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Fact: Energy in a gallon of ethanol = 76,000 Btu (LHV)

Source: DOE Household Vehicles Energy Use: Latest Data & Trends, Appendix C. (Google search this title if you want the complete document.)

Notes: See p. 159 (pdf p.3) below. LHV means "Low Heating Value." Ethanol's LHV should be compared with the LHV of gasoline. Low heading values are based on the assumption that the energy in the exhaust water vapor cannot be used. This is true for cars. (For home heating the heat in the water vapor can be captured and used, so HHV is appropriate.)

APPENDIX C

QUALITY OF THE DATA

INTRODUCTION

This section discusses several issues relating to the quality of the National Household Travel Survey (NHTS) data and to the interpretation of conclusions based on these data. In particular, the focus of our discussion is on the quality of specific data items, such as the fuel economy and fuel type, that were imputed to the NHTS via a cold-decking imputation procedure. This imputation procedure used vehicle-level information from the NHTSA Corporate Average Fuel Economy files for model year's 1978 through 2001. It is nearly impossible to quantify directly the quality of this imputation procedure because NHTS does not collect the necessary fuel economy information for comparison. At best, we have indirect evidence on the quality of our imputations, which is addressed in the following sections. Indeed, such an imputation procedure could be vastly improved with the collection of Vehicle Identification Number (VIN), fuel type and retail fuel price for each sample vehicle. However, those collections may represent an unreasonable burden on NHTS respondents.

The quality of the data collection and the processing of the data affect the accuracy of estimates based on survey data. All the statistics published in this appendix, such as total vehicle-miles traveled (VMT), are estimates of population values. These estimates are based on observations from a randomly chosen subset of the entire population of occupied housing units. Consequently, the estimates always differ from the true population values. Because the NHTS is a sample survey, data from the survey are subject to various sources of nonsampling and sampling error.

Nonsampling error is a measure of variability due to the execution and processing of the survey. These errors can include: population undercoverage during sampling; questionnaire wording and format; response bias and variance; interviewer error; coding and/or keypunching error; and nonresponse bias. Nonsampling errors are treated in several sections of this appendix. The main section pertains to the imputation procedures used for "missing" fuel economy, fuel type, and fuel economy adjustments. In the previous sections, fuel economy adjustments were addressed. This section deals mainly with imputing fuel economy or $MPG_{i(EPA\ 55/45)}$ to each appropriate sample vehicle.

NONSAMPLING ERROR

Nonsampling errors are due to the conduct of the survey, and include both random errors and systematic errors or biases. The magnitudes of nonsampling biases cannot be estimated from the sample data. Thus, avoidance of systematic biases is a primary objective of all stages of survey design. Subsequent to conducting a survey, problems of unit nonresponse and item nonresponse need to be addressed.

VEHICLE FUEL PRICE AND EXPENDITURES

In the 2001 NHTS, fuel price data were not collected via fuel purchase diaries, compared to previous EIA studies (e.g., RTECS). Instead, fuel prices were determined from EIA price series. Unfortunately, there is no way to validate the price methodology used to assign a monthly price paid for transportation fuel because EIA lacks the necessary fuel purchase diaries from NHTS repondents.

The Bureau of Labor Statistics (BLS) *Retail Pump Average Gasoline Prices* and the Lundberg Survey, Inc. offer alternate price series. However, there was a general consistency with using a price series from one statistical agency.

GASOLINE EQUIVALENT GALLON

The following table provides the gasoline equivalent gallon conversion used in this appendix. All conversion values, to the extent possible, have been made to mirror the conversion values used in deriving equivalent-gallon fuel economy estimates found in the NHTSA CAFE files.

Table C3. Gasoline Equivalent Gallon Conversion Values

Transportation Fuel	Gasoline Equivalent Gallon
Diesel	1 diesel gallon = 1 gasoline equivalent gallon
Electricity	33,705 Watt-hours = 1 gasoline equivalent gallon
Compressed Natural Gas	121.5 cubic feet = 1 gasoline equivalent gallon

Sources: 40 CFR Parts 80, 85, 86, 88, and 600 and 10 CFR Part 474.

GREET MODEL

Of course, there are other conversion factors available, depending on the various fuel-specific factors. For the Greenhouse Gases, Regulated Emissions, and Energy Use in Transportation (GREET) model, the U.S. Department of Energy, Argonne National Laboratory uses the following:

Table C4. Lower and Higher Heating Values for Select Transportation Fuels Based on the GREET Model

Transportation Fuel	LHV (net) Btu per gallon	HHV (gross) Btu per gallon	Density Grams per gallon	Carbon Content (% by wt)	Sulfur Content (ppm by wt)
Conv.Gasoline	115,500	125,000	2,791	85.5%	200
Ref. Gasoline	112,265	121,456	2,795	82.9%	30
Diesel	128,500	138,700	3,240	87.0%	250
Methanol	57,000	65,000	2,996	37.5%	0
Ethanol	76,000	84,500	2,996	52.2%	0
LPG	84,000	91,300	2,000	82.0%	0
Natural gas	928	1,031	21	74.0%	7