained from prior editions of the Transportation Energy Data Book, published by the Oak Ridge National Laboratory. See <http://cta.ornl.gov/data/index.shtml>.

10 Form EIA-886, "Annual Survey of Alternative Fueled Vehicle Suppliers and Users".

11 Data on Federal AFVs in use is obtained from the Federal Automotive Statistical Tool (FAST), operated jointly by the General Services Administration and the Department of Energy.

12 Alternate fuel providers, as defined by the Energy Policy Act of 1992, are electricity providers, natural gas providers, and propane (LPG) providers.