ENERGY INFORMATION ADMINISTRATION (EIA)

DOE/EIA-0464(2005)
NOVERMBER 2005

HOUSEHOLD VEHICLES ENERGY USE: LATEST DATA & TRENDS

BASED ON AUGMENTATIONS OF THE JANUARY 2004 RELEASE OF THE 2001 NATIONAL HOUSEHOLD TRAVEL SURVEY CONDUCTED BY THE U.S. DEPARTMENT OF TRANSPORTATION AND OTHER RELEVANT EIA DATA

ENERGY INFORMATION ADMINISTRATION
OFFICE OF ENERGY MARKETS AND END USE
U.S. DEPARTMENT OF ENERGY
WASHINGTON, DC 20585

THIS PUBLICATION IS AVAILABLE ON THE WEB AT:
WWW.EIA.DOE.GOV/EMEU/RTECS/NHTS_SURVEY/2001/INDEX.HTML

ENERGY INFORMATION ADMINISTRATION

CONTACTS AND ACKNOWLEDGEMENTS

This report was prepared by the Energy Information Administration (EIA) under the general direction of Margot Anderson, Director of the Office of the Energy Markets and End Use (202.586.2589). Dwight K. French, Director of the Energy Consumption Division (ECD) (202.586.1126) and Mark A. Schipper, Program Manager (202.586.1136), directed this project. Specific technical information may be obtained from Derrick S. Pinckney (202.586.5744), Survey Statistician for transportation programs.

EIA expresses its gratitude for the data support received from the National Highway Traffic Safety Administration's Corporate Average Fuel Economy (CAFE) program for critical data components of this project, without such assistance and participation none of this effort would have been possible.

Contacts for detailed technical questions on energy consumption and consumer topics may be found on http://www.eia.doe.gov/contacts/multifc.htm. For information on the National Household Travel Survey and its sampling and estimation methods, please contact Susan Liss of the Federal Highway Administration on 202.366.5060 or Patricia Hu, Director of the Center for Transportation Analysis of Oak Ridge National Laboratory of Center for Transportation Analysis, Oak Ridge National Laboratory, on 865.946.1349.

This report, Household Vehicles Energy Use: Latest Data & Trends, provides details on the nation's energy use for household passenger travel. A primary purpose of this report is to release the latest consumer-based data on household vehicles and expenditures, derived from the U.S. Department of Transportation's 2001 National Household Travel Survey (NHTS) and independent estimates of vehicle miles per gallon and fuel prices at that time.

This report also draws on data programs made available to the EIA from other Federal agencies, EIA's past Residential Transportation Energy Consumption Surveys (RTECS) and other EIA data sources and projections to assess household transport energy use from 1983 to the present time and into the near future. The data and analysis in this report center on several important intensities of use of household energy use for travel: number and type of vehicles per household; annual miles per household and per vehicle; gallons of fuel consumed and type of fuel used; prices paid for fuel and total expenditures; and fuel economy.

Only light-duty vehicles and recreational vehicles are included in this report. EIA has excluded motorcycles, mopeds, large trucks, and buses in an effort to maintain consistency with its past residential transportation series, which was discontinued after 1994.

CONTENTS

TABLE TITLES

DETAILED TABLE TITLES [U.S. EQUIVALENTS]

DETAILED TABLE TITLE [INTERNATIONAL SYSTEM OF UNITS (SI)]

FIGURES

This page left blank.

EXECUTIVE SUMMARY

This page left blank.

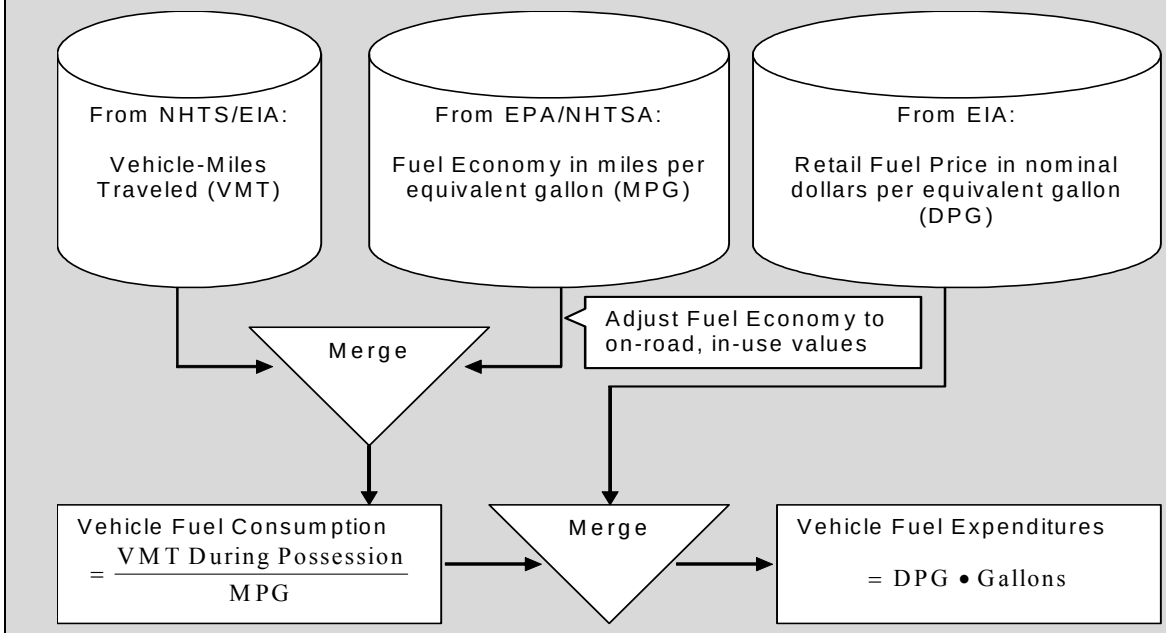
EXECUTIVE SUMMARY

INTRODUCTION

This report, *Household Vehicles Energy Use: Latest Data & Trends*, provides details on the nation's energy use for household passenger travel. A primary purpose of this report is to release the latest consumer-based data on household vehicles and expenditures, derived from the U.S. Department of Transportation's 2001 National Household Travel Survey (NHTS) and independent estimates of vehicle miles per gallon and fuel prices at that time (see Figure ES1).

This report also draws on data programs made available to the Energy Information Administration (EIA) from other Federal agencies, the five past Residential Transportation Energy Consumption Surveys[1] (RTECS) conducted by EIA and other EIA data sources and projections to assess household transport energy use from 1983 to the present time and into the near future. The data and analysis in this report center on several important intensities of use for travel: number and type of vehicles per household; annual miles per household and per vehicle; gallons of fuel consumed and type of fuel used; prices paid for fuel and total expenditures; and fuel economy.

Figure ES1. Schema for Estimating Energy and Energy-Related Statistics, 2001



Sources: NHTS – National Household Travel Survey, EPA – Environmental Protection Agency, EIA – Energy Information Administration, and NHTSA – National Highway Traffic Safety Administration.

[1] The RTECS was conducted on a multi-year basis: 1983, 1985, 1988, 1991, and 1994, after which it was discontinued by EIA.

HIGHLIGHTS

1. The energy consumed by light-duty vehicles focuses attention on the volatility of crude oil prices and the prospects for reducing reliance on oil imports, as well as the potential environmental impacts.

In 2001, the United States consumed 113.1 billion gasoline-equivalent gallons (GEG) to fuel passenger travel by light-duty vehicles, a rise of 3.3 percent per year from 1994, when 90.6 billion was consumed. That fuel consumption by light-duty vehicles, stored in a tank the size of a regulation football field, would require the tank to have walls nearly 50 miles high.[2] The *entire* transport sector is not only the second largest consumer of energy, but it also has recently become the largest contributor to the nation's greenhouse gas emissions of carbon dioxide, topping industrial emissions in 1999, primarily due to transport's heavy reliance on petroleum products, such as motor gasoline.[3]

The nation currently cannot provide for all its petroleum demand with domestically produced crude oil. The decline in domestic oil production, coupled with a rise in oil consumption, resulted in net imports of crude oil and petroleum products surpassing 11.8 million barrels per day in 2004, with imports reaching an all-time high of just over 12.9 million barrels per day, of which over 40 percent had originated at countries belonging to the Organization of Petroleum Exporting Countries (OPEC). Furthermore, motor gasoline accounted for nearly one-half (8.9 million barrels per day) of the 20 million barrels per day of petroleum products consumed domestically in 2004, with 13.6 million barrels per day of that total identified as transport sector use.

2. Costlier energy, in part, powers consumers' expenditures to higher levels, as they paid nearly equal amounts for household services and for their transport energy needs.

For consumers, energy costs are a foremost concern. Transportation costs have increased due to many factors related to travel and prices paid for transportation fuel, while being somewhat offset by improved fuel economy. In 2001, consumers paid nearly equal amounts for energy used for household services (ranging from cooking and water heating to refrigeration and lighting) and for personal transport. The average household spent $1,520 for transport and remitted $1,493 for household services, just $27 more per year, as measured in nominal dollars.

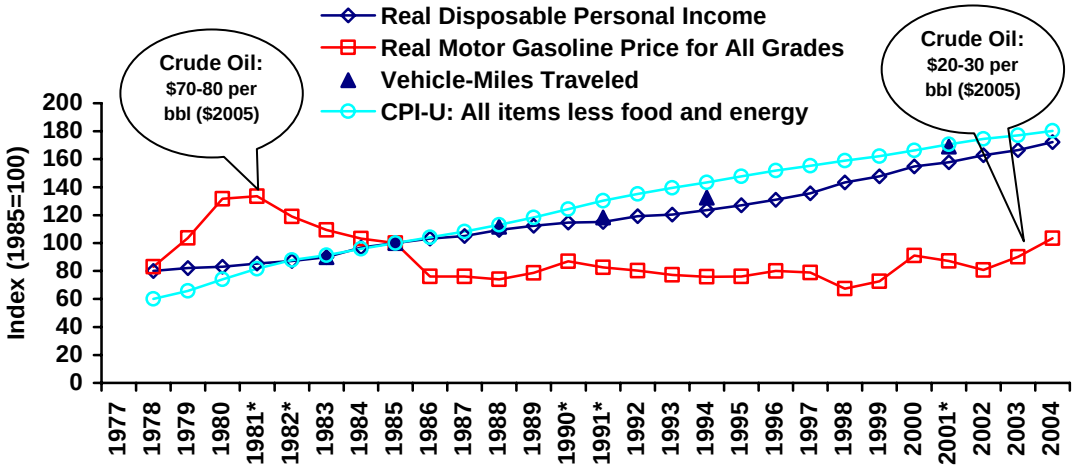
By contrast, an average household paid $1,174 for passenger travel in 1994, while having paid $1,620 for household services in 1993 – a year in which heating and cooling seasons were

[2] A ft^3 equals 7.48 gallons. See www.ncaa.org/champadmin/football/football_field.gif for field dimensions.

[3] Burning a gallon of gasoline releases 8.9 kilograms (373.8 kg per bbl) of carbon dioxide into the atmosphere. See *National Research Council*, Effectiveness and Impact of Corporate Average Fuel Economy (CAFE) Standards (Washington, D.C.: National Academy of Sciences, 2002), p. 85.

well within 30-year norms. It can be argued that, based on those statistics, what America drives on its roadways[4] has become as important energy-wise as what heating equipment it places in its basements and appliances in its electrical sockets.

Figure ES2. Annual Indices of Real Disposable Income, Vehicle-Miles Traveled, Consumer Price Index (CPI-U), and Real Average Retail Gasoline Price, 1978-2004, 1985=100



*Sources: Energy Information Administration, Annual Energy Review 2004; Bureau of Economic Analysis; Note * = recession year.*

While the real retail price of gasoline has risen and fallen over the past two decades, there has been an overall decline of 1.3 percent per year between 1983 and 2001, with substantial drops in 1986 and 1998 and somewhat smaller ones in 1991 and 2001 (see Figure E1 for a Chronology of World Oil Prices, as this price explains most of the variations found in refined gasoline prices). In contrast, the prices of other consumer products[5] have risen dramatically, taking a higher real percentage of consumers' budgets. Given the minor role fuel prices have played in determining vehicle use, there is little surprise that vehicle-miles traveled is better correlated with disposable income than retail prices; furthermore, the improvement in energy intensity, though unexceptional, might have further weakened a diminished price signal by mitigating the effect of fuel prices, where consumers could travel further on a single dollar of transportation fuel. Given that retail price is primarily based on the price paid for crude oil, price signals to consumers should mimic world crude oil prices, which have exceeded $50 per barrel (bbl) – at times surpassing $60 per bbl.[6]

[4] 8.3 million lane-miles. See *Federal Highway Administration*, Highway Statistics 2003 (U.S. Department of Transportation, Washington, DC) table HM-60.

[5] See components of the Consumer Price Index conducted by the U.S. Bureau of Labor Statistics.

[6] See *Federal Trade Commission*, Gasoline Price Changes: the Dynamic of Supply, Demand, and Competition, July 5, 2005, Washington, DC. Accessed http://www.ftc.gov/opa/2005/07/gaspricefactor.htm on July 25, 2005.

3. Vehicle fuel expenditures are expected to rise in the near term, all else being equal.

Based on expected future energy prices which partially reflect producers' acquisition costs, the gap between transport cost and household services cost may expand. Between 2001 and 2006, expenditures for motor gasoline are expected to increase from $1,370 per household per year to $2,327 in 2006, up nearly $960 per household. For comparison, in 2001, gasoline prices averaged $1.43 per gallon; in 2006, gasoline prices are expected to average $2.43 per gallon (a 71-percent increase in nominal terms and 52-percent increase when adjusted by inflation)[7]

4. Households, on average, have increased their mobility.

In 2001 there were 107.4 million households in the United States, of which nearly 98.9 million (92 percent) actually owned or possessed one or more vehicles, an increase of 1.8 percent per year from 1983, when 86 percent, or 72.2 million out of 84.4 million households, had possessed one or more vehicles. The increasing number of households and a greater fraction of those possessing a vehicle, all else been equal, should result in increased energy needs for the nation.

Since 1983, with some minor deviations, the growth in vehicle-miles traveled has mirrored the increases in real disposable income. For instance, between 1983 and 1985, when annual real gasoline prices dropped 4.4 percent per year, the annual growth of vehicle-miles traveled (i.e., overall travel) and disposable income rose 5.4 and 5.5 percent, respectively. Despite some inconsistencies when travel activity grew faster than disposable income, their overall growth between 1983 and 2001 is in near lock-step formation, with real disposable income registering a rise of 3.2 percent per year and travel activity growing at an annual rate of 3.6 percent.

5. Based on new vehicle sales figures, consumers' preferences for sports-utility vehicles is unmistakable, although cars still rank as the single largest segment of the nation's vehicle stock – accounting for nearly 6 out of every 10 vehicles on American roadways.

Even though sports-utility vehicles (SUVs) are increasingly popular among Americans, passenger cars still rank as their overall vehicle of choice, as they make up the majority of vehicles on America's roadways. Cars, including station wagons, represented just over 50 percent

[7] Energy Information Administration, Short-Term Energy Outlook. Accessed http://www.eia.doe.gov/emeu/steo/pub/contents.html on November 14, 2005.

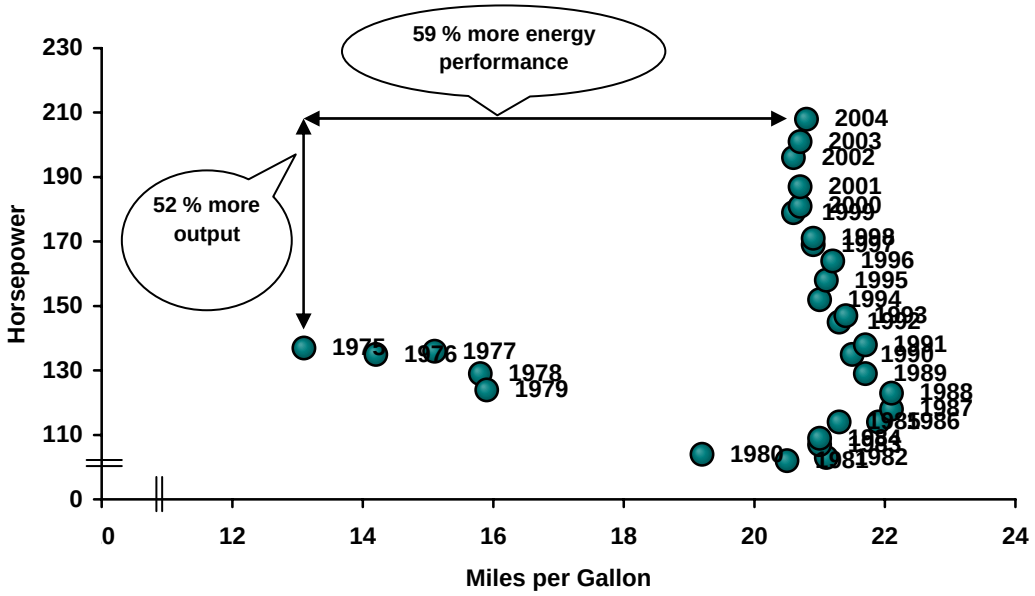
of the new vehicle purchases in 2001, as reported by the EPA, though in each of the subsequent years they have lost market share to SUVs. As of 2001, a recession year, the distribution of sales and scrappage rates had resulted in a household vehicle fleet of 191.0 million vehicles: 112.4 million (58 percent) passenger cars, 18.4 million (10 percent) vans, 23.2 million (12 percent) SUVs, 35.6 million (19 percent) pickups, and 1.4 million (1 percent) recreational vehicles.

6. The vehicles desired by consumers over the past 15 or 20 years have led to heavier, more powerful, and faster vehicles, equipped with increasingly powerful engines, generally exhibiting unexceptional improvements in energy performance (defined as gallons of fuel needed to travel one thousand miles or liters to travel 100 kilometers).

Tracking an economy's energy intensity – one measure of energy performance – as the ratio of energy per Gross Domestic Product (GDP) or the environmentally analogous intensity of carbon dioxide emitted per GDP[8] is common in energy economics, and such a technique can be applied to transport. Instead of a ratio of economy-wide energy use per GDP, a ratio of gasoline-equivalent gallons (GEG) per vehicle-miles traveled for the *entire* vehicle stock is calculated. That overall intensity of energy use has steadily improved since 1983, though the greatest strides in lowering (improving) energy intensity had occurred before 1991. Post-1991 intensity improvements (i.e., *energy performance*) slowed dramatically, yielding an overall annual improvement of 1.6 percent between 1983 and 2001, as compared to the 3.2 and 4.2 percent gains seen in the 1983-1985 and 1985-1988 time periods, respectively. Figures ES3 and ES4 provide evidence of the lopsided improvement in the nation's energy performance. Moreover, this report also decomposes the change in energy use over time.

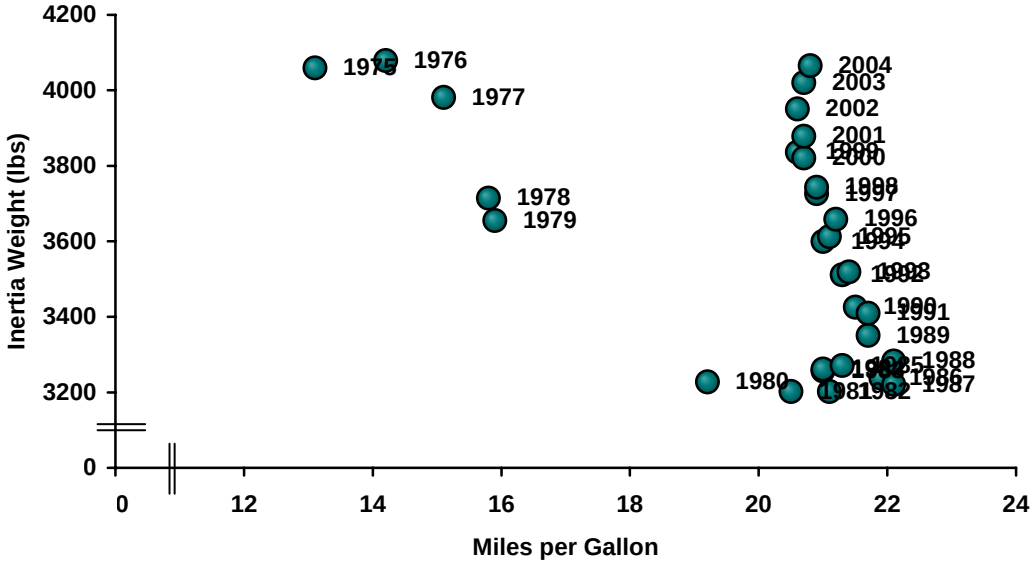
[8] Emissions from petroleum-powered vehicles are directly proportional to energy use.

Figure ES3. Sales-Weighted Horsepower and On-Road Fuel Economy for New Light-Duty Vehicles, 1975-2004 Model Years



Source: Environmental Protection Agency, Fuel Economy Trends 2004.

Figure ES4. Sales-Weighted Inertia Weight and On-Road Fuel Economy for New Light-Duty Vehicles, 1975-2004 Model Years

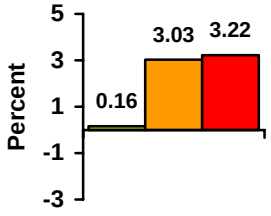


Source: Environmental Protection Agency, Fuel Economy Trends 2004.

DECOMPOSING ENERGY USE

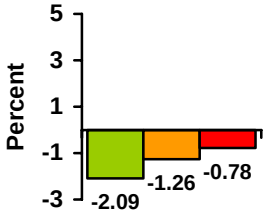
7. Over time, fuel economy's influence on driving down energy use has lessened. Decomposing the change in energy use reveals such influences that fueled the growth in energy use, as well as deflated it, shedding light on the nation's continuing economic exposure to oil.

Figure ES5. Actual Annual Energy Growth – All Effects Are Included



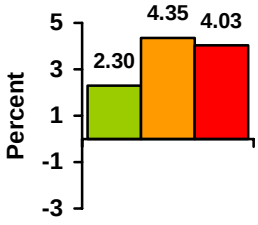
Source: Energy Information Administration.

Figure ES6. Fuel Economy Effects on Annual Energy Growth



Source: Energy Information Administration.

Figure ES7. Adjusted Annual Energy Growth – No Fuel Economy Effects



Source: Energy Information Administration.

1988-1991 | 1991-1994 | 1994-2001

Consumers' energy needs for travel using personally owned vehicles (POV) grew unevenly between 1988 and 2001, averaging 2.46 percent per year. Measuring…

the effect on the change in energy use from improving technologies shows that Fuel Economy effects had dampened energy use, but those effects have sharply diminished over time, suggesting significant savings occurred prior to 1991 and much less so in following years. By excluding the effects of technology advancements affecting fuel economy…

energy use would have surged to even higher levels, climbing higher than the actual amounts because of those exclusions – 2.30 percent per year versus 0.16 percent between 1988 and 1991; 4.35 percent versus 3.03 percent between 1991 and 1994; 4.03 percent versus 3.22 percent between 1994 and 2001, resulting in billions of gallons of energy "savings" and decreasing, though at a declining rate, the nation's exposure to oil.

In addition to Fuel Economy Effects, there are numerous other factors affecting the change in energy use – though not always as an offset. Decomposition is a means of analyzing an overall change over time. The key is identifying intermediate predictors that are measurable and dimensionally intertwined with each other in measurable ratios such that an overall ratio can be "decomposed" into the product of two or more "effects," effectively linking them together. One then can conclude that the components represent the contributions of the change in each of the effects represented by the component ratios to the overall change.