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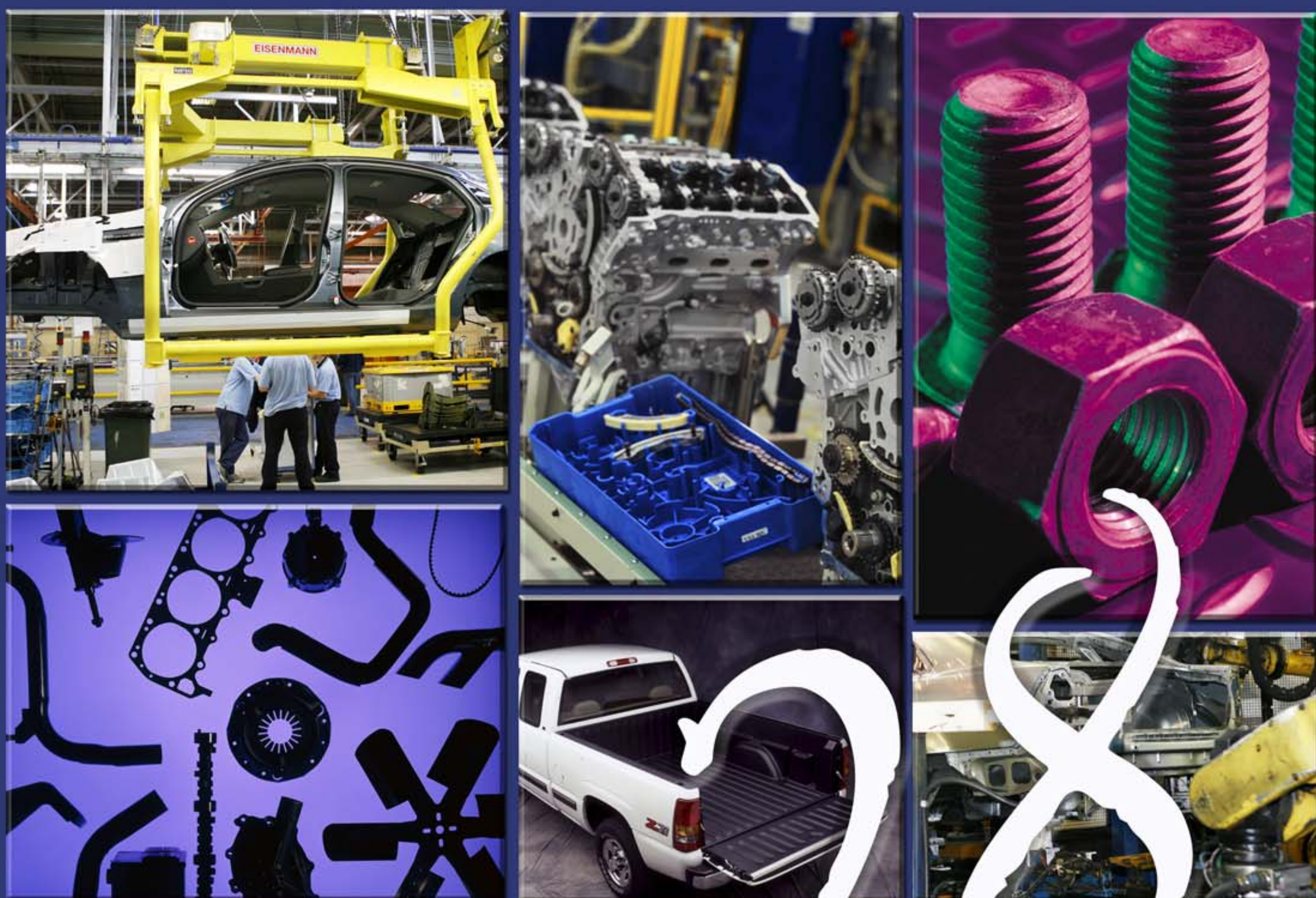
Transportation Energy Data Book

Stacy C. Davis • Susan W. Diegel • Robert G. Boundy



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FOREWORD

Welcome to this 28th edition of the Transportation Energy Data Book. Over two-thirds of these editions have been produced by Stacy Davis. DOE is grateful for her dedication and the skill she has brought to this effort.

We would like to bring to your attention some of the data that is new in this edition:

Figure 2.2: Light Rail Transit Energy Intensity. These data show the large variation in light rail energy intensity across metropolitan areas in the U.S.

Table 3.10: Car and Light Truck Survivability Rates and Lifetime Miles. A new source for these data is now being used. The light truck lifetime miles is 174,954, which is 27,817 more miles than for cars.

Table 5.10: Effect of Terrain on Class 8 Truck Fuel Economy. These data show the affect of slope and of single wide tires on fuel economy.

Table 8.11: Share of Vehicles by Annual Miles of Travel and Vehicle Age. These data show the annual travel for vehicles as a function of age. For example, only 3% of new vehicles travel less than 1,000 miles per year, whereas, 7% of 10-year old vehicles and 47% of vehicles over 20 years old travel less than 1,000 miles per year.

Table 10.11: Average Price of a New Car, 1906-2007. A number of sources were used to develop these estimates of new car prices back to 1906. These data show that in 2007 constant dollars, a new car in 1906 had a cost that was $13,106 greater than the cost of a new car in 2007. The real cost of a 2007 new car was $453 less than a new car in 1986.

Table 11.7: Transportation Greenhouse Gas Emissions by Mode, 1990 and 2007. Heavy trucks had the biggest percent increases in CO2 between 1990 and 2007.

Table 11.11: Carbon Dioxide Emissions from a Gallon of Fuel.

We hope you find value in this data book. We welcome suggestions on how to improve it.

Philip D. Patterson

ACKNOWLEDGMENTS

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ABSTRACT

The *Transportation Energy Data Book: Edition 28* is a statistical compendium prepared and published by Oak Ridge National Laboratory (ORNL) under contract with the U.S. Department of Energy, Office of Energy Efficiency and Renewable Energy, Vehicle Technologies Program and the Hydrogen, Fuel Cells, and Infrastructure Technologies Program. Designed for use as a desk-top reference, the Data Book represents an assembly and display of statistics and information that characterize transportation activity, and presents data on other factors that influence transportation energy use. The purpose of this document is to present relevant statistical data in the form of tables and graphs. The latest edition of the Data Book is available to a larger audience via the Internet (cta.ornl.gov/data).

This edition of the Data Book has 12 chapters which focus on various aspects of the transportation industry. Chapter 1 focuses on petroleum; Chapter 2 – energy; Chapter 3 – highway vehicles; Chapter 4 – light vehicles; Chapter 5 – heavy vehicles; Chapter 6 – alternative fuel vehicles; Chapter 7 – fleet vehicles; Chapter 8 – household vehicles; Chapter 9 – nonhighway modes; Chapter 10 – transportation and the economy; Chapter 11 – greenhouse gas emissions; and Chapter 12 – criteria pollutant emissions. The sources used represent the latest available data. There are also three appendices which include detailed source information for some tables, measures of conversion, and the definition of Census divisions and regions. A glossary of terms and a title index are also included for the reader's convenience.

INTRODUCTION

In January 1976, the Transportation Energy Conservation (TEC) Division of the Energy Research and Development Administration contracted with Oak Ridge National Laboratory (ORNL) to prepare a Transportation Energy Conservation Data Book to be used by TEC staff in their evaluation of current and proposed conservation strategies. The major purposes of the Data Book were to draw together, under one cover, transportation data from diverse sources, to resolve data conflicts and inconsistencies, and to produce a comprehensive document. The first edition of the TEC Data Book was published in October 1976. With the passage of the Department of Energy (DOE) Organization Act, the work being conducted by the former Transportation Energy Conservation Division fell under the purview of the DOE's Office of Transportation Programs.

Policymakers and analysts need to be well-informed about activity in the transportation sector. The organization and scope of the data book reflect the need for different kinds of information. For this reason, Edition 28 updates much of the same type of data that is found in previous editions.

In any attempt to compile a comprehensive set of statistics on transportation activity, numerous instances of inadequacies and inaccuracies in the basic data are encountered. Where such problems occur, estimates are developed by ORNL. To minimize the misuse of these statistics, an appendix (Appendix A) is included to document the estimation procedures. The attempt is to provide sufficient information for the conscientious user to evaluate the estimates and to form their own opinions as to their utility. Clearly, the accuracy of the estimates cannot exceed the accuracy of the primary data, an accuracy which in most instances is unknown. In cases where data accuracy is known or substantial errors are strongly suspected in the data, the reader is alerted. In all cases it should be recognized that the estimates are not precise.

The majority of the statistics contained in the data book are taken directly from published sources, although these data may be reformatted for presentation by ORNL. Consequently, neither ORNL nor DOE endorses the validity of these data.

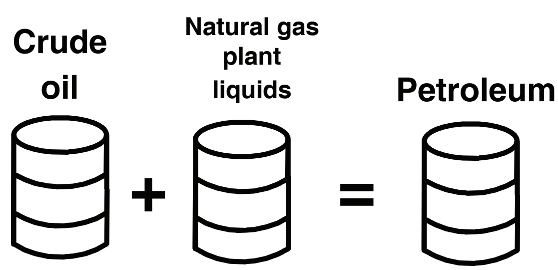
Currently, the Vehicle Technologies Program and the Hydrogen, Fuel Cells, and Infrastructure Technologies Program in the Office of Energy Efficiency and Renewable Energy, support the Data Book production.

Chapter 1
Petroleum

Summary Statistics from Tables/Figures in this Chapter

Source			
Table 1.3	World Petroleum Production, 2008 (million barrels per day)		81.73
	U.S. Production (million barrels per day)		*6.74*
	U.S. Share		*8.2%*
Table 1.4	World Petroleum Consumption, 2007 (million barrels per day)		85.90
	U.S. Consumption (million barrels per day)		*19.44*
	U.S. Share		*24.1%*
Figure 1.5	Average refinery yield, 2007	OECD Europe	North America
	Gasoline	*20.3%*	*41.0%*
	Diesel oil	*37.2%*	*25.0%*
	Residual fuel	*15.6%*	*6.0%*
	Kerosene	*6.6%*	*8.0%*
	Other	*20.3%*	*20.0%*
Table 1.12	U.S. transportation petroleum use as a percent of U.S. petroleum production, 2008		198.0%
Table 1.12	Net imports as a percentage of U.S. petroleum consumption, 2008		56.9%
Table 1.13	Transportation share of U.S. petroleum consumption, 2007		68.3%
Table 1.16	Highway share of transportation petroleum consumption, 2007		83.9%
Table 1.16	Light vehicle share of transportation petroleum consumption, 2007		64.9%

In this document, petroleum is defined as crude oil (including lease condensate) and natural gas plant liquids.



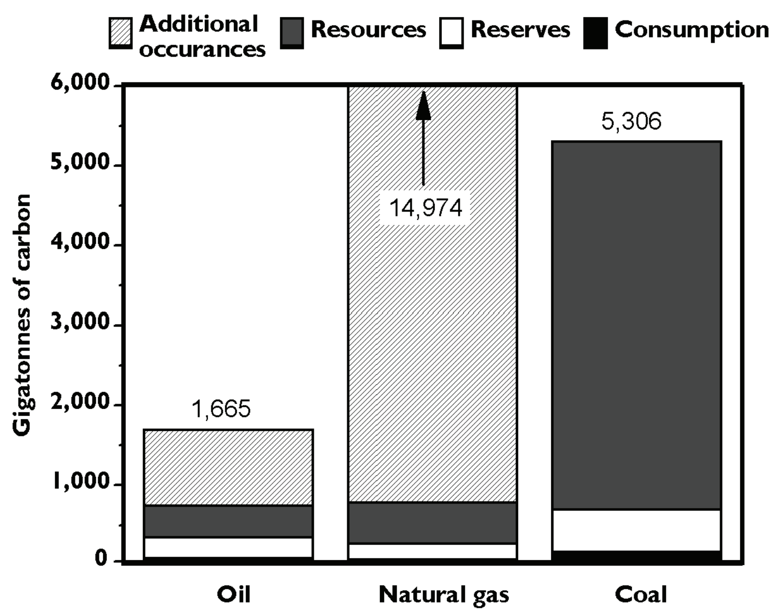
Although the world has consumed about 40% of estimated conventional oil resources, the total fossil fuel potential is huge. Methane hydrates–a potential source of natural gas–are included in the "additional occurrences" of unconventional natural gas, and constitute the largest resource.

Table 1.1
World Fossil Fuel Potential
(gigatonnes of carbon)

	Consumption (1860–1998)	Reserves	Resources	Additional occurrences
Oil				
Conventional	97	120	121	0
Unconventional	6	102	305	914
Natural Gas				
Conventional	36	83	170	0
Unconventional	1	144	364	14,176
Coal	155	533	4,618	[a]

Source:
Rogner, H.H., *World Energy Assessment: Energy and the Challenge of Sustainability, Part II*, Chapter 5, 2000, p. 149.

Figure 1.1. World Fossil Fuel Potential



Source:
See Table 1.1.

[a] Data are not available.

In 2008, the Organization of Petroleum Exporting Countries (OPEC) accounted for more than 45% of world oil production. Responding to low oil prices in early 2000, Mexico, Norway, Russia, and Oman joined OPEC in cutting production. This group of oil countries, referred to here as OPEC+, account for more than 65% of world oil production.

Table 1.2
World Crude Oil Production, 1960-2008[a]
(million barrels per day)

Year	United States	U.S. share	Total OPEC[b]	OPEC share	OPEC +[c]	OPEC +[c] share	Total non-OPEC	Persian Gulf nations[d]	Persian Gulf[d] share	World
1960	7.04	33.5%	8.70	41.4%	12.25	58.3%	12.29	5.27	25.1%	20.99
1965	7.80	25.7%	14.35	47.3%	19.83	65.4%	15.98	8.37	27.6%	30.33
1970	9.64	21.0%	23.30	50.8%	31.12	67.8%	22.59	13.39	29.2%	45.89
1975	8.38	15.9%	26.10	51.3%	37.86	71.4%	25.73	18.93	35.8%	52.83
1980	8.60	14.4%	26.96	45.3%	41.38	69.5%	32.60	17.96	30.2%	59.56
1985	8.97	16.6%	16.93	31.4%	32.54	60.3%	37.27	9.63	17.8%	53.97
1986	8.68	15.4%	18.28	32.5%	34.05	60.6%	37.95	11.70	20.8%	56.23
1987	8.35	14.7%	18.52	32.7%	34.72	61.3%	38.15	12.10	21.4%	56.67
1988	8.14	13.9%	20.32	34.6%	36.66	62.4%	38.42	13.46	22.9%	58.74
1989	7.61	12.7%	22.07	36.9%	38.50	64.3%	37.79	14.84	24.8%	59.86
1990	7.36	12.2%	23.96	39.6%	39.81	65.8%	36.64	15.28	25.3%	60.49
1991	7.42	12.3%	23.27	38.6%	38.53	64.0%	36.94	14.74	24.5%	60.21
1992	7.17	11.9%	24.40	40.5%	37.67	62.6%	35.81	15.97	26.5%	60.21
1993	6.85	11.4%	25.12	41.7%	37.65	62.5%	35.12	16.71	27.7%	60.24
1994	6.66	10.9%	25.51	41.8%	37.67	61.8%	35.48	16.96	27.8%	60.99
1995	6.56	10.5%	27.04	43.3%	39.27	63.0%	36.34	17.21	27.6%	62.39
1996	6.46	10.1%	27.57	43.2%	40.25	63.1%	36.19	17.37	27.2%	63.75
1997	6.45	9.8%	28.81	43.8%	41.80	63.6%	36.93	18.10	27.5%	65.74
1998	6.25	9.3%	29.89	44.6%	42.73	63.8%	37.08	19.34	28.9%	66.97
1999	5.88	8.9%	28.70	43.5%	41.61	63.1%	37.23	18.67	28.3%	65.92
2000	5.82	8.5%	30.41	44.4%	44.09	64.4%	38.09	19.89	29.0%	68.50
2001	5.80	8.5%	29.50	43.3%	43.69	64.1%	38.60	19.10	28.0%	68.10
2002	5.75	8.6%	27.64	41.2%	42.26	62.9%	39.92	17.79	26.5%	67.16
2003	5.68	8.2%	29.14	42.0%	44.50	64.1%	40.30	19.06	27.5%	69.43
2004	5.42	7.5%	31.50	43.5%	47.39	65.4%	40.99	20.79	28.7%	72.49
2005	5.18	7.0%	32.94	44.7%	48.78	66.2%	40.80	21.60	29.3%	73.74
2006	5.10	6.9%	32.61	44.4%	48.34	65.8%	40.85	21.23	28.9%	73.46
2007	5.06	6.9%	31.17	44.1%	47.67	65.3%	40.83	20.67	28.3%	73.01
2008	4.96	6.7%	33.44	45.3%	48.54	65.8%	40.36	21.87	29.6%	73.79
					Average annual percentage change					
1960–2008	-0.7%		2.8%		2.9%		2.5%	3.0%		2.7%
1980–2008	-1.9%		0.8%		0.6%		0.8%	0.7%		0.8%
1998–2008	-2.3%		1.1%		1.3%		0.9%	1.2%		1.0%

Source:

U.S. Department of Energy, Energy Information Administration, *Monthly Energy Review, March 2009,* Washington, DC, 2009, Table 11.1a and 11.1b. (Additional resources: www.eia.doe.gov)

[a] Includes lease condensate. Excludes natural gas plant liquids.
[b] See Glossary for membership.
[c] OPEC+ includes all OPEC nations plus Russia, Mexico, Norway and Oman.
[d] See Glossary for Persian Gulf Nations.

This table shows petroleum production, which includes both crude oil and natural gas plant liquids. The United States was responsible for 8.2% of the world's petroleum production in 2008, but only 6.7% of the world's crude oil production (Table 1.2).

Table 1.3
World Petroleum Production, 1973-2008[a]
(million barrels per day)

Year	United States	U.S. share	Total OPEC[b]	OPEC share	Total non-OPEC	Non-OPEC share	Persian Gulf nations[c]	Persian Gulf[c] share	World
1973	10.95	18.7%	31.33	53.6%	27.14	46.4%	20.86	35.7%	58.47
1974	10.44	17.8%	31.04	53.1%	27.47	46.9%	21.51	36.8%	58.51
1975	10.01	18.0%	27.47	49.4%	28.48	51.2%	19.18	34.5%	55.62
1976	9.74	16.2%	31.06	51.6%	29.14	48.4%	21.81	36.2%	60.21
1977	9.86	15.7%	31.75	50.6%	30.94	49.4%	22.06	35.2%	62.69
1978	10.27	16.2%	30.37	48.0%	32.87	52.0%	21.02	33.2%	63.24
1979	10.14	15.4%	31.58	47.9%	34.37	52.1%	21.52	32.6%	65.96
1980	10.17	16.1%	27.69	43.9%	35.70	56.6%	18.50	29.3%	63.03
1981	10.18	17.1%	23.65	39.6%	36.03	60.4%	15.84	26.5%	59.68
1982	10.20	17.9%	19.96	35.0%	37.13	65.0%	12.77	22.4%	57.09
1983	10.25	18.0%	18.69	32.9%	38.21	67.1%	11.63	20.4%	56.90
1984	10.51	18.0%	18.78	32.2%	39.60	68.8%	11.39	19.5%	58.38
1985	10.58	18.3%	17.59	30.4%	40.85	70.5%	10.28	17.7%	57.91
1986	10.23	16.9%	19.82	32.8%	41.14	68.2%	12.40	20.5%	60.36
1987	9.94	16.3%	20.06	32.9%	41.44	68.0%	12.82	21.0%	60.92
1988	9.77	15.5%	22.16	35.1%	41.83	66.2%	14.27	22.6%	63.18
1989	9.16	14.2%	24.00	37.3%	41.11	63.9%	15.69	24.4%	64.30
1990	8.91	13.7%	25.24	38.7%	40.73	62.5%	16.21	24.9%	65.13
1991	9.08	14.0%	25.38	39.0%	40.46	62.2%	15.67	24.1%	65.01
1992	8.87	13.7%	26.61	41.0%	39.29	60.5%	16.97	26.1%	64.96
1993	8.58	13.2%	27.41	42.0%	38.74	59.4%	17.76	27.2%	65.23
1994	8.39	12.6%	28.13	42.3%	39.22	58.9%	18.29	27.5%	66.57
1995	8.32	12.2%	28.81	42.3%	40.22	59.1%	18.57	27.3%	68.04
1996	8.30	11.9%	29.34	42.2%	41.25	59.3%	18.72	26.9%	69.53
1997	8.27	11.5%	30.67	42.8%	42.03	58.7%	19.52	27.2%	71.66
1998	8.01	11.0%	31.82	43.6%	42.32	58.0%	20.83	28.5%	73.03
1999	7.73	10.7%	30.69	42.5%	41.47	57.5%	20.16	27.9%	72.16
2000	7.79	10.4%	32.51	43.4%	42.45	56.6%	21.54	28.7%	74.96
2001	7.67	10.2%	31.81	42.5%	43.06	57.5%	20.82	27.8%	74.87
2002	7.63	10.3%	30.05	40.6%	43.99	59.4%	19.59	26.5%	74.04
2003	7.40	9.7%	31.69	41.4%	44.90	58.6%	21.04	27.5%	76.59
2004	7.23	9.0%	34.21	42.8%	45.68	57.2%	22.89	28.6%	79.89
2005	6.90	8.5%	35.88	44.1%	45.51	55.9%	23.78	29.2%	81.39
2006	6.84	8.4%	35.63	43.9%	45.62	56.1%	23.52	28.9%	81.26
2007	6.85	8.5%	35.27	43.6%	45.69	56.4%	22.99	28.4%	80.96
2008	6.74	8.2%	36.59	44.8%	45.14	55.2%	24.21	29.6%	81.73
					Average annual percentage change				
1973–2008	-1.4%		0.4%		1.5%		0.4%		1.0%
1998–2008	-1.7%		1.4%		0.6%		1.5%		1.1%

Source:
U.S. Department of Energy, Energy Information Administration, *International Petroleum Monthly*, March 2009, Tables 1.1c, 1.1d and 1.3. (Additional resources: www.eia.doe.gov)

[a] Includes natural gas plant liquids, crude oil and lease condensate. Does not account for all inputs or refinery processing gain.

[b] Organization of Petroleum Exporting Countries. See Glossary for membership.

[c] See Glossary for Persian Gulf Nations.

The United States has accounted for approximately one-quarter of the world's petroleum consumption for the last two decades.

Table 1.4
World Petroleum Consumption, 1960–2008
(million barrels per day)

Year	United States	U.S. share	Total OECD[a]	Total non-OECD	World
1960	9.80	45.9%	15.78	5.56	21.34
1965	11.51	37.0%	22.81	8.33	31.14
1970	14.70	31.4%	34.69	12.12	46.81
1975	16.32	29.0%	39.14	17.06	56.20
1976	17.46	29.3%	41.72	17.95	59.67
1977	18.43	29.8%	42.78	19.05	61.83
1978	18.85	29.4%	43.98	20.18	64.16
1979	18.51	28.4%	44.39	20.84	65.22
1980	17.06	27.0%	41.76	21.35	63.11
1981	16.06	26.4%	39.49	21.45	60.94
1982	15.30	25.7%	37.77	21.78	59.54
1983	15.23	25.9%	36.91	21.87	58.78
1984	15.73	26.3%	37.69	22.12	59.82
1985	15.73	26.2%	37.48	22.60	60.09
1986	16.28	26.3%	38.60	23.21	61.81
1987	16.67	26.4%	39.34	23.75	63.10
1988	17.28	26.6%	40.65	24.31	64.97
1989	17.33	26.2%	41.33	24.75	66.08
1990	16.99	25.5%	41.61	25.07	66.68
1991	16.71	24.8%	42.00	25.28	67.28
1992	17.03	25.2%	42.95	24.52	67.46
1993	17.24	25.5%	43.30	24.30	67.60
1994	17.72	25.7%	44.44	24.43	68.86
1995	17.73	25.3%	44.90	25.17	70.07
1996	18.31	25.6%	45.98	25.65	71.63
1997	18.62	25.4%	46.72	26.65	73.37
1998	18.92	25.6%	46.89	27.12	74.00
1999	19.52	25.8%	47.81	27.86	75.66
2000	19.70	25.7%	47.93	28.79	76.71
2001	19.65	25.4%	47.99	29.46	77.44
2002	19.76	25.3%	47.94	30.15	78.09
2003	20.03	25.1%	48.65	31.01	79.66
2004	20.73	25.2%	49.34	33.07	82.41
2005	20.80	24.8%	49.82	34.18	84.01
2006	20.69	24.3%	49.56	35.42	84.98
2007	20.68	24.1%	49.13	36.77	85.90
2008	19.44	[b]	47.33	[b]	[b]
			Average annual percentage change [c]		
1960–2008	1.4%		2.3%	4.1%	3.0%
1970–2008	0.7%		0.8%	3.0%	1.7%
1998–2008	0.3%		0.1%	3.4%	1.7%

Source:
U.S. Department of Energy, Energy Information Administration, *International Petroleum Monthly*, February 2009. (Additional resources: www.eia.doe.gov)

[a] Organization for Economic Cooperation and Development. See Glossary for membership.
[b] Not available.
[c] Average annual percentage for latest available year.

Figure 1.2. World Oil Reserves, Production and Consumption, 2007

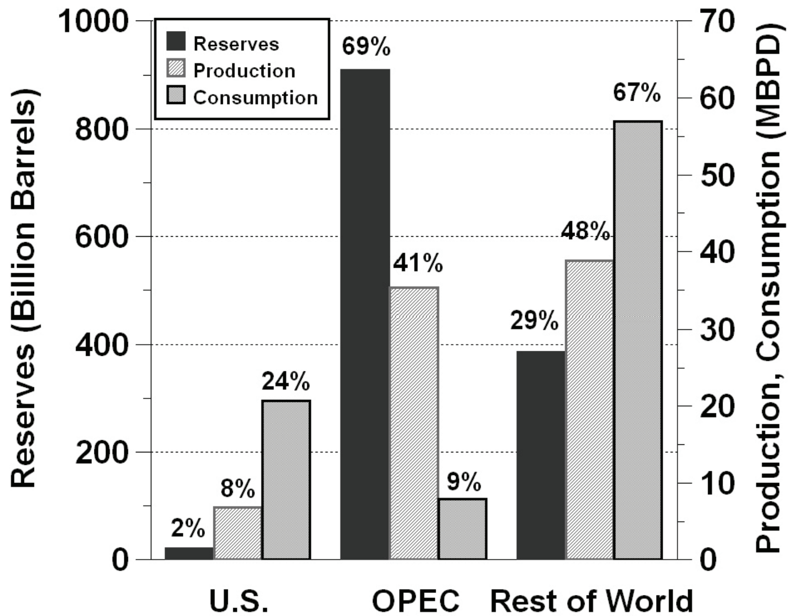


Table 1.5
World Oil Reserves, Production and Consumption, 2007

	Crude oil reserves (billion barrels)	Reserve share	Petroleum production (million barrels per day)	Production share	Petroleum consumption (million barrels per day)	Consumption share
United States	21.0	2%	6.8	8%	20.7	24%
OPEC	908.9	69%	35.3	41%	7.9	9%
Rest of world	386.8	29%	38.8	48%	57.0	67%

Sources:
Reserves – Energy Information Administration, *International Energy Annual 2006*, December 2008, Table 8.1.
Production – Energy Information Administration, *International Petroleum Monthly*, February 2009, Tables 1.1c, 1.1d, and 1.3.
Consumption (2006 data) – Energy Information Administration, *International Energy Annual 2006,* December 2008, Table 1.2, and *International Petroleum Monthly*, February 2009, Table 4.6. (Additional resources: www.eia.doe.gov)

Note: Total consumption is higher than total production due to refinery gains including alcohol and liquid products produced from coal and other sources. OPEC countries include Venezuela, Iran, Iraq, Kuwait, Qatar, Saudi Arabia, United Arab Emirates, Algeria, Libya, Nigeria, Indonesia, Gabon, and Ecuador. OPEC consumption data are for 2006.

Figure 1.3. World Natural Gas Reserves, Production and Consumption, 2006

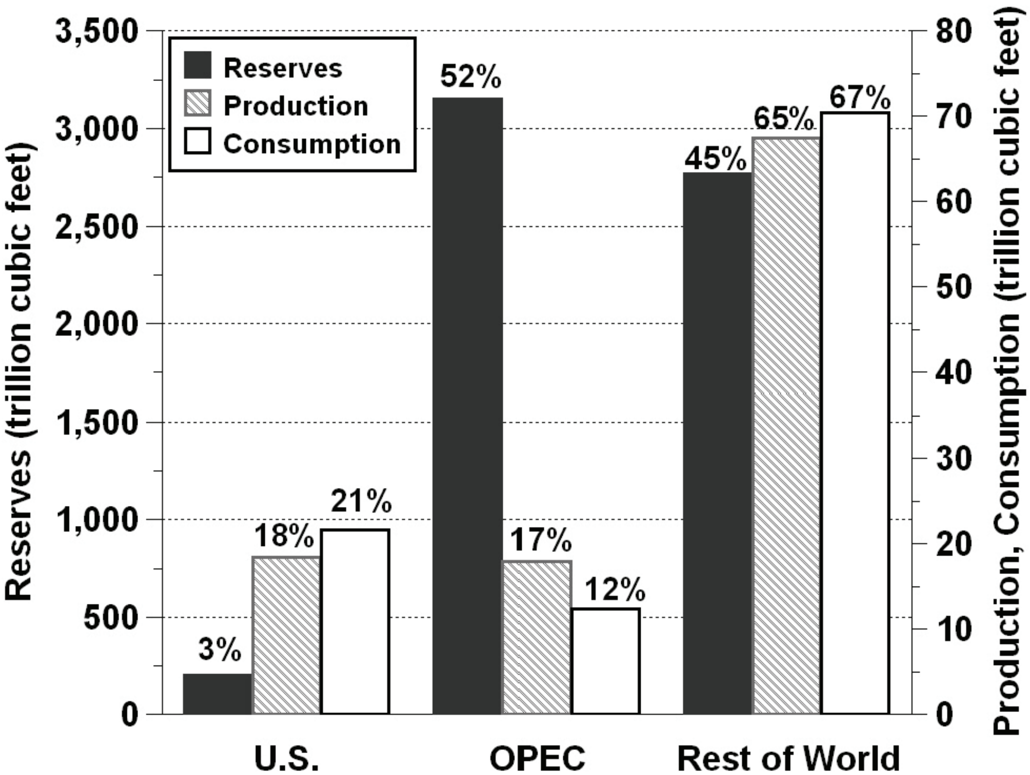


Table 1.6
World Natural Gas Reserves, Production and Consumption, 2006
(trillion cubic feet)

	Natural gas reserves	Reserve share	Natural gas production	Production share	Natural gas consumption	Consumption share
United States	204.4	3%	18.5	18%	21.7	21%
OPEC	3,153.4	52%	18.0	17%	12.4	12%
Rest of world	2,766.2	45%	67.5	65%	70.4	67%

Source:
Energy Information Administration, *International Energy Annual 2006*, August 2008, Tables 1.3, 2.4 and 8.1. (Additional resources: www.eia.doe.gov)

Note: Reserves as of January 1, 2007. Production data are dry gas production.

The share of petroleum imported to the United States can be calculated using total imports or net imports. Net imports, which is the preferred data, rose to 50% of U.S. petroleum consumption for the first time in 1998, while total imports reached 50% for the first time in 1993. OPEC share of net imports has been below 50% since 1993.

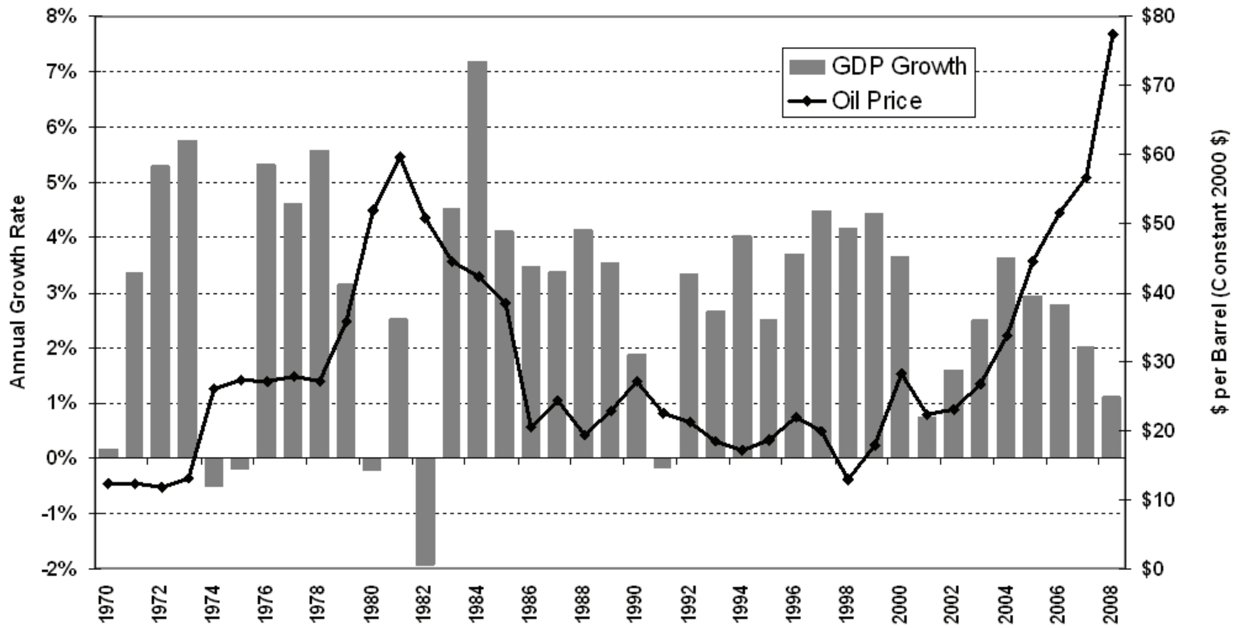
Table 1.7
U.S. Petroleum Imports by World Region of Origin, 1960–2008
(million barrels per day)

Year	Net OPEC[a] imports	Net OPEC share	Net Persian Gulf nation[b] imports	Net Persian Gulf share	Net imports	Net imports as a share of U.S. consumption	Total imports
1960	1.31	81.3%	[c]	[c]	1.61	[c]	1.82
1965	1.48	64.7%	[c]	[c]	2.28	[c]	2.47
1970	1.34	42.5%	[c]	[c]	3.16	[c]	3.42
1975	3.60	61.6%	1.17	19.2%	5.85	35.8%	6.06
1980	4.30	62.2%	1.52	22.0%	6.36	37.3%	6.91
1981	3.32	55.4%	1.22	20.3%	5.40	33.6%	6.00
1982	2.15	42.0%	0.70	13.7%	4.30	28.1%	5.11
1983	1.86	36.9%	0.44	8.7%	4.31	28.2%	5.05
1984	2.05	37.7%	0.51	9.4%	4.72	29.9%	5.44
1985	1.83	36.1%	0.31	6.1%	4.29	27.3%	5.07
1986	2.84	45.6%	0.91	14.6%	5.44	33.4%	6.22
1987	3.06	45.8%	1.08	16.2%	5.91	35.4%	6.68
1988	3.52	47.6%	1.54	20.8%	6.59	38.0%	7.40
1989	4.14	51.4%	1.86	23.1%	7.20	41.3%	8.06
1990	4.30	53.6%	1.97	24.6%	7.16	42.2%	8.02
1991	4.09	53.7%	1.84	24.1%	6.63	38.9%	7.63
1992	4.09	51.9%	1.78	22.6%	6.94	40.9%	7.89
1993	4.27	49.6%	1.78	20.6%	7.62	44.9%	8.62
1994	4.25	47.2%	1.73	19.2%	8.05	45.7%	9.00
1995	4.00	45.2%	1.57	17.8%	7.89	44.5%	8.84
1996	4.21	44.4%	1.60	16.9%	8.50	46.4%	9.48
1997	4.57	45.0%	1.76	17.3%	9.16	49.2%	10.16
1998	4.91	45.8%	2.14	19.9%	9.76	51.6%	10.71
1999	4.95	45.6%	2.46	22.7%	9.91	50.8%	10.85
2000	5.20	45.4%	2.49	21.7%	10.42	52.9%	11.46
2001	5.53	46.6%	2.76	23.3%	10.90	55.5%	11.87
2002	4.61	39.9%	2.27	19.7%	10.55	53.4%	11.53
2003	5.16	42.1%	2.50	20.4%	11.24	56.1%	12.26
2004	5.70	43.4%	2.49	19.0%	12.10	58.4%	13.15
2005	5.59	40.7%	2.33	17.0%	12.55	60.3%	13.71
2006	5.52	40.2%	2.21	16.1%	12.39	59.9%	13.71
2007	5.98	44.4%	2.16	16.1%	12.04	58.2%	13.47
2008	5.97	46.3%	2.37	18.4%	11.00	56.9%	12.87
			Average annual percentage change				
1960–2008	3.2%		[c]		4.1%		4.2%
1970–2008	4.0%		[c]		3.3%		3.5%
1997–2008	2.0%		1.0%		1.2%		1.9%

Source:
U.S. Department of Energy, Energy Information Administration, *Monthly Energy Review,* Washington, DC, March 2009, Table 3.3a.

[a] Organization of Petroleum Exporting Countries. See Glossary for membership.
[b] See Glossary for Persian Gulf Nations.
[c] Data are not available.

Figure 1.4. Oil Price and Economic Growth, 1970–2008



Source:
Greene, D.L. and N. I. Tishchishyna, *Costs of Oil Dependence: A 2000 Update*, Oak Ridge National Laboratory, ORNL/TM-2000/152, Oak Ridge, TN, 2000, and data updates, 2009. (Additional resources: www-cta.ornl.gov/publications)

The Costs of Oil Dependence

Authors Greene and Tishchishyna indicate that the oil market upheavals caused by the OPEC cartel over the last 30 years have cost the United States in the vicinity of $7 trillion (present value 1998 dollars) in total economic costs, which is about as large as the sum total of payment on the national debt over the same period.

Oil dependence is the product of (1) a noncompetitive world oil market strongly influenced by the OPEC cartel, (2) high levels of U.S. oil imports, (3) oil's critical role in the U.S. economy, and (4) the absence of economical and readily available substitutes for oil. Transportation is key to the problem because transportation vehicles account for a majority of U.S. oil consumption and nearly all of the high-value light products that drive the market.

Major oil price shocks have disrupted world energy markets five times in the past 30 years (1973-74, 1979-80, 1990-91, 1999-2000, 2008). Most of the oil price shocks were followed by an economic recession in the United States.

Estimates of military expenditures for defending oil supplies in the Middle East range from $6 to $60 billion per year. This wide range in estimates reflects the difficulty in assigning a precise figure to the military cost of defending the U.S. interests in the Middle East. The two main reasons for the difficulty are 1) the Department of Defense does not divide the budget into regional defense sectors and 2) it is difficult to determine how much of the cost is attributable to defending Persian Gulf oil.

Table 1.8
Summary of Military Expenditures for Defending Oil Supplies from the Middle East

Source	Original estimates (billion dollars)	Year of original estimate
General Accounting Office [1]	$33	1990
Congressional Research Service [2]	$6.4	1990
Greene and Leiby [3]	$14.3	1990
Kaufmann and Steinbruner [4]	$64.5	1990
Ravenal [5]	$50	1992
Delucchi and Murphy[a] [6]	$20–40	1996
National Defense Council Foundation [7]	$49.1	2003
Delucchi and Murphy[a] [8]	$47–98	2004

[1] U.S. General Accounting Offices, *Southwest Asia: Cost of Protecting U.S. Interests*, GAO/NSIAD-91-250, Washington, DC, August 1991.

[2] Congressional Research Service, *The External Costs of Oil Used in Transportation*, prepared for the U.S. Alternative Fuels Council, Washington, DC, June 1992.

[3] Greene, D.L., and P. Leiby, *The Social Costs to the U.S. of Monopolization of the World Oil Market*, 1972-1991, ORNL-6744, Oak Ridge National Laboratory, Oak Ridge, TN, March 1993.

[4] Kaufmann, W.W., and J.D. Steinbruner, *Decisions for Defense: Prospects for a New Order*, The Brookings Institution, Washington, DC, 1991.

[5] Ravenal, E.C., *Designing Defense for a New World Order: The Military Budget in 1992 and Beyond*, Cato Institute, Washington, DC, 1991.

[6] Delucchi, M.A., and J. Murphy, *U.S. Military Expenditures to Protect the Use of Persian-Gulf Oil for Motor Vehicles*, UCD-ITS-RR-96-3 (15), University of California, Davis, California, April 1996.

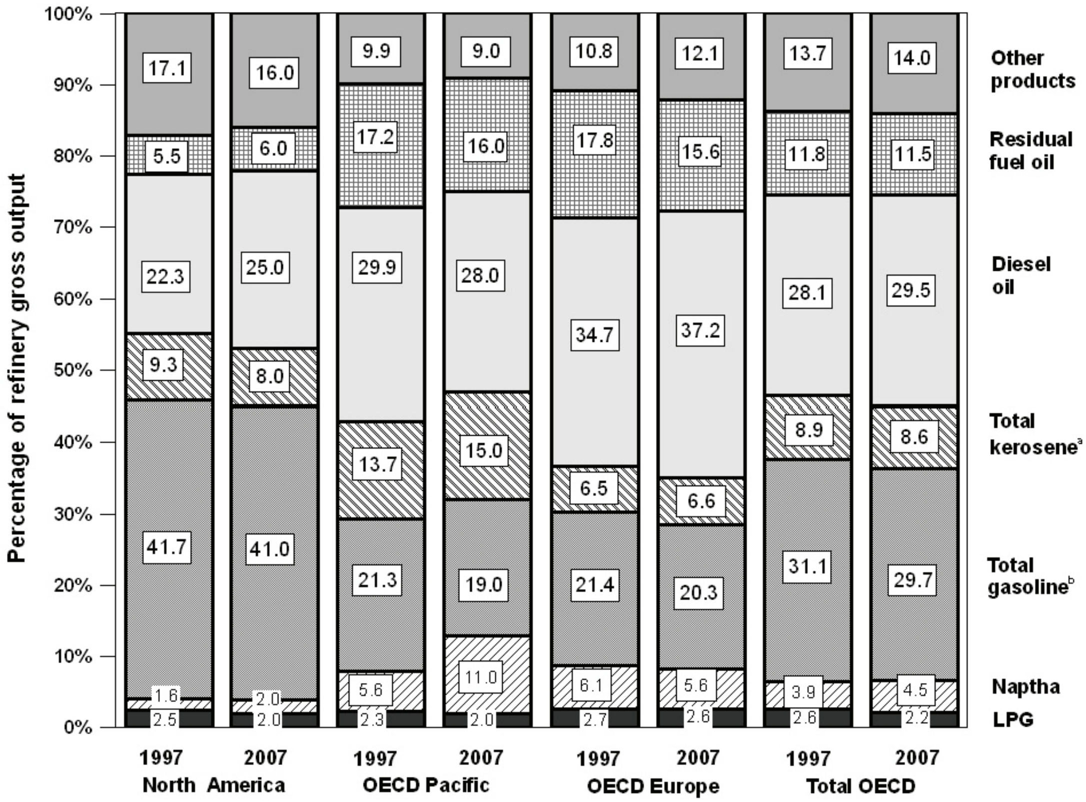
[7] Copulas, Milton R., *America's Achilles Heel – The Hidden Costs of Imported Oil*, National Defense Council Foundation, Washington, DC, October 2003.

[8] Delucchi, M.A. and J. Murphy, "U.S. Military Expenditures to Protect the Use of Persian-Gulf Oil for Motor Vehicles," *Energy Policy*, April 2008.

[a] Annual cost to defend all U.S. interests in the Persian Gulf.

Other parts of the world refine crude oil to produce more diesel fuel and less gasoline than does North America. The OECD Pacific countries produce the lowest share of gasoline.

Figure 1.5. Refinery Gross Output by World Region, 1997 and 2007



Source:
U.S. Department of Commerce, Bureau of the Census, 2002. *Vehicle Inventory and User Survey*, Microdata File on CD, 2005. (Additional resources: www.census.gov/svsd/ and www.tiusview.html)

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[a] Includes jet kerosene and other kerosene.
[b] Includes motor gasoline, jet gasoline, and aviation gasoline.
[c] Organization for Economic Cooperation and Development. See Glossary for membership.

Oxygenate refinery input increased significantly in 1995, most certainly due to the Clean Air Act Amendments of 1990 which mandated the sale of reformulated gasoline in certain areas beginning in January 1995. The use of MTBE has declined in recent years due to some states banning the additive. The other hydrocarbons and liquids category includes unfinished oils, motor gasoline blending components and aviation gasoline blending components. In 2005 the gasoline blending components rose significantly.

Table 1.9
U.S. Refinery Input of Crude Oil and Petroleum Products, 1987–2007
(thousand barrels)

			Oxygenates				
Year	Crude oil	Natural gas liquids	Fuel ethanol	MTBE[a]	Other oxygenates[b]	Other hydrocarbons & liquids	Total input to refineries
1987	4,691,783	280,889	[c]	[c]	[d]	132,720	5,105,392
1988	4,848,175	304,566	[c]	[c]	[d]	105,645	5,258,386
1989	4,891,381	182,109	[c]	[c]	[d]	223,797	5,297,287
1990	4,894,379	170,589	[c]	[c]	[d]	260,108	5,325,076
1991	4,855,016	172,306	[c]	[c]	[d]	280,265	5,307,587
1992	4,908,603	171,701	[c]	[c]	[d]	272,676	5,352,980
1993	4,968,641	179,213	3,351	49,393	1,866	280,074	5,482,538
1994	5,061,111	169,868	3,620	52,937	1,918	193,808	5,483,262
1995	5,100,317	172,026	9,055	79,396	4,122	190,411	5,555,327
1996	5,195,265	164,552	11,156	79,407	3,570	214,282	5,668,232
1997	5,351,466	151,769	11,803	86,240	4,246	201,268	5,806,792
1998	5,434,383	146,921	11,722	89,362	4,038	206,135	5,892,561
1999	5,403,450	135,756	13,735	94,784	4,147	225,779	5,877,651
2000	5,514,395	138,921	15,268	90,288	4,005	201,135	5,964,012
2001	5,521,637	156,479	16,929	87,116	4,544	192,632	5,979,337
2002	5,455,530	155,429	26,320	90,291	2,338	224,567	5,955,475
2003	5,585,875	152,763	55,626	67,592	1,937	163,459	6,027,252
2004	5,663,861	154,356	74,095	47,600	940	194,203	6,135,055
2005	5,555,332	161,037	84,088	39,751	612	295,064	6,135,884
2006	5,563,354	182,924	117,198	11,580	57	322,989	6,198,102
2007	5,532,097	184,383	136,603	1,610	0	349,807	6,204,500
			Average annual percentage change				
1987–2007	0.8%	-2.1%	[d]	[d]	[d]	5.0%	1.0%
1997–2007	0.3%	2.0%	27.7%	-32.8%	-100.0%	5.7%	0.7%

Source:
U.S. Department of Energy, Energy Information Administration, *Petroleum Supply Annual 200*7, Vol. 1, July 2008, Table 15, and annual. (Additional resources: www.eia.doe.gov)

[a] Methyl tertiary butyl ether (MTBE).
[b] Includes methanol and other oxygenates.
[c] Reported in "Other" category in this year.
[d] Data are not available.

When crude oil and other hydrocarbons are processed into products that are, on average, less dense than the input, a processing volume gain occurs. Due to this gain, the product yield from a barrel of crude oil is more than 100%. The processing volume gain has been growing over the years.

Table 1.10
Refinery Yield of Petroleum Products from a Barrel of Crude Oil, 1978–2008
(percentage)

Year	Motor gasoline	Distillate fuel oil	Jet fuel	Liquified petroleum gas	Other[a]	Total[b]
1978	44.1	21.4	6.6	2.3	29.6	104.0
1979	43.0	21.5	6.9	2.3	30.3	104.0
1980	44.5	19.7	7.4	2.4	30.0	104.0
1981	44.8	20.5	7.6	2.4	28.7	104.0
1982	46.4	21.5	8.1	2.2	26.2	104.4
1983	47.6	20.5	8.5	2.7	24.8	104.1
1984	46.7	21.5	9.1	2.9	24.2	104.4
1985	45.6	21.6	9.6	3.1	24.6	104.5
1986	45.7	21.2	9.8	3.2	24.8	104.7
1987	46.4	20.5	10.0	3.4	24.5	104.8
1988	46.0	20.8	10.0	3.6	24.4	104.8
1989	45.7	20.8	10.1	4.0	24.2	104.8
1990	45.6	20.9	10.7	3.6	24.1	104.9
1991	45.7	21.3	10.3	3.8	24.1	105.2
1992	46.0	21.2	9.9	4.3	24.0	105.4
1993	46.1	21.9	10.0	4.1	23.3	105.4
1994	45.5	22.3	10.1	4.2	23.2	105.3
1995	46.4	21.8	9.7	4.5	22.9	105.3
1996	45.7	22.7	10.4	4.5	22.4	105.7
1997	45.7	22.5	10.3	4.6	22.5	105.6
1998	46.2	22.3	10.4	4.4	22.5	105.8
1999	46.5	22.3	10.2	4.5	22.3	105.8
2000	46.2	23.1	10.3	4.5	22.0	106.1
2001	46.2	23.8	9.8	4.3	21.7	105.8
2002	47.3	23.2	9.8	4.3	21.5	106.1
2003	46.9	23.7	9.5	4.2	22.1	106.4
2004	46.8	23.9	9.7	4.0	22.2	106.6
2005	46.2	25.0	9.8	3.6	21.6	106.2
2006	45.8	25.4	9.3	3.9	21.7	106.1
2007	45.5	26.1	9.1	4.1	21.5	106.3
2008	44.2	27.8	9.6	4.1	20.8	106.5

Source:
Department of Energy, Energy Information Administration, *Petroleum Supply Annual 2007*, Vol.1, July 2008, Table 21 and annual. (Additional resources: www.eia.doe.gov)

[a] Includes aviation gasoline (0.1%), kerosene (0.2%), residential fuel oil (4.0%), naphtha and other oils for petrochemical feedstock use (1.0%), special naphthas (0.3%), lubricants (1.1%), waxes (0.1%), petroleum coke (5.3%) asphalt and road oil (2.7%), still gas (4.3%), and miscellaneous products (0.5%).

[b] Products sum greater than 100% due to processing gain. The processing gain for years 1978 to 1980 is assumed to be 4 percent.

Most of the petroleum imported by the United States is in the form of crude oil. The United States does export small amounts of petroleum, mainly refined petroleum products which go to Canada and Mexico.

Table 1.11
United States Petroleum Production, Imports and Exports, 1950–2008
(million barrels per day)

	Domestic Production			Imports			Exports		
	Crude oil	Natural gas plant liquids	Total[a]	Crude oil	Petroleum products	Total	Crude oil	Petroleum products	Total
1950	5.41	0.50	5.91	0.49	0.22	0.85	0.10	0.21	0.31
1955	6.81	0.77	7.58	0.78	0.46	1.23	0.03	0.34	0.37
1960	7.05	0.93	7.98	1.02	0.80	1.82	0.01	0.19	0.20
1965	7.80	1.21	9.01	1.24	1.23	2.47	0.00	0.18	0.19
1970	9.64	1.66	11.30	1.32	2.10	3.42	0.01	0.25	0.26
1975	8.38	1.63	10.01	4.11	1.95	6.06	0.01	0.20	0.21
1980	8.60	1.57	10.17	5.26	1.65	6.91	0.29	0.26	0.54
1981	8.57	1.61	10.18	4.40	1.60	6.00	0.23	0.37	0.60
1982	8.65	1.55	10.20	3.49	1.63	5.11	0.24	0.58	0.82
1983	8.69	1.56	10.25	3.33	1.72	5.05	0.16	0.58	0.74
1984	8.90	1.63	10.53	3.43	2.01	5.44	0.18	0.54	0.72
1985	8.97	1.61	10.58	3.20	1.87	5.07	0.20	0.58	0.78
1986	8.68	1.55	10.23	4.18	2.05	6.22	0.15	0.63	0.79
1987	8.35	1.60	9.95	4.67	2.00	6.68	0.15	0.61	0.76
1988	8.16	1.63	9.97	5.11	2.30	7.40	0.16	0.66	0.82
1989	7.61	1.55	9.16	5.84	2.22	8.06	0.14	0.72	0.86
1990	7.36	1.56	8.91	5.89	2.12	8.02	0.11	0.75	0.86
1991	7.42	1.66	9.08	5.78	1.84	7.63	0.12	0.89	1.00
1992	7.18	1.70	8.88	6.08	1.81	7.89	0.09	0.86	0.95
1993	6.85	1.74	8.59	6.79	1.83	8.62	0.10	0.90	1.00
1994	6.66	1.73	8.39	7.06	1.93	9.00	0.10	0.84	0.94
1995	6.56	1.76	8.32	7.23	1.61	8.84	0.10	0.86	0.95
1996	6.47	1.83	8.30	7.51	1.97	9.48	0.11	0.87	0.98
1997	6.45	1.82	8.27	8.23	1.94	10.16	0.11	0.90	1.00
1998	6.25	1.76	8.01	8.71	2.00	10.71	0.11	0.84	0.95
1999	5.88	1.85	7.73	8.73	2.12	10.85	0.12	0.82	0.94
2000	5.82	1.91	7.73	9.07	2.39	11.46	0.05	0.99	1.04
2001	5.80	1.87	7.67	9.33	2.54	11.87	0.02	0.95	0.97
2002	5.75	1.88	7.63	9.14	2.39	11.53	0.01	0.98	0.98
2003	5.68	1.72	7.40	9.67	2.60	12.26	0.01	1.01	1.03
2004	5.42	1.81	7.23	10.09	3.06	13.15	0.03	1.02	1.05
2005	5.18	1.72	6.90	10.13	3.59	13.71	0.03	1.13	1.17
2006	5.10	1.74	6.84	10.12	3.59	13.71	0.03	1.29	1.32
2007	5.06	1.78	6.85	10.03	3.42	13.47	0.03	1.41	1.43
2008	4.96	1.78	6.74	9.76	3.12	12.87	0.03	1.80	1.83
				Average annual percentage change					
1950–2008	-0.1%	2.2%	0.2%	5.3%	4.7%	4.8%	-2.1%	3.8%	3.1%
1970–2008	-1.7%	0.2%	-1.4%	5.4%	1.0%	3.5%	2.9%	5.3%	5.3%
1998–2008	-2.3%	-0.1%	-1.7%	1.1%	4.5%	1.9%	-12.2%	7.9%	6.8%

Source:
U.S. Department of Energy, Energy Information Administration, *Annual Energy Review 2007*, June 2008, Table 5.3 and *Monthly Energy Review*, March 2009, Tables 3.1 and 3.3b.

[a] Total domestic production includes crude oil, natural gas plant liquids and small amounts of other liquids.

The U.S. share of the world's petroleum consumption is approximately one-quarter. The United States relies heavily on imported petroleum. Imports accounted for over 56% of U.S. petroleum consumption in 2008.

Table 1.12
Petroleum Production and Consumption and Some Important Percent Shares, 1950–2008

	Domestic petroleum production[a]	Net petroleum imports	Transportation petroleum consumption	U.S. petroleum consumption	World petroleum consumption	Net imports as a share of U.S. consumption	U.S. petroleum consumption as a share of world consumption	Transportation petroleum use as a share of domestic production
	(million barrels per day)							
1950	5.91	0.55	3.36	6.46	[b]	8.4%	[b]	56.8%
1955	7.58	0.88	4.46	8.46	[b]	10.4%	[b]	58.8%
1960	7.99	1.62	5.15	9.82	21.34	16.5%	46.0%	64.5%
1965	9.01	2.28	6.04	11.51	31.14	19.8%	37.0%	67.0%
1970	11.30	3.16	7.78	14.70	46.81	21.5%	31.4%	68.9%
1975	10.01	5.85	8.95	16.32	56.20	35.8%	29.0%	89.4%
1980	10.17	6.36	9.57	17.06	63.11	37.3%	27.0%	94.1%
1981	10.18	5.40	9.49	16.06	60.94	33.6%	26.3%	93.2%
1982	10.20	4.30	9.31	15.30	59.54	28.1%	25.7%	91.2%
1983	10.25	4.31	9.41	15.23	58.78	28.3%	25.9%	91.8%
1984	10.51	4.72	9.71	15.73	59.82	30.0%	26.3%	92.4%
1985	10.58	4.29	9.84	15.73	60.08	27.3%	26.2%	93.0%
1986	10.23	5.44	10.19	16.28	61.81	33.4%	26.3%	99.6%
1987	9.94	5.91	10.50	16.67	63.10	35.5%	26.4%	105.7%
1988	9.76	6.59	10.88	17.28	64.97	38.1%	26.6%	111.4%
1989	9.16	7.20	10.94	17.33	66.08	41.6%	26.2%	119.4%
1990	8.91	7.16	10.89	16.99	66.63	42.2%	25.5%	122.2%
1991	9.08	6.63	10.76	16.71	67.22	39.6%	24.9%	118.5%
1992	8.87	6.94	10.91	17.03	67.39	40.8%	25.3%	123.0%
1993	8.58	7.62	11.12	17.24	67.51	44.2%	25.5%	129.7%
1994	8.39	8.05	11.13	17.72	68.78	45.5%	25.8%	132.6%
1995	8.32	7.89	11.61	17.73	68.99	44.5%	25.3%	139.5%
1996	8.30	8.50	11.91	18.31	71.54	46.4%	25.6%	143.5%
1997	8.27	9.16	12.05	18.62	73.30	49.2%	25.4%	145.7%
1998	8.01	9.76	12.36	18.92	73.94	51.6%	25.6%	154.3%
1999	7.73	9.91	12.70	19.52	75.60	50.8%	25.8%	164.3%
2000	7.73	10.42	12.98	19.70	76.71	52.9%	25.7%	167.9%
2001	7.67	10.90	12.86	19.65	77.44	55.5%	25.4%	167.7%
2002	7.63	10.55	13.12	19.76	78.09	53.4%	25.3%	172.0%
2003	7.40	11.24	13.20	20.03	79.66	56.1%	25.1%	178.4%
2004	7.23	12.10	13.61	20.73	82.41	58.4%	25.2%	188.2%
2005	6.90	12.55	13.79	20.80	84.01	60.3%	24.8%	200.0%
2006	6.84	12.39	13.95	20.69	84.98	59.9%	24.3%	203.9%
2007	6.85	12.04	13.97	20.68	85.90	58.2%	24.1%	204.1%
2008	6.74	11.04	13.34	19.42	[b]	56.9%	[b]	198.0%
	Average annual percentage change							
1950–2008	0.2%	5.3%	2.4%	1.9%	[b]			
1970–2008	-1.4%	3.3%	1.4%	0.7%	1.7%[c]			
1998–2008	-1.7%	1.2%	0.8%	0.3%	1.7%[c]			

Sources:

U.S. Department of Energy, Energy Information Administration, *Monthly Energy Review*, March 2009, Tables 2.5, 3.1, and A3. (Pre-1973 data from the *Annual Energy Review*). World petroleum consumption - U.S. Department of Energy, Energy Information Administration, *International Energy Annual 2006*, December 2008, Table 1.1 and annual. (Additional resources: www.eia.doe.gov)

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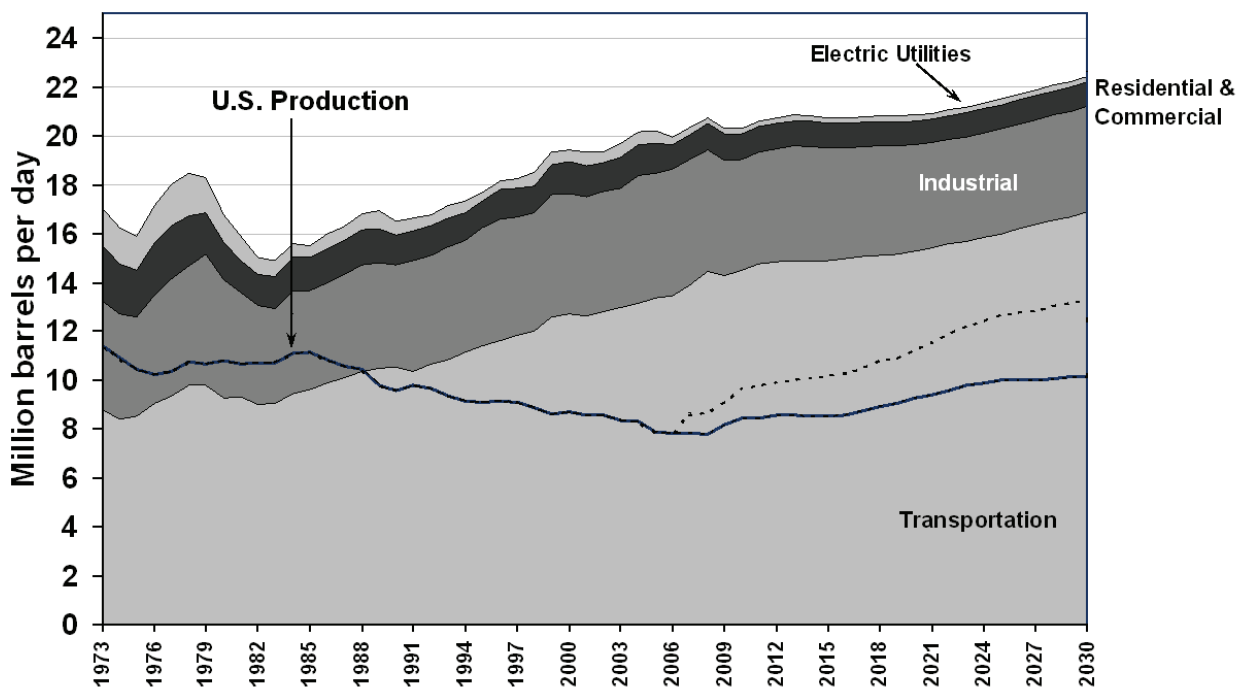
[a] Total domestic production includes crude oil, natural gas plant liquids and small amounts of other liquids.

[b] Data are not available.

[c] Average annual percentage change is to the latest year possible.

In 1973 the United States produced two-thirds of the petroleum consumed. By 2007, only 40% of U.S. consumption is produced domestically. Forecasts show, however, that with ethanol, liquids from coal, and liquids from biofuels added to domestic petroleum consumption, the United States will produce close to 60% in 2030.

Figure 1.6. United States Petroleum Production and Consumption – All Sectors, 1973–2030



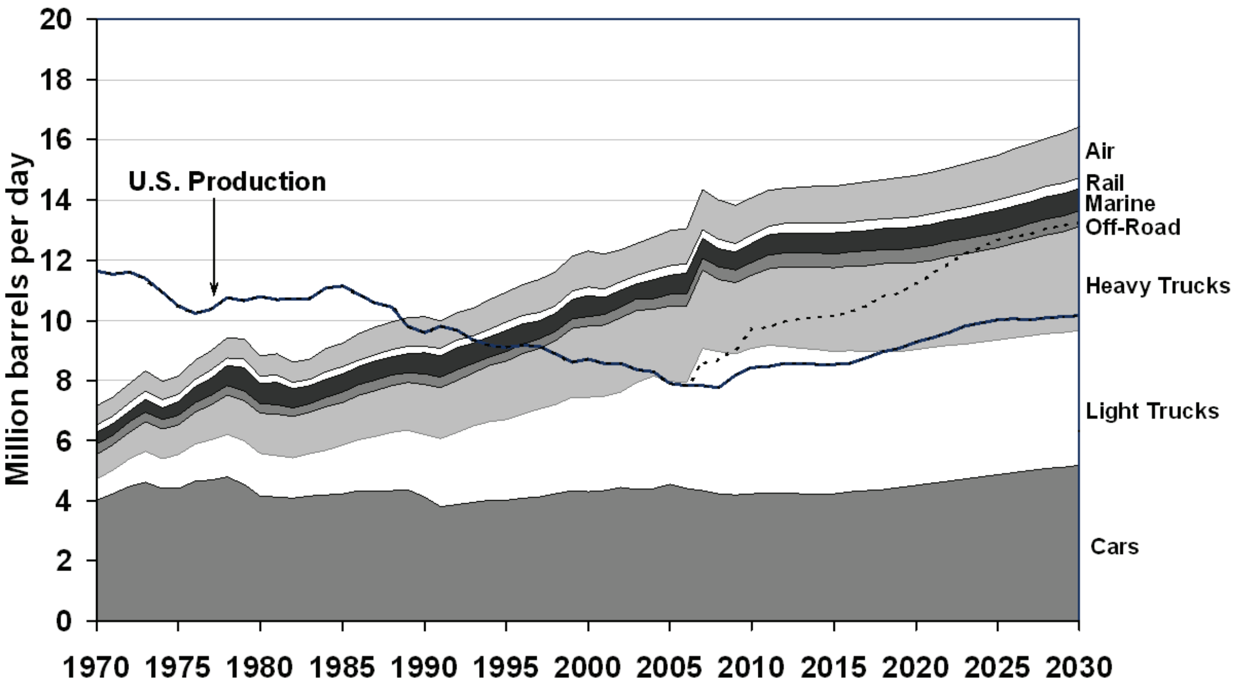
Source:
See Tables 1.12 and 2.6. Projections are from the Energy Information Administration, *Annual Energy Outlook 2009*, March 2009.

Notes: The U.S. Production has two lines after 2005. The solid line is conventional sources of petroleum. The dashed line adds in other inputs -- ethanol, liquids from coal, and liquids from biomass. Historical petroleum production includes crude oil, natural gas plant liquids, refinery gains, and other inputs, which include liquids from gas, liquids from coal, and alcohols, ethers, petroleum product stock withdrawals, domestic sources of blending components, other hydrocarbons, and natural gas converted to liquid fuel.

The sharp increase in values between 2006 and 2007 is caused by the data change from historical to projected values.

In 1989 the transportation sector petroleum consumption surpassed U.S. petroleum production for the first time, creating a gap that must be met with imports of petroleum. By the year 2030, transportation petroleum consumption is expected to grow to more than 16 million barrels per day; at that time, the gap between U.S. production and transportation consumption will be about 6 million barrels per day. The highway mode is expected to account for the largest growth in petroleum use, with light truck and heavy truck petroleum usage growing the fastest.

Figure 1.7. United States Petroleum Production Transportation and Consumption, 1970–2030



Source:
See Tables 1.12 and 2.6. Projections are from the Energy Information Administration, *Annual Energy Outlook 2009*, March 2009.

Notes: The U.S. Production has two lines after 2005. The solid line is conventional sources of petroleum. The dashed line adds in other inputs -- ethanol, liquids from coal, and liquids from biomass. Historical petroleum production includes crude oil, natural gas plant liquids, refinery gains, and other inputs, which include liquids from gas, liquids from coal, and alcohols, ethers, petroleum product stock withdrawals, domestic sources of blending components, other hydrocarbons, and natural gas converted to liquid fuel.

The sharp increase in values between 2006 and 2007 is caused by the data change from historical to projected values.

Transportation accounts for more than two-thirds of the U.S. petroleum use. Total petroleum consumption has been more than 20 million barrels per day since 2004.

Table 1.13
Consumption of Petroleum by End-Use Sector, 1973–2008
(million barrels per day)

Year	Transportation	Percentage	Residential	Commercial	Industrial	Electric utilities	Total
1973	9.05	52.3%	1.49	0.75	4.48	1.54	17.31
1974	8.84	53.1%	1.36	0.68	4.30	1.48	16.65
1975	8.95	54.8%	1.32	0.63	4.04	1.39	16.32
1976	9.40	53.7%	1.43	0.70	4.46	1.52	17.51
1977	9.76	53.0%	1.42	0.72	4.82	1.71	18.43
1978	10.16	53.9%	1.38	0.69	4.87	1.75	18.85
1979	10.01	54.0%	1.09	0.63	5.34	1.44	18.51
1980	9.57	56.0%	0.91	0.61	4.86	1.15	17.10
1981	9.49	59.1%	0.81	0.52	4.27	0.96	16.06
1982	9.31	60.9%	0.76	0.48	4.06	0.69	15.30
1983	9.41	61.8%	0.74	0.55	3.85	0.68	15.23
1984	9.62	61.0%	0.78	0.61	4.21	0.56	15.77
1985	9.84	62.6%	0.84	0.50	4.07	0.48	15.72
1986	10.19	62.6%	0.82	0.54	4.09	0.64	16.28
1987	10.50	63.0%	0.87	0.53	4.21	0.55	16.67
1988	10.88	62.7%	0.90	0.52	4.36	0.69	17.34
1989	10.94	62.8%	0.90	0.49	4.33	0.75	17.41
1990	10.89	64.7%	0.77	0.47	4.15	0.57	16.84
1991	10.76	63.2%	0.77	0.44	4.53	0.53	17.03
1992	10.91	64.2%	0.78	0.42	4.45	0.44	17.00
1993	11.12	63.8%	0.80	0.38	4.64	0.50	17.44
1994	11.13	64.2%	0.78	0.39	4.57	0.47	17.33
1995	11.61	64.9%	0.77	0.36	4.83	0.33	17.90
1996	11.91	64.6%	0.84	0.37	4.96	0.36	18.44
1997	12.05	65.2%	0.81	0.35	4.86	0.41	18.47
1998	12.36	65.5%	0.74	0.33	4.84	0.58	18.86
1999	12.70	65.3%	0.85	0.34	5.03	0.53	19.46
2000	12.98	65.9%	0.90	0.38	4.92	0.51	19.69
2001	12.86	65.7%	0.88	0.38	4.89	0.56	19.57
2002	13.12	66.7%	0.85	0.35	4.93	0.43	19.67
2003	13.20	66.3%	0.89	0.39	4.90	0.53	19.91
2004	13.61	65.9%	0.88	0.38	5.23	0.54	20.64
2005	13.79	66.8%	0.83	0.36	5.10	0.55	20.63
2006	13.95	68.2%	0.71	0.32	5.19	0.29	20.45
2007	14.00	68.7%	0.73	0.31	5.05	0.29	20.38
2008	13.28	69.8%	0.69	0.29	4.57	0.21	19.04
			Average annual percentage change				
1973–2008	1.1%		-2.2%	-2.7%	0.1%	-5.5%	0.3%
1998–2008	0.7%		-0.7%	-1.3%	-0.6%	-9.7%	0.1%

Source:
U.S. Department of Energy, Energy Information Administration, *Monthly Energy Review,* April 2009, Tables 2.2–2.6. Converted to million barrels per day using Table A3. (Additional resources: www.eia.doe.gov)

The highway sector used nearly 14 million barrels of petroleum per day in 2007, mostly in light vehicles. Light trucks include pick-ups, minivans, sport-utility vehicles, and vans. See Table 2.7 for highway energy use in trillion Btu.

Table 1.14
Highway Transportation Petroleum Consumption by Mode, 1970–2007[a]
(thousand barrels per day)

Year	Cars	Light trucks	Light vehicles subtotal	Motor-cycles	Buses	Heavy trucks	Highway subtotal	Total transportation[b]
1970	4,424	803	5,227	4	62	738	6,031	7,335
1975	4,836	1,245	6,081	7	58	952	7,099	8,474
1976	5,107	1,359	6,466	8	63	1,005	7,542	8,971
1977	5,157	1,460	6,617	8	65	1,114	7,805	9,316
1978	5,261	1,576	6,837	9	66	1,247	8,160	9,795
1979	4,996	1,595	6,591	11	68	1,299	7,969	9,727
1980	4,565	1,552	6,117	13	68	1,302	7,500	9,120
1981	4,508	1,546	6,054	14	69	1,329	7,466	9,177
1982	4,509	1,481	5,989	13	71	1,330	7,403	8,946
1983	4,587	1,562	6,149	11	72	1,354	7,586	9,079
1984	4,609	1,670	6,280	11	69	1,398	7,758	9,366
1985	4,665	1,785	6,450	12	72	1,396	7,930	9,538
1986	4,773	1,897	6,670	12	76	1,426	8,184	9,898
1987	4,782	1,996	6,778	12	77	1,469	8,336	10,113
1988	4,784	2,130	6,914	13	80	1,495	8,503	10,345
1989	4,821	2,170	6,992	14	79	1,534	8,618	10,507
1990	4,538	2,323	6,861	12	78	1,597	8,549	10,441
1991	4,196	2,493	6,688	12	83	1,630	8,413	10,259
1992	4,268	2,670	6,938	12	87	1,660	8,698	10,596
1993	4,374	2,795	7,169	13	86	1,711	8,979	10,821
1994	4,428	2,878	7,305	13	86	1,806	9,211	11,090
1995	4,440	2,975	7,415	13	87	1,881	9,396	11,347
1996	4,515	3,089	7,604	13	88	1,931	9,636	11,602
1997	4,559	3,222	7,781	13	91	1,949	9,834	11,777
1998	4,677	3,292	7,969	13	93	2,012	10,086	12,061
1999	4,780	3,448	8,228	14	96	2,212	10,550	12,639
2000	4,766	3,453	8,219	14	98	2,298	10,630	12,792
2001	4,798	3,491	8,290	13	93	2,295	10,690	12,672
2002	4,923	3,602	8,525	12	91	2,401	11,029	12,938
2003	4,866	3,963	8,829	12	90	2,334	11,265	13,108
2004	4,919	4,137	9,055	13	92	2,162	11,323	13,344
2005	5,050	3,840	8,890	12	93	2,426	11,422	13,537
2006	4,893	3,959	8,852	14	94	2,476	11,436	13,605
2007	4,850	4,032	8,883	16	92	2,515	11,505	13,710
				Average annual percentage change				
1970–2007	0.2%	4.5%	1.4%	3.8%	1.1%	3.4%	1.8%	1.7%
1997–2007	0.6%	2.3%	1.3%	2.1%	0.1%	2.6%	1.6%	1.5%

Source:
See Appendix A for Highway Energy Use.

[a] Each gallon of petroleum product was assumed to equal one gallon of crude oil. The oil used to produce electricity is also estimated. See Appendix A, p. 18 for details.

[b] Total transportation figures do not include military and off-highway energy use and may not include all possible uses of fuel for transportation (e.g., snowmobiles).

Although about 20% of transportation energy use is for nonhighway modes, only 16% of transportation petroleum use is for nonhighway. This is because some nonhighway modes, such as pipelines and transit rail, use electricity. An estimate for the petroleum used to make electricity is included in the data. See Table 2.8 for nonhighway transportation energy use in trillion Btu.

Table 1.15
Nonhighway Transportation Petroleum Consumption by Mode, 1970–2007[a]
(thousand barrels per day)

Year	Air	Water	Pipeline	Rail	Nonhighway subtotal	Total transportation[b]
1970	625	383	43	253	1,304	7,335
1975	651	425	50	249	1,375	8,474
1976	624	494	51	260	1,429	8,971
1977	655	536	54	265	1,511	9,316
1978	691	626	53	264	1,635	9,795
1979	723	721	44	270	1,758	9,727
1980	697	627	35	262	1,620	9,120
1981	706	724	29	253	1,711	9,177
1982	701	606	21	214	1,543	8,946
1983	699	562	19	212	1,492	9,079
1984	781	579	16	232	1,608	9,366
1985	814	566	13	216	1,608	9,538
1986	884	603	17	210	1,714	9,898
1987	920	628	15	213	1,776	10,113
1988	958	646	18	220	1,842	10,345
1989	960	690	18	221	1,888	10,507
1990	1,006	657	14	216	1,892	10,441
1991	940	692	12	202	1,846	10,259
1992	954	726	10	208	1,898	10,596
1993	961	654	11	215	1,842	10,821
1994	1,002	636	11	230	1,879	11,090
1995	1,036	669	7	239	1,951	11,347
1996	1,068	645	8	245	1,966	11,602
1997	1,114	575	9	246	1,943	11,777
1998	1,148	567	12	248	1,974	12,061
1999	1,196	626	11	257	2,090	12,639
2000	1,234	663	10	256	2,163	12,792
2001	1,167	547	11	257	1,982	12,672
2002	1,071	573	8	257	1,910	12,938
2003	1,073	497	10	263	1,843	13,108
2004	1,136	597	10	278	2,021	13,344
2005	1,199	626	10	281	2,116	13,537
2006	1,216	662	5	286	2,169	13,605
2007	1,215	709	5	276	2,205	13,710
			Average annual percentage change			
1970–2007	1.8%	1.7%	-5.6%	0.2%	1.4%	1.7%
1997–2007	0.9%	2.1%	-5.7%	1.2%	1.3%	1.5%

Source:
See Appendix A for Nonhighway Energy Use.

[a] Each gallon of petroleum product was assumed to equal one gallon of crude oil. The oil used to produce electricity is also estimated. See Appendix A, p. 18 for details.
[b] Total transportation figures do not include military and off-highway energy use and may not include all possible uses of fuel for transportation (e.g., snowmobiles).

Highway vehicles were responsible for over 80% of all transportation petroleum use in 2007. See Table 2.6 for transportation energy use in trillion Btu.

Table 1.16
Transportation Petroleum Use by Mode, 2006–2007[a]

	Thousand barrels per day		Percentage of total	
	2006	2007	2006	2007
HIGHWAY	**11,436.3**	**11,505.5**	**84.1%**	**83.9%**
Light vehicles	**8,866.0**	**8,898.4**	**65.2%**	**64.9%**
Cars	4,893.0	4,850.3	36.0%	35.4%
Light trucks[b]	3,958.6	4,032.4	29.1%	29.4%
Motorcycles	14.4	15.8	0.1%	0.1%
Buses	**94.2**	**92.4**	**0.7%**	**0.7%**
Transit	47.0	43.8	0.3%	0.3%
Intercity	13.6	14.0	0.1%	0.1%
School	33.6	34.6	0.2%	0.3%
Medium/heavy trucks	**2,476.1**	**2,514.7**	**18.2%**	**18.3%**
NONHIGHWAY	**2,168.7**	**2,204.8**	**15.9%**	**16.1%**
Air	**1,215.5**	**1,214.9**	**8.9%**	**8.9%**
General aviation	126.0	120.0	0.9%	0.9%
Domestic air carriers	893.3	892.5	6.6%	6.5%
International air	196.3	202.4	1.4%	1.5%
Water	**662.3**	**708.7**	**4.9%**	**5.2%**
Freight	535.4	581.9	3.9%	4.2%
Recreational	126.9	126.8	0.9%	0.9%
Pipeline	5.3	**5.3**	**0.0%**	**0.0%**
Rail	**285.6**	**275.9**	**2.1%**	**2.0%**
Freight (Class I)	274.9	266.6	2.0%	1.9%
Passenger	10.7	9.3	0.1%	0.1%
Transit	1.0	0.0	0.0%	0.0%
Commuter	5.5	5.3	0.0%	0.0%
Intercity	4.2	4.0	0.0%	0.0%
HWY & NONHWY TOTAL[c]	**13,605.0**	**13,710.2**	**100.0%**	**100.0%**

Source: See Appendix A for Energy Use Sources.

[a] Each gallon of petroleum product was assumed to equal one gallon of crude oil. The oil used to produce electricity is also estimated. See Appendix A, p. 18 for details.

[b] Two-axle, four-tire trucks.

[c] Civilian consumption only. Totals may not include all possible uses of fuels for transportation (e.g., snowmobiles).

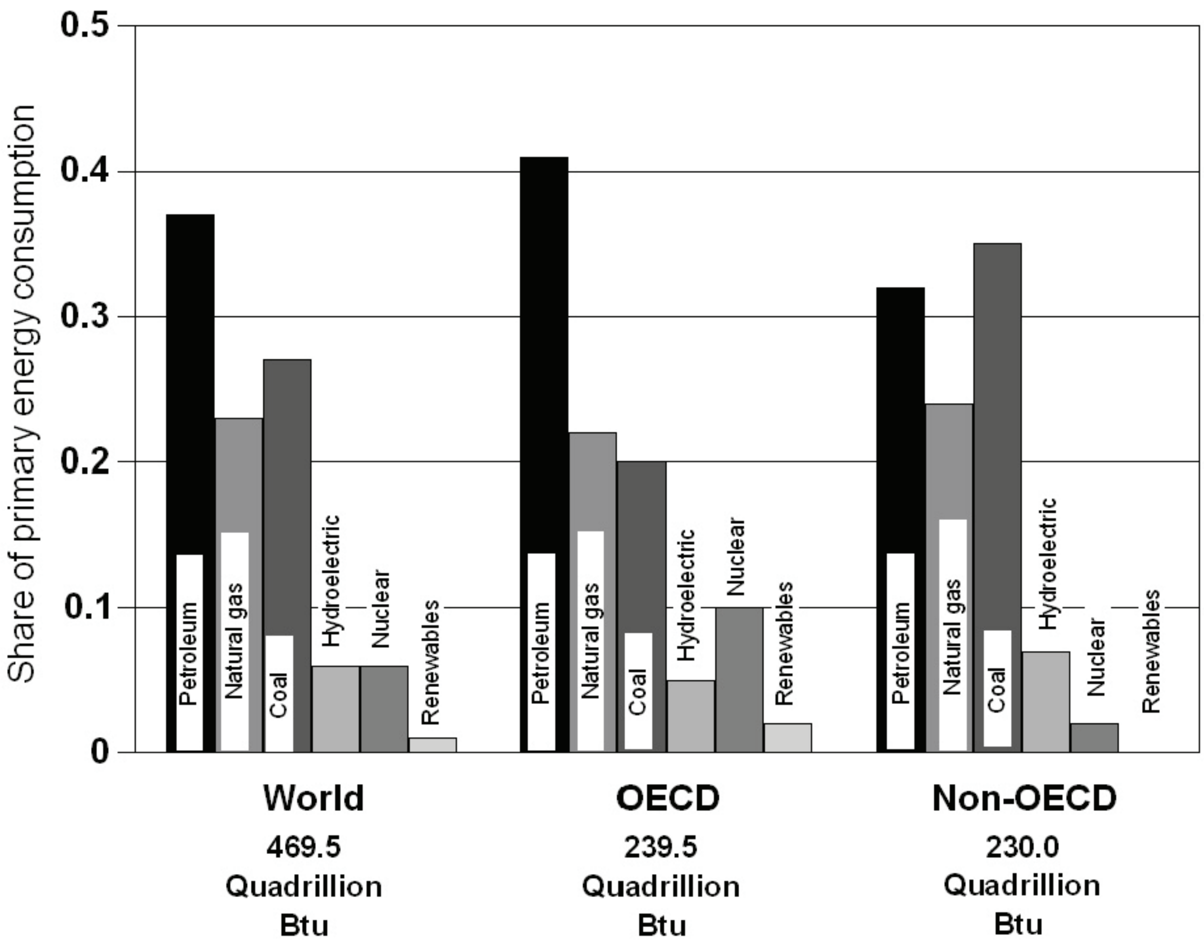
Chapter 2
Energy

Summary Statistics from Tables in this Chapter

Source			
Table 2.1	Transportation share of U.S. energy consumption, 2008	28.2%	
Table 2.2	Petroleum share of transportation energy consumption, 2008	94.3%	
Table 2.3	Alternative fuel and oxygenate consumption, 2006		
		(thousand gasoline equivalent gallons)	(share)
	Ethanol in gasohol	*3,729,168*	*77.0%*
	MTBE	*435,000*	*9.0%*
	Liquified petroleum gas	*173,130*	*3.6%*
	Compressed natural gas	*172,011*	*3.6%*
	E85	*44,041*	*0.9%*
	Liquified natural gas	*23,474*	*0.5%*
	Electricity	*5,104*	*0.1%*
Table 2.6	Transportation energy use by mode, 2007	(trillion Btu)	(share)
	Cars	*9,218*	*32.9%*
	Light trucks	*7,676*	*27.4%*
	Medium/heavy trucks	*5,274*	*18.8%*
	Buses	*194*	*0.7%*
	Total Highway	***22,393***	***80.0%***
	Air	*2,510*	*9.0%*
	Water	*1,559*	*5.6%*
	Pipeline	*884*	*3.2%*
	Rail	*658*	*2.3%*

Petroleum accounted for nearly 40% of the world's energy use in 2006. Though petroleum is the dominant energy source for both OECD countries and non-OECD countries, the non-OECD countries rely on coal, natural gas, and hydro-electric power more than OECD countries do.

Figure 2.1. World Consumption of Primary Energy, 2006



Source:
U.S. Department of Energy, Energy Information Administration, *International Energy Annual 2006*, Washington, DC, 2008, Table 1.8. (Additional resources: www.eia.doe.gov)

The Energy Information Administration revised the historical energy data series to include renewable energy in each sector. Also, the residential and commercial sector data are now separated. Total energy use was 99.6 quads in 2008 with transportation using 28.2%.

Table 2.1
U. S. Consumption of Total Energy by End-Use Sector, 1973–2008
(quadrillion Btu)

Year	Transportation	Percentage transportation of total	Industrial	Commercial	Residential	Total
1973	18.6	24.6%	32.7	9.5	14.9	75.7
1974	18.1	24.5%	31.8	9.4	14.7	74.0
1975	18.2	25.3%	29.4	9.5	14.8	72.0
1976	19.1	25.1%	31.4	10.0	15.4	76.0
1977	19.8	25.4%	32.3	10.2	15.7	78.0
1978	20.6	25.8%	32.7	10.5	16.2	80.0
1979	20.5	25.3%	34.0	10.6	15.8	80.9
1980	19.7	25.2%	32.1	10.6	15.8	78.1
1981	19.5	25.6%	30.8	10.6	15.4	76.3
1982	19.1	26.1%	27.7	10.9	15.6	73.3
1983	19.2	26.2%	27.5	11.0	15.5	73.1
1984	19.9	25.9%	29.6	11.5	15.8	76.7
1985	20.1	26.3%	28.9	11.4	16.1	76.5
1986	20.9	27.2%	28.4	11.6	15.9	76.8
1987	21.5	27.2%	29.5	12.0	16.2	79.2
1988	21.4	25.8%	30.8	12.6	17.1	82.8
1989	22.6	26.6%	31.4	13.2	17.8	85.0
1990	22.4	26.5%	31.9	13.3	17.0	84.7
1991	22.2	26.2%	31.5	13.5	17.1	84.6
1992	22.5	26.2%	32.7	13.4	17.4	86.0
1993	22.9	26.1%	36.7	13.8	18.3	87.6
1994	23.5	26.3%	33.6	14.1	18.1	89.3
1995	23.8	26.2%	34.0	14.7	18.6	91.2
1996	24.4	25.9%	35.0	15.2	19.6	94.2
1997	24.8	26.1%	35.3	15.7	19.0	94.8
1998	25.3	26.8%	34.9	16.0	19.0	95.2
1999	26.0	26.8%	34.9	16.4	19.6	96.8
2000	26.6	26.8%	34.8	17.2	20.5	99.0
2001	26.3	27.3%	32.8	17.1	20.1	96.3
2002	26.8	27.4%	32.8	17.4	20.9	97.9
2003	27.0	27.5%	32.7	17.4	21.2	98.2
2004	27.9	27.8%	33.6	17.6	21.2	100.4
2005	28.4	28.2%	32.5	17.9	21.7	100.5
2006	28.8	28.8%	32.5	17.7	20.8	99.9
2007	29.1	28.6%	32.5	18.3	21.6	101.6
2008	28.0	28.2%	31.1	18.7	21.7	99.6
		Average annual percentage change				
1973–2008	1.2%		-0.1%	2.0%	1.1%	0.8%
1998–2008	1.0%		-1.1%	1.6%	1.3%	0.5%

Source:
U.S. Department of Energy, Energy Information Administration, *Monthly Energy Review,* March 2009, Washington, DC, Table 2.1. (Additional resources: www.eia.doe.gov)

[a] Electrical energy losses have been distributed among the sectors.

The Energy Information Administration revised the historical energy data series to include renewable energy in each sector. In transportation, the alcohol fuels blended into gasoline to make gasohol (10% ethanol or less) are now counted under "renewables" and have been taken out of petroleum. The petroleum category, however, still contains other blending agents, such as MTBE, that are not actually petroleum, but are not broken out into a separate category.

Table 2.2
Distribution of Energy Consumption by Source, 1973 and 2008
(percentage)

Energy source	Transportation		Residential		Commercial		Industrial		Electric utilities	
	1973	2008	1973	2008	1973	2008	1973	2008	1973	2008
Petroleum[a]	95.8	94.3	18.9	5.7	16.5	3.5	27.9	26.8	17.8	1.1
Natural gas[b]	4.0	2.4	33.3	23.0	27.9	17.2	31.8	26.2	19.0	16.9
Coal	0.0	0.0	0.6	0.0	1.7	0.4	12.4	5.8	43.8	51.4
Renewable	0.0	3.0	2.4	2.6	0.1	0.6	3.7	6.7	14.5	9.2
Nuclear	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	4.6	21.0
Electricity[c]	0.2	0.3	44.7	68.7	53.9	78.4	24.2	34.5	0.2	0.3
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0

Source:
U.S. Department of Energy, Energy Information Administration, *Monthly Energy Review*, March 2009, Washington, DC, Tables 2.2, 2.3, 2.4, 2.5, and 2.6. (Additional resources: www.eia.doe.gov)

[a] In transportation, the petroleum category contains some blending agents which are not petroleum.
[b] Includes supplemental gaseous fuels. Transportation sector includes pipeline fuel and natural gas vehicle use.
[c] Includes electrical system energy losses.

Oxygenates are blended with gasoline to be used in conventional vehicles. The amount of oxygenate use dwarfs the alternative fuel use. Gasoline-equivalent gallons are used in this table to allow comparisons of different fuel types. The biodiesel data are not available for 2007.

Table 2.3
Alternative Fuel and Oxygenate Consumption, 2003–2007
(thousand gasoline–equivalent gallons)

	2003	2004	2005	2006	2007
Alternative fuel					
Liquified petroleum gas	224,697	211,883	188,171	173,130	152,360
Compressed natural gas	133,222	158,903	166,878	172,011	178,585
Liquified natural gas	13,503	20,888	22,409	23,474	24,594
E85[a]	26,376	31,581	38,074	44,041	54,091
Electricity[b]	5,141	5,269	5,219	5,104	5,037
Hydrogen	2	8	25	41	66
Biodiesel	18,220	28,244	91,649	260,606	[c]
Other	0	0	2	2	2
Subtotal	**421,161**	**456,766**	**512,427**	**678,409**	[c]
Oxygenates					
MTBE[d]	2,368,400	1,877,300	1,654,500	435,000	618,000
Ethanol in gasohol	1,919,572	2,414,167	2,756,663	3,729,168	4,694,304
Total	**4,709,133**	**4,748,243**	**4,923,590**	**4,842,577**	[c]

Source:
U.S. Department of Energy, Energy Information Administration, *Alternatives to Traditional Transportation Fuels, 2007*, Washington, DC, April 2009, Web site www.eia.doe.gov/cneaf/alternate/page/atftables/afvtransfuel_II.html, C1. (Additional resources: www.eia.doe.gov)

[a] Consumption includes gasoline portion of the mixture.
[b] Vehicle consumption only; does not include power plant inputs.
[c] Data are not available.
[d] Methyl Tertiary Butyl Ether. This category includes a very small amount of other ethers, primarily Tertiary Amyl Methyl Ether (TAME) and Ethyl Tertiary Butyl Ether (ETBE).

Ethanol is used as an oxygenate, blended with gasoline to be used as gasohol in conventional vehicles. The amount of ethanol used in gasohol dwarfs the amount used in E85. Production of E95 ended in 2000.

Table 2.4
Ethanol Consumption, 1995–2007
(thousand gallons)

	Ethanol blends			
	E85	E95	Ethanol in gasohol	Total
1995	166	970	934,615	935,751
2000	10,530	12	1,114,313	1,124,855
2001	12,756	0	1,173,323	1,186,079
2002	15,513	0	1,450,721	1,466,234
2003	26,376	0	1,919,572	1,945,948
2004	31,581	0	2,414,167	2,445,748
2005	38,074	0	2,756,663	2,794,737
2006	44,041	0	3,729,168	3,773,209
2007	54,091	0	4,694,304	4,748,395
2007 Percentage	1.1%	0.0%	98.9%	0.0%

Source:
U.S. Department of Energy, Energy Information Administration, *Alternatives to Traditional Transportation Fuels, 2007* , Washington, DC, April 2009, Web site: http://www.eia.doe.gov/cneaf/alternate/page/atftables/afvtransfuel_II.html, Table C1. (Additional resources: www.eia.doe.gov)

Note: Gallons of E85, E95 and Ethanol in gasohol, do not include the gasoline portion of the blended fuel.

As data about alternative fuel use become available, an attempt is made to incorporate them into this table. Sometimes assumptions must be made in order to use the data. Please see Appendix A for a description of the methodology used to develop these data. See Table 1.16 for transportation petroleum use in thousand barrels per day.

Table 2.5
Domestic Consumption of Transportation Energy by Mode and Fuel Type, 2007[a]
(trillion Btu)

	Gasoline	Diesel fuel	Liquified petroleum gas	Jet fuel	Residual fuel oil	Natural gas	Electricity	Total
HIGHWAY	**17,022.5**	**5,288.9**	**62.4**			**18.4**	**0.6**	**22,392.7**
Light vehicles	**16,485.5**	**394.5**	**44.9**					**16,924.9**
Cars	9,166.6	51.6						9,218.2
Light trucks[b]	7,288.5	343.0	44.9					7,676.4
Motorcycles	30.3							30.3
Buses	**6.9**	**167.7**				**18.4**	**0.6**	**193.7**
Transit	0.3	71.8				18.4	0.6	91.2
Intercity		29.7						29.7
School	6.6	66.2						72.8
Medium/heavy trucks	**530.1**	**4,726.6**	**17.5**					**5,274.2**
NONHIGHWAY	**241.7**	**930.9**	**0.0**	**2,470.5**	**1,012.1**	**642.2**	**312.1**	**5,609.5**
Air	**38.9**	**0.0**	**0.0**	**2,470.5**	**0.0**	**0.0**	**0.0**	**2,509.5**
General aviation	38.9			204.7				243.6
Domestic air carriers				1,847.0				1,847.0
International air carriers[c]				418.8				418.8
Water	**202.7**	**344.2**			**1,012.1**			**1,559.1**
Freight		299.6			1,012.1			1,311.7
Recreational	202.7	44.6						247.3
Pipeline	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**642.2**	**241.3**	**883.5**
Rail	**0.0**	**586.7**	**0.0**	**0.0**	**0.0**	**0.0**	**70.8**	**657.5**
Freight (Class I)		566.9						566.9
Passenger		19.8					70.8	90.5
Transit		0.0					46.6	46.6
Commuter		11.2					18.2	29.4
Intercity		8.6					6.0	14.5
TOTAL HWY & NONHWY	**17,264.1**	**6,219.7**	**62.4**	**2,470.5**	**1,012.1**	**660.6**	**312.7**	**28,002.2**

Source:
See Appendix A for Energy Use Sources.

[a] Civilian consumption only. Totals may not include all possible uses of fuels for transportation (e.g., snowmobiles).
[b] Two-axle, four-tire trucks.
[c] One half of fuel used by domestic carriers in international operation.

Highway vehicles were responsible for 80% of all transportation energy use in 2007. See Table 1.16 for transportation energy use in thousand barrels per day.

Table 2.6
Transportation Energy Use by Mode, 2006–2007[a]

	Trillion Btu		Percentage of total based on Btus	
	2006	2007	2006	2007
HIGHWAY	**22,283.5**	**22,392.7**	**80.3%**	**80.0%**
Light vehicles	**16,892.6**	**16,924.9**	**60.9%**	**60.4%**
Cars	9,315.7	9,218.2	33.6%	32.9%
Light trucks[b]	7,549.3	7,676.4	27.2%	27.4%
Motorcycles	27.6	30.3	0.1%	0.1%
Buses	**197.0**	**193.7**	**0.7%**	**0.7%**
Transit	98.0	91.2	0.4%	0.3%
Intercity	28.9	29.7	0.1%	0.1%
School	70.8	72.8	0.3%	0.3%
Medium/heavy trucks	**5,193.4**	**5,274.2**	**18.7%**	**18.8%**
NONHIGHWAY	**5,474.8**	**5,609.5**	**19.7%**	**20.0%**
Air	**2,511.3**	**2,509.5**	**9.0%**	**9.0%**
General aviation	256.3	243.6	0.9%	0.9%
Domestic air carriers	1,848.7	1,847.0	6.7%	6.6%
International air	406.2	418.8	1.5%	1.5%
Water	**1,451.8**	**1,559.1**	**5.2%**	**5.6%**
Freight	1,204.3	1,311.7	4.3%	4.7%
Recreational	247.5	247.3	0.9%	0.9%
Pipeline	**841.8**	**883.5**	**3.0%**	**3.2%**
Rail	**670.0**	**657.5**	**2.4%**	**2.3%**
Freight (Class I)	584.5	566.9	2.1%	2.0%
Passenger	85.4	90.5	0.3%	0.3%
Transit	44.9	46.6	0.2%	0.2%
Commuter	26.3	29.4	0.1%	0.1%
Intercity	14.3	14.5	0.1%	0.1%
HWY & NONHWY TOTAL	**27,758.4**	**28,002.2**	**100.0%**	**100.0%**

Source:
See Appendix A for Energy Use Sources.

[a] Civilian consumption only. Totals may not include all possible uses of fuels for transportation (e.g., snowmobiles).
[b] Two-axle, four-tire trucks.

The highway sector is by far the largest part of transportation energy use. Light truck energy use has increased at the greatest rate, due to their increased use as personal passenger vehicles. Light trucks include pick-ups, minivans, sport-utility vehicles, and vans. See Table 1.14 for highway petroleum use in thousand barrels per day.

Table 2.7
Highway Transportation Energy Consumption by Mode, 1970–2007
(trillion Btu)

Year	Cars	Light trucks	Light vehicles subtotal	Motor-cycles	Buses	Heavy trucks	Highway subtotal	Total transportation[a]
1970	8,479	1,539	10,018	7	129	1,553	11,707	15,399
1975	9,298	2,384	11,682	14	124	2,003	13,823	17,427
1980	8,800	2,975	11,775	26	143	2,686	14,630	18,944
1981	8,693	2,963	11,656	27	145	2,724	14,552	18,744
1982	8,673	2,837	11,510	25	151	2,707	14,393	18,241
1983	8,802	2,989	11,791	22	152	2,770	14,735	18,371
1984	8,837	3,197	12,034	22	146	2,873	15,075	19,966
1985	8,932	3,413	12,345	23	153	2,883	15,405	19,208
1986	9,138	3,629	12,767	23	160	2,958	15,908	20,280
1987	9,157	3,819	12,976	24	164	3,061	16,225	20,775
1988	9,158	4,077	13,235	25	169	3,118	16,547	21,330
1989	9,232	4,156	13,388	26	169	3,199	16,782	21,688
1990	8,688	4,451	13,139	24	167	3,334	16,664	21,616
1991	8,029	4,774	12,803	23	177	3,402	16,405	21,208
1992	8,169	5,117	13,286	24	184	3,468	16,962	21,869
1993	8,368	5,356	13,724	25	183	3,577	17,509	22,324
1994	8,470	5,515	13,985	26	183	3,778	17,972	22,928
1995	8,489	5,695	14,184	25	184	3,937	18,330	23,467
1996	8,634	5,917	14,551	24	186	4,045	18,806	23,975
1997	8,710	6,168	14,878	25	192	4,086	19,181	24,329
1998	8,936	6,303	15,239	26	196	4,218	19,679	24,758
1999	9,134	6,602	15,736	26	202	4,638	20,602	25,948
2000	9,100	6,607	15,707	26	208	4,819	20,760	26,269
2001	9,161	6,678	15,839	24	196	4,813	20,872	25,960
2002	9,391	6,682	16,273	24	191	5,035	21,523	26,520
2003	9,255	7,551	16,806	24	189	4,895	21,914	26,673
2004	9,331	7,861	17,192	25	193	4,535	21,945	27,066
2005	9,579	7,296	16,875	24	195	5,088	22,182	27,526
2006	9,316	7,549	16,865	28	198	5,193	22,284	27,759
2007	9,218	7,676	16,895	30	194	5,274	22,393	28,002
				Average annual percentage change				
1970–2007	0.2%	4.4%	1.4%	4.0%	1.1%	3.4%	1.8%	1.6%
1997–2007	0.6%	2.2%	1.3%	1.8%	0.1%	2.6%	1.6%	1.4%

Source:
See Appendix A for Highway Energy Use.

Note: Totals may not add due to rounding.

[a] Total transportation figures do not include military and off-highway energy use and may not include all possible uses of fuel for transportation (e.g., snowmobiles). These data have been revised due to a new data series for recreational boats.

About 20% of transportation energy use is for nonhighway modes. Air travel accounts for nearly half of nonhighway energy use. See Table 1.15 for nonhighway petroleum use in thousand barrels per day.

Table 2.8
Nonhighway Transportation Energy Consumption by Mode, 1970–2007
(trillion Btu)

Year	Air	Water	Pipeline	Rail	Nonhighway subtotal	Total transportation[a]
1970	1,307	840	990	555	3,692	15,399
1975	1,274	931	840	559	3,604	17,427
1980	1,434	1,396	896	588	4,314	18,944
1981	1,453	1,273	904	561	4,192	18,744
1982	1,445	1,067	855	481	3,848	18,241
1983	1,440	1,978	740	478	3,636	18,371
1984	1,609	1,968	782	532	3,891	19,966
1985	1,677	1,874	755	498	3,804	19,208
1986	1,823	1,327	735	487	4,372	20,280
1987	1,899	1,382	772	498	4,550	20,775
1988	1,978	1,421	874	511	4,783	21,330
1989	1,981	1,520	890	515	4,906	21,688
1990	2,077	1,445	923	506	4,952	21,616
1991	1,939	1,526	860	478	4,803	21,208
1992	1,970	1,602	846	490	4,907	21,869
1993	1,986	1,440	885	505	4,815	22,324
1994	2,070	1,396	951	539	4,956	22,928
1995	2,141	1,470	967	559	5,137	23,467
1996	2,206	1,412	979	572	5,169	23,975
1997	2,300	1,252	1,022	574	5,148	24,329
1998	2,371	1,233	897	578	5,079	24,758
1999	2,471	1,369	908	599	5,346	25,948
2000	2,549	1,455	904	601	5,509	26,269
2001	2,411	1,188	886	603	5,088	25,960
2002	2,213	1,249	931	605	4,997	26,520
2003	2,217	1,075	850	617	4,759	26,673
2004	2,348	1,300	822	650	5,121	27,066
2005	2,477	1,369	842	657	5,344	27,526
2006	2,511	1,452	842	670	5,475	27,759
2007	2,509	1,559	883	657	5,609	28,002
			Average annual percentage change			
1970–2007	1.8%	1.7%	-0.3%	0.5%	1.1%	1.6%
1997–2007	0.9%	2.2%	-1.5%	1.4%	0.9%	1.4%

Source:
See Appendix A for Nonhighway Energy Use.

Note: Totals may not add due to rounding.

[a] Total transportation figures do not include military and off-highway energy use and may not include all possible uses of fuel for transportation (e.g., snowmobiles).

A recent study on off-highway fuel consumption uses the Environmental Protection Agency's NONROAD2002 model and the Census Bureau's 1997 Vehicle Inventory and Use Survey to estimate fuel use.

Table 2.9
Off-highway Transportation-related Fuel Consumption, 1997 and 2001
(million gallons)

	1997				2001			
Sector	Gasoline	Diesel	Other	Total	Gasoline	Diesel	Other	Total
Agriculture	319	2,994	5	3,318	338	3,352	4	3,694
Industrial and commercial	1,761	1,579	1,854	5,193	1,733	1,794	2,108	5,636
Construction	289	4,766	18	5,073	274	5,347	19	5,639
Personal and recreational	3,425	37	7	3,469	3,524	42	7	3,573
Other	2	48	2	52	2	61	2	65
Total	5,797	9,424	1,885	17,106	5,870	10,596	2,141	18,607

Examples of off-highway transportation-related vehicles and equipment	
Agriculture	Tractors, mowers, combines, balers, and other farm equipment which has utility in its movement.
Industrial and commercial	Forklifts, commercial mowers, forestry equipment, shredders, terminal tractors
Construction	Pavers, rollers, drill rigs, graders, backhoes, excavators, cranes, mining equipment
Personal and recreational	Lawn mowers, tillers, tractors, motorcycles, snowmobiles, golf carts
Other	Airport ground equipment

Source:
Davis, S.C. and L.F. Truett, Off-Highway Transportation-Related Fuel Use, ORNL/TM-2002/92, Oak Ridge National Laboratory, Oak Ridge, TN, April 2004. (Additional resources: www-cta.ornl.gov/Publications/Publications_2004.html)

Mowing equipment consumes nearly half of all the fuel used by lawn and garden equipment. The gasoline used in lawn and garden equipment is 1.8% of total gasoline use.

Table 2.10
Fuel Consumption from Lawn and Garden Equipment, 2007
(million gallons)

Equipment	Classification	Gasoline	Diesel	LPG	Total fuel consumption
Mowing Equipment					
Front mowers	Commercial	19.30	98.67	0.00	117.97
Lawn & garden tractors	Commercial	217.97	20.37	0.00	238.34
Lawn & garden tractors	Residential	524.19	0.00	0.00	524.19
Lawn mowers	Commercial	146.73	0.00	0.00	146.73
Lawn mowers	Residential	198.36	0.00	0.00	198.36
Rear engine riding mowers	Commercial	16.03	0.00	0.00	16.03
Rear engine riding mowers	Residential	38.91	0.00	0.00	38.91
Total		**1,161.49**	**119.04**	**0.00**	**1,280.53**
Soil and Turf Equipment					
Commercial turf equipment[a]	Commercial	700.24	15.83	0.00	716.07
Rotary tillers < 6 HP	Commercial	82.28	0.00	0.00	82.28
Rotary tillers < 6 HP	Residential	18.21	0.00	0.00	18.21
Total		**800.73**	**15.83**	**0.00**	**816.56**
Wood Cutting Equipment					
Chain saws < 6 HP	Commercial	70.99	0.00	0.00	70.99
Chain saws < 6 HP	Residential	18.04	0.00	0.00	18.04
Chippers/stump grinders	Commercial	37.71	134.27	19.09	191.07
Shredders < 6 HP	Commercial	8.79	0.00	0.00	8.79
Total		**135.54**	**134.27**	**19.09**	**288.89**
Blowers and Vacuums					
Leafblowers/vacuums	Commercial	197.33	0.01	0.00	197.34
Leafblowers/vacuums	Residential	18.23	0.00	0.00	18.23
Snowblowers	Commercial	31.26	1.75	0.00	33.01
Snowblowers	Residential	16.55	0.00	0.00	16.55
Total		**263.37**	**1.76**	**0.00**	**265.13**
Trimming Equipment					
Trimmers/edgers/brush cutter	Commercial	60.10	0.00	0.00	60.10
Trimmers/edgers/brush cutter	Residential	26.13	0.00	0.00	26.13
Other lawn & garden equipment[b]	Commercial	22.73	0.37	0.00	23.10
Other lawn & garden equipment[b]	Residential	19.05	0.00	0.00	19.05
Total		**128.00**	**0.37**	**0.00**	**128.37**
Total All Equipment		**2,489.12**	**271.28**	**19.09**	**2,779.49**

Source:
U.S. Environmental Protection Agency, NONROAD2005 Model, www.epa.gov/otaq/nonrdmdl.htm.

[a] Includes equipment such as aerators, dethatchers, sod cutters, hydro-seeders, turf utility vehicles, golf course greens mowers, and sand trap groomers.
[b] Includes equipment not otherwise classified such as augers, sickle-bar mowers, and wood splitters.

The Federal Highway Administration (FHWA) cautions that data from 1993 on may not be directly comparable to earlier years. Some states have improved reporting procedures in recent years, and the estimation procedures were revised in 1994. The definition of gasohol was expanded in 1993 to include blends that are less than 10%. Now, the FHWA does not publish separate estimates of gasohol or ethanol used in gasohol. See Table 2.3 for details on oxygenate usage.

Table 2.11
Highway Usage of Gasoline and Special Fuels, 1973–2007
(billion gallons)

Year	Gasoline	Gasohol	Ethanol used in gasohol[a]	Total gasoline and gasohol	Diesel[b]	Percent diesel	Total highway fuel use
1973	[c]	[c]	[c]	100.6	9.8	8.9%	110.5
1975	[c]	[c]	[c]	99.4	9.6	8.8%	109.0
1980	100.7	0.5	0.0	101.2	13.8	12.0%	115.0
1981	98.9	0.7	0.1	99.6	14.9	13.0%	114.5
1982	96.2	2.3	0.2	98.5	14.9	13.1%	113.4
1983	95.9	4.3	0.4	100.1	16.0	13.8%	116.1
1984	96.0	5.4	0.5	101.4	17.3	14.6%	118.7
1985	95.6	8.0	0.8	103.6	17.8	14.6%	121.3
1986	98.6	8.1	0.8	106.8	18.4	14.7%	125.2
1987	101.8	6.9	0.8	108.7	19.0	14.9%	127.7
1988	101.7	8.1	0.8	109.8	20.1	15.5%	129.9
1989	103.7	6.9	0.7	110.6	21.2	16.1%	131.9
1990	102.6	7.5	0.8	110.2	21.4	16.3%	131.6
1991	99.3	8.6	0.9	107.9	20.7	16.1%	128.6
1992	102.1	8.8	0.9	111.0	22.0	16.5%	132.9
1993	103.4	10.3	1.0	113.7	23.5	17.1%	137.2
1994	104.0	11.0	1.0	115.0	25.1	17.9%	140.1
1995	104.0	13.1	1.2	117.1	26.2	18.3%	143.3
1996	107.4	12.1	1.1	119.5	27.2	18.5%	146.7
1997	106.2	14.7	1.3	120.9	29.4	19.6%	150.3
1998	110.7	14.0	1.3	124.7	30.2	19.5%	154.9
1999	114.6	14.2	1.3	128.7	31.9	19.9%	160.7
2000	112.6	16.3	1.5	128.9	33.4	20.6%	162.3
2001	112.3	17.4	1.5	129.7	33.4	20.5%	163.1
2002	112.0	21.0	2.1	133.0	34.8	20.7%	167.8
2003	101.5	32.5	2.7	134.1	35.5	20.9%	169.6
2004	92.4	44.0	3.7	136.5	37.4	21.5%	173.9
2005	[d]	[d]	[d]	135.2	39.1	22.4%	174.3
2006	[d]	[d]	[d]	134.8	40.1	22.9%	174.9
2007	[d]	[d]	[d]	135.4	40.7	23.1%	176.1
				Average annual percentage change			
1973–2007	[d]	[d]	[d]	0.9%	4.3%		1.4%
1997–2007	[d]	[d]	[d]	1.1%	3.3%		1.6%

Source:
U.S. Department of Transportation, Federal Highway Administration, *Highway Statistics 2007*, Washington, DC, 2008, Table MF-21 and annual. (Additional resources: www.fhwa.dot.gov)

[a] Estimated for 1980–92 and 2002 as 10% of gasohol consumption.
[b] Consists primarily of diesel fuel, with small quantities of liquified petroleum gas.
[c] Data for gasoline and gasohol cannot be separated in this year.
[d] Gasohol data is no longer published by the Federal Highway Administration.

Great care should be taken when comparing modal energy intensity data among modes. Because of the inherent differences among the transportation modes in the nature of services, routes available, and many additional factors, it is not possible to obtain truly comparable national energy intensities among modes. These values are averages, and there is a great deal of variability even within a mode.

Table 2.12
Passenger Travel and Energy Use, 2007

					Energy intensities		
	Number of vehicles (thousands)	Vehicle-miles (millions)	Passenger-miles (millions)	Load factor (persons/ vehicle)	(Btu per vehicle-mile)	(Btu per passenger-mile)	Energy use (trillion Btu)
Cars	**135,932.9**	**1,670,994**	**2,623,461**	**1.57**	**5,517**	**3,514**	**9,218.2**
Personal trucks	**89,286.4**	**928,755**	**1,597,459**	**1.72**	**6,788**	**3,946**	**6,304.0**
Motorcycles	**7,183.5**	**13,612**	**16,334**	**1.2**	**2,224**	**1,853**	**30.3**
Demand response [a]	**64.9**	**1,471**	**1,502**	**1.0**	**16,771**	**16,429**	**24.7**
Buses	[b]	[b]	[b]	[b]	[b]	[b]	**193.7**
Transit	65.8	2,314	21,132	9.1	39,408	4,315	91.2
Intercity [c]	[b]	[b]	[b]	[b]	[b]	[b]	29.7
School [c]	677.2	[b]	[b]	[b]	[b]	[b]	72.8
Air	[b]	[b]	[b]	[b]	[b]	[b]	**2,090.7**
Certificated route[e]	[b]	6,122	595,327	**97.2**	**301,684**	3,103	1,847.0
General aviation	231.6	[b]	[b]	[b]	[b]	[b]	243.6
Recreational boats	**13,078.0**	[b]	[b]	[b]	[b]	[b]	**247.3**
Rail	**19.7**	**1,333**	**35,007**	**26.3**	**67,900**	**2,586**	**90.5**
Intercity (Amtrak)	0.3	267	5,784	21.7	54,585	2,516	14.5
Transit (light & heavy)	13.0	741	18,070	24.4	62,833	2,577	46.6
Commuter	6.4	326	11,153	34.2	90,328	2,638	29.4

Source:
See Appendix A for Passenger Travel and Energy Use.

[a] Includes passenger cars, vans, and small buses operating in response to calls from passengers to the transit operator who dispatches the vehicles.

[b] Data are not available.

[c] Energy use is estimated.

[d] Only domestic service and domestic energy use are shown on this table. (Previous editions included half of international energy.) These energy intensities may be inflated because all energy use is attributed to passengers–cargo energy use is not taken into account.

Great care should be taken when comparing modal energy intensity data among modes. Because of the inherent differences among the transportation modes in the nature of services, routes available, and many additional factors, it is not possible to obtain truly comparable national energy intensities among modes. These values are averages, and there is a great deal of variability even within a mode.

Table 2.13
Energy Intensities of Highway Passenger Modes, 1970–2007

	Cars		Light truck[a]	Transit Buses[b]	
Year	(Btu per vehicle-mile)	(Btu per passenger-mile)	(Btu per vehicle-mile)	(Btu per vehicle-mile)	(Btu per passenger-mile)
1970	9,250	4,868	12,479	31,796	2,472
1975	8,993	4,733	11,879	33,748	2,814
1976	9,113	4,796	11,523	34,598	2,896
1977	8,950	4,710	11,160	35,120	2,889
1978	8,839	4,693	10,807	36,603	2,883
1979	8,647	4,632	10,467	36,597	2,795
1980	7,916	4,279	10,224	36,553	2,813
1981	7,670	4,184	9,997	37,745	3,027
1982	7,465	4,109	9,268	38,766	3,237
1983	7,365	4,092	9,124	37,962	3,177
1984	7,202	4,066	8,931	38,705	3,307
1985	7,164	4,110	8,730	38,876	3,423
1986	7,194	4,197	8,560	37,889	3,545
1987	6,959	4,128	8,359	36,247	3,594
1988	6,683	4,033	8,119	36,673	3,706
1989	6,589	4,046	7,746	36,754	3,732
1990	6,169	3,856	7,746	37,374	3,794
1991	5,912	3,695	7,351	37,732	3,877
1992	5,956	3,723	7,239	40,243	4,310
1993	6,087	3,804	7,182	39,043	4,262
1994	6,024	3,765	7,212	37,246	4,261
1995	5,902	3,689	7,208	37,209	4,302
1996	5,874	3,683	7,247	37,404	4,334
1997	5,797	3,646	7,251	38,778	4,425
1998	5,767	3,638	7,260	41,157	4,384
1999	5,821	3,684	7,327	40,414	4,327
2000	5,687	3,611	7,158	41,491	4,509
2001	5,626	3,583	7,080	38,295	4,120
2002	5,662	3,607	7,124	37,246	4,100
2003	5,535	3,525	7,673	36,731	4,171
2004	5,489	3,496	7,653	37,452	4,318
2005	5,607	3,571	7,009	36,990	4,200
2006	5,511	3,510	6,974	39,049	4,259
2007	5,517	3,514	6,908	39,408	4,315
		Average annual percentage change			
1970–2007	-1.4%	-0.9%	-1.6%	0.4%	1.4%
1997–2007	-0.5%	-0.4%	-0.5%	0.2%	-0.6%

Source:
See Appendix A for Highway Passenger Mode Energy Intensities.

[a] All two-axle, four-tire trucks.
[b] Series not continuous between 1983 and 1984 because of a change in data source by the American Public Transportation Association (APTA).
[c] Data are not available.

Great care should be taken when comparing modal energy intensity data among modes. Because of the inherent differences between the transportation modes in the nature of services, routes available, and many additional factors, it is not possible to obtain truly comparable national energy intensities among modes.

Table 2.14
Energy Intensities of Nonhighway Passenger Modes, 1970–2007

	Air	Rail		
Year	Certificated air carriers[a] (Btu per passenger-mile)	Intercity Amtrak (Btu per passenger-mile)	Rail transit (Btu per passenger-mile)	Commuter rail (Btu per passenger-mile
1970	10,115	[b]	2,157	[b]
1975	7,625	3,548	2,625	[b]
1976	7,282	3,278	2,633	[b]
1977	6,990	3,443	2,364	[b]
1978	6,144	3,554	2,144	[b]
1979	5,607	3,351	2,290	[b]
1980	5,561	3,065	2,312	[b]
1981	5,774	2,883	2,592	[b]
1982	5,412	3,052	2,699	[b]
1983	5,133	2,875	2,820	[b]
1984	5,298	2,923	3,037	2,804
1985	5,053	2,703	2,809	2,826
1986	5,011	2,481	3,042	2,926
1987	4,827	2,450	3,039	2,801
1988	4,861	2,379	3,072	2,872
1989	4,844	2,614	2,909	2,864
1990	4,875	2,505	3,024	2,822
1991	4,662	2,417	3,254	2,770
1992	4,516	2,534	3,155	2,629
1993	4,490	2,565	3,373	2,976
1994	4,397	2,282	3,338	2,682
1995	4,349	2,501	3,340	2,632
1996	4,172	2,690	3,017	2,582
1997	4,166	2,811	2,856	2,724
1998	4,146	2,788	2,823	2,646
1999	4,061	2,943	2,785	2,714
2000	3,952	3,235	2,797	2,551
2001	3,968	3,257	2,803	2,515
2002	3,703	3,212	2,872	2,514
2003	3,587	2,800	2,837	2,545
2004	3,339	2,760	2,750	2,569
2005	3,264	2,709	2,783	2,743
2006	3,250	2,650	2,707	2,527
2007	3,153	2,516	2,577	2,638
		Average annual percentage change[c]		
1970–2007	-3.1%	-1.1%	0.5%	-0.3%
1997–2007	-2.7%	-1.1%	-1.0%	-0.3%

Source:
See Appendix A for Nonhighway Passenger Mode Energy Intensities.

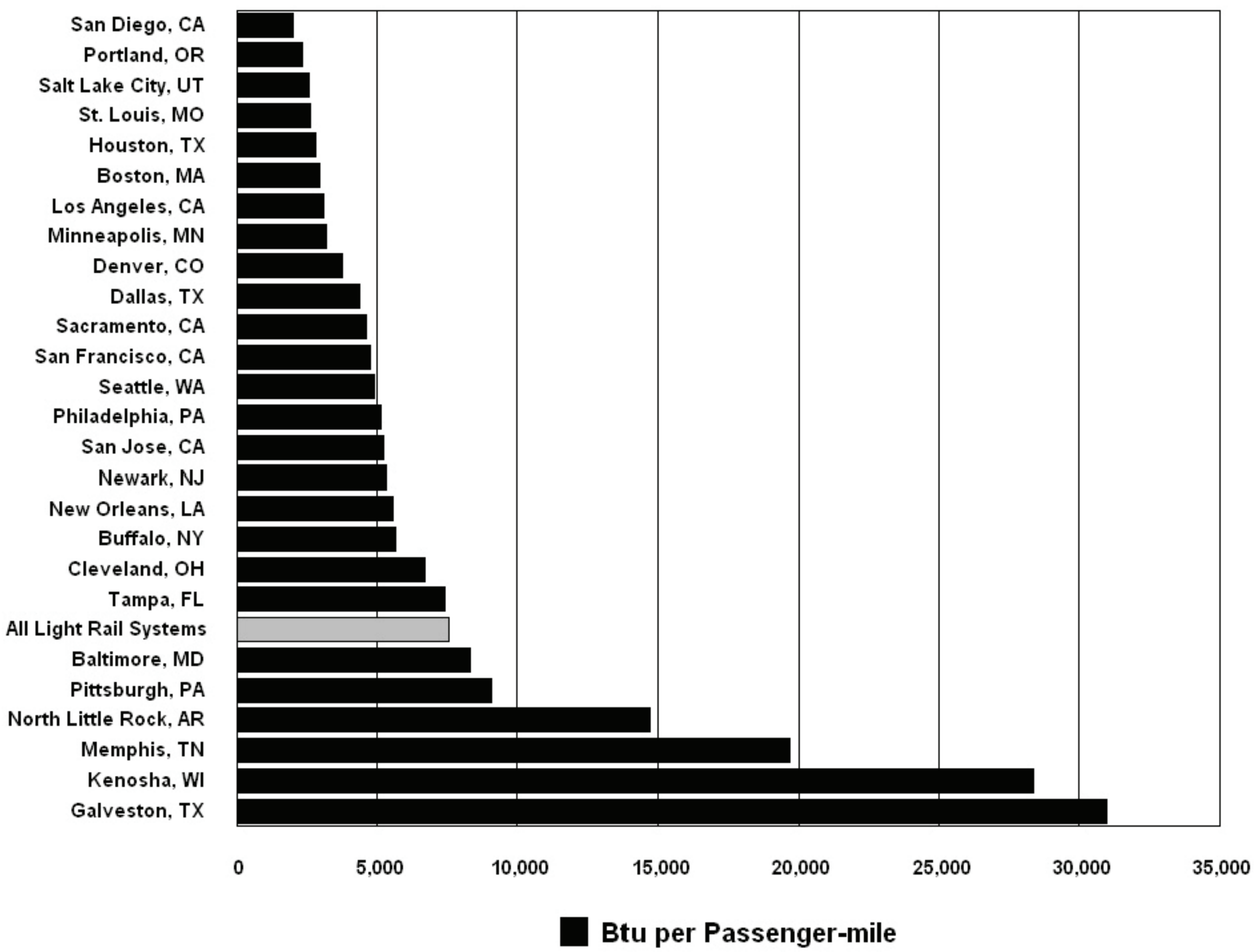
[a] These data differ from the data on Table 2.12 because they do not include any international services. These energy intensities may be inflated because all energy use is attributed to passengers–cargo energy use is not taken into account.

[b] Data are not available.

[c] Average Annual Percent calculated to latest year possible.

The energy intensity of light rail systems, measured in btu per passenger-mile varies greatly. The average of all light rail systems in 2007 is 7,605 btu/passenger-mile.

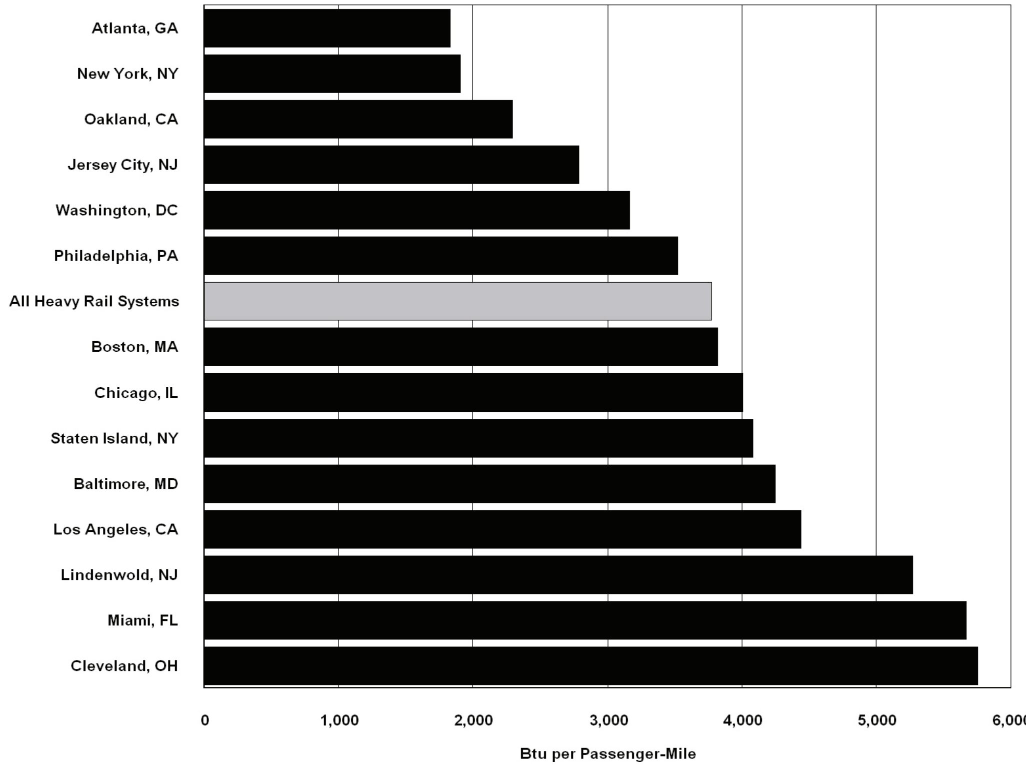
Figure 2.2. Energy Intensity of Light Rail Transit Systems, 2007



Source:

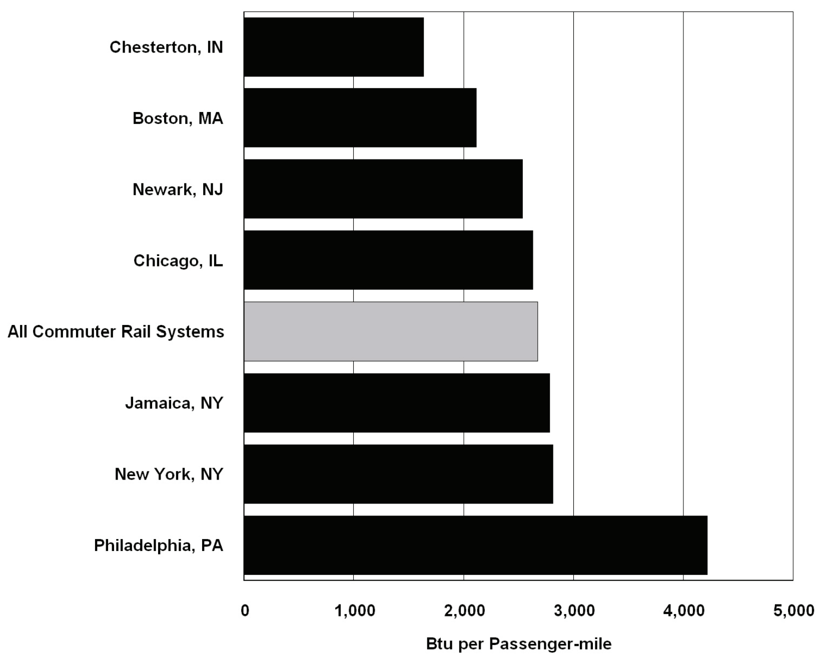
U.S. Department of Transportation, *National Transit Database*, April 2009. (Additional resources: http://204.68.195.57/ntdprogram/data.htm)

Figure 2.3. Energy Intensity of Heavy Rail Systems, 2007



Source:
U.S. Department of Transportation, *National Transit Database*, April 2009. (Additional resources: http://204.68.195.57/ntdprogram/data.htm)

Figure 2.4. Energy Intensity of Commuter Rail Systems, 2007



Source:
U.S. Department of Transportation, *National Transit Database*, April 2009. (Additional resources: http://204.68.195.57/ntdprogram/data.htm)

Great care should be taken when comparing modal energy intensity data among modes. Because of the inherent differences between the transportation modes in the nature of services, routes available, and many additional factors, it is not possible to obtain truly comparable national energy intensities among modes.

Table 2.15
Intercity Freight Movement and Energy Use in the United States, 2006 and 2007

	Waterborne commerce		Class I railroads	
	2006	2007[a]	2006	2007
Number of vehicles (thousands)	41	[a]	24[b]	24[b]
Ton-miles (billions)	562	[a]	1,772	1,771
Tons shipped (millions)	1,024	[a]	1,957	1,940
Average length of haul (miles)	549	[a]	906	913
Energy intensity (Btu/ton-mile)	571	[a]	330	320
Energy use (trillion Btu)	321	[a]	585	567

Source:
See Appendix A for Freight Movement and Energy Use.

[a] Not available.
[b] Number of locomotives.

Great care should be taken when comparing modal energy intensity data among modes. Because of the inherent differences between the transportation modes in the nature of services, routes available, and many additional factors, it is not possible to obtain truly comparable national energy intensities among modes.

Table 2.16
Energy Intensities of Freight Modes, 1970–2007

Year	Heavy single-unit and combination trucks (Btu per vehicle-mile)	Class I freight railroad (Btu per freight car-mile)	Class I freight railroad (Btu per ton-mile)	Domestic waterborne commerce (Btu per ton-mile)
1970	24,960	17,669	691	545
1971	24,485	18,171	717	506
1972	24,668	18,291	714	522
1973	24,777	18,468	677	576
1974	24,784	18,852	681	483
1975	24,631	18,739	687	549
1976	24,566	18,938	680	468
1977	24,669	19,226	669	458
1978	24,655	18,928	641	383
1979	24,745	19,188	618	436
1980	24,757	18,742	597	358
1981	25,058	18,629	572	360
1982	24,296	18,404	553	310
1983	23,852	17,864	525	286
1984	23,585	17,795	510	346
1985	23,343	17,500	497	446
1986	23,352	17,265	486	463
1987	22,922	16,790	456	414
1988	22,596	16,758	443	361
1989	22,411	16,894	437	403
1990	22,795	16,619	420	387
1991	22,749	15,835	391	386
1992	22,608	16,043	393	398
1993	22,373	16,056	389	389
1994	22,193	16,340	388	369
1995	22,096	15,992	372	374
1996	22,109	15,747	368	412
1997	21,340	15,784	370	415
1998	21,516	15,372	365	435
1999	22,884	15,363	363	457
2000	23,448	14,917	352	473
2001	23,023	15,108	346	460
2002	23,461	15,003	345	470
2003	22,461	15,016	344	418
2004	20,540	15,274	341	510
2005	22,866	15,152	337	513
2006	23,340	14,990	330	571
2007	23,238	14,846	320	[a]
		Average annual percentage change		
1970–2007	-0.2%	-0.5%	-2.1%	[a]
1997–2007	0.9%	-0.6%	-1.4%	[a]

Source:
See Appendix A for Freight Mode Energy Intensities.

[a] Data are not available.

Chapter 3
All Highway Vehicles and Characteristics

Summary Statistics from Tables in this Chapter

Source		
Table 3.1	U.S. share of world car registrations, 2007	21.0%
Table 3.2	U.S. share of world truck & bus registrations, 2007	42.6%
Table 3.3	Number of U.S. cars, 2007 (thousands)	135,222
Table 3.3	Number of U.S. trucks, 2007 (thousands)	113,479
Table 3.6	Vehicle miles traveled, 2007 (million miles)	3,029,821
	Cars	*55.2%*
	Two-axle, four-tire trucks	*36.7%*
	Combination trucks	*4.8%*
	Other single-unit trucks	*2.7%*
	Motorcycles	*0.4%*
	Buses	*0.2%*
Table 3.9	Median age of vehicles, 2007	
	Cars (years)	*9.4*
	All trucks (years)	*7.6*
	Light trucks (years)	*7.5*

The 1997 data in this series were never published. Use caution comparing historical data because of disconnects in data series, such as China in 1998. Also, the United States is unique in how many light trucks (SUVs, minivans, pickups) are used for personal travel. Those light trucks are not included on this table. The U.S. share of world cars has been declining since 1998.

Table 3.1
Car Registrations for Selected Countries, 1950–2007
(thousands)

Year	China	India	Japan	France	United Kingdom	Germany[a]	Canada[b]	United States[c]	U.S. percentage of world[c]	World total
1950	[d]	[d]	43	[d]	2,307	[d]	1,913	40,339	76.0%	53,051
1955	[d]	[d]	153	[d]	360	[d]	2,961	52,145	71.4%	73,036
1960	[d]	[d]	457	4,950	5,650	4,856	4,104	61,671	62.7%	98,305
1965	[d]	[d]	2,181	8,320	9,131	9,719	5,279	75,258	53.8%	139,776
1970	[d]	[d]	8,779	11,860	11,802	14,376	6,602	89,244	46.1%	193,479
1975	[d]	[d]	17,236	15,180	14,061	18,161	8,870	106,706	41.0%	260,201
1980	351	[d]	23,660	18,440	15,438	23,236	10,256	121,601	38.0%	320,390
1985	795	1,607	27,845	20,800	18,953	26,099	11,118	127,885	34.5%	370,504
1990	1,622	2,694	34,924	23,010	22,528	30,695	12,622	133,700	30.7%	435,050
1991	1,852	2,954	37,076	23,550	22,744	31,309	12,578	128,300	29.1%	441,377
1992	2,262	3,205	38,963	24,020	23,008	37,579	12,781	126,581	28.0%	452,311
1993	2,860	3,361	40,772	24,385	23,402	39,202	12,927	127,327	28.3%	450,473
1994	3,497	3,569	42,678	24,900	23,832	39,918	13,122	127,883	27.0%	473,487
1995	4,179	3,837	44,680	25,100	24,307	40,499	13,183	128,387	26.9%	477,010
1996	4,700	4,246	46,868	25,500	24,864	41,045	13,300	129,728	26.7%	485,954
1997					Data are not available.					
1998	2,940	4,820	49,896	26,800	22,115	41,674	13,887	131,839	27.5%	478,625
1999	3,400	5,200	51,164	27,480	27,539	42,423	16,538	126,869	26.7%	496,059
2000	3,750	5,150	52,437	28,060	27,185	43,772	16,832	127,721	23.3%	547,147
2001	4,325	5,750	53,300	28,700	27,790	44,383	17,055	128,714	22.9%	561,652
2002	4,950	6,945	54,540	29,160	28,484	44,657	17,544	129,907	22.5%	575,847
2003	6,789	6,669	55,213	29,560	29,008	44,023	17,755	130,800	22.1%	589,272
2004	7,900	7,300	55,994	29,900	29,378	45,376	17,290	132,823	22.0%	603,274
2005	8,900	7,654	57,091	30,100	30,652	46,090	18,124	132,909	21.5%	617,914
2006	11,000	8,100	57,521	30,250	30,995	41,020	18,739	135,047	21.4%	630,043
2007	13,758	8,595	57,624	30,550	31,225	41,184	19,199	135,222	21.0%	645,286
					Average annual percentage change					
1950–2007	[d]	[d]	13.5%	[d]	4.7%	[d]	4.1%	2.1%		4.5%
1970–2007	[d]	[d]	5.2%	2.6%	2.7%	2.9%	2.9%	1.1%		3.3%
1997–2007	10.3%	6.6%	1.9%	1.7%	2.1%	0.0%	3.4%	0.4%		2.6%

Source:
Ward's Communications, *Ward's World Motor Vehicle Data*, *2008 Edition*, Southfield, MI, 2008, pp. 239–242 and annual. (Additional resources: www.wardsauto.com)

[a] Data for 1991 and prior include West Germany only. Kraftwagen are included with cars.
[b] Data from 1991 and later are not comparable to prior data and data from 1999 and later are not comparable to prior data.
[c] Data from 1985 and later are not comparable to prior data.
[d] Data are not available.

The 1997 data in this series were never published. Use caution comparing historical data because of disconnects in data series, such as China in 1998. The United States totals include SUVs, minivans, and light trucks, many of which are used for personal travel.

Table 3.2
Truck and Bus Registrations for Selected Countries, 1950–2007
(thousands)

Year	China	India	Japan	France	United Kingdom	Germany[a]	Canada[b]	United States[c]	U.S. percentage of world[c]	World total
1950	[d]	[d]	183	[d]	1,060	[d]	643	8,823	50.9%	17,349
1955	[d]	[d]	318	[d]	1,244	[d]	952	10,544	46.1%	22,860
1960	[d]	[d]	896	1,540	1,534	786	1,056	12,186	42.6%	28,583
1965	[d]	[d]	4,119	1,770	1,748	1,021	1,232	15,100	39.6%	38,118
1970	[d]	[d]	8,803	1,850	1,769	1,228	1,481	19,175	36.2%	52,899
1975	811	[d]	10,854	2,210	1,934	1,337	2,158	26,243	38.8%	67,698
1980	1,480	[d]	14,197	2,550	1,920	1,617	2,955	34,195	37.7%	90,592
1985	2,402	1,045	18,313	3,310	3,278	1,723	3,149	43,804	37.4%	117,038
1990	4,496	1,536	22,773	4,748	3,774	1,989	3,931	55,097	37.2%	148,073
1995	6,221	2,221	22,173	5,195	3,635	3,062	3,485	73,143	43.1%	169,749
1996	6,750	2,506	21,933	5,255	3,621	3,122	3,515	76,637	41.3%	185,404
1997					Data are not available.					
1998	8,313	2,610	20,919	5,500	3,169	4,357	3,694	79,062	44.0%	179,498
1999	9,400	3,000	20,559	5,609	3,392	3,370	722[f]	86,640	46.9%	188,367
2000	9,650	2,390	20,211	5,753	3,361	3,534	739[f]	85,579	42.1%	203,273
2001	10,212	2,663	19,985	5,897	3,412	3,592	729[f]	87,969	42.5%	207,033
2002	10,500	3,535	17,714	5,984	3,487	3,568	724[f]	91,120	43.2%	210,776
2003	17,222	4,025	17,312	6,068	3,569	3,541	740[f]	95,262	42.5%	223,729
2004	19,800	4,190	17,012	6,139	3,696	3,540	745	98,576	42.2%	233,537
2005	21,750	4,415	16,734	6,198	3,943	3,133	786	104,788	42.6%	245,798
2006	24,000	4,850	16,731	6,230	4,041	2,766	841	109,596	42.8%	256,222
2007	26,336	5,327	16,505	6,297	4,164	2,837	872	113,477	42.6%	266,236
					Average annual percentage change					
1950–2007	[d]	[d]	8.2%	[d]	2.4%	[d]	0.5%	4.6%		4.9%
1970–2007	[d]	[d]	1.7%	3.4%	2.3%	2.3%	-1.4%	4.9%		4.5%
1997–2007	13.2%	7.1%	-2.6%	1.7%	1.3%	-0.9%	-11.9%	3.6%		3.3%

Source:
Ward's Communications, *Ward's World Motor Vehicle Data, 2008 Edition*, Southfield, MI, 2008, pp. 239–242 and annual. (Additional resources: www.wardsauto.com)

[a] Data for 1991 and prior include West Germany only. Kraftwagen are included with cars. Data from 1999 and later are not comparable to prior data.
[b] Data from 1991 and later are not comparable to prior data.
[c] Data from1985 and later are not comparable to prior data.
[d] Data are not available.
[e] Data not comparable to prior data due to reclassification of autos and trucks.
[f] Canada reclassified autos and trucks in 1999.

VEHICLES IN USE

Both the Federal Highway Administration (FHWA) and The Polk Company report figures on the car and truck population each year. The two estimates, however, differ by as much as 11.2% (1981). The differences can be attributed to several factors:

- The FHWA data include all vehicles which have been registered at any time throughout the calendar year. Therefore, the data include vehicles which were retired during the year and may double count vehicles which have been registered in different states or the same states to different owners. The Polk Company data include only those vehicles which are registered on July 1 of the given year.
- The classification of mini-vans, station wagons on truck chasses, and utility vehicles as cars or trucks causes important differences in the two estimates. The Polk Company data included passenger vans in the car count until 1980; since 1980 all vans have been counted as trucks. Recently, the Federal Highway Administration adjusted their definition of cars and trucks. Starting in 1993, some minivans and sport utility vehicles that were previously included with cars were included with trucks. This change produced a dramatic change in the individual percentage differences of cars and trucks. The difference in total vehicles has been less than 5% each year since 1990 and does not appear to be significantly affected by the FHWA reclassifications.
- The FHWA data include all non-military Federal vehicles, while The Polk Company data include only those Federal vehicles which are registered within a state. Federal vehicles are not required to have State registrations, and, according to the General Services Administration, most Federal Vehicles are not registered.

According to The Polk Company statistics, the number of cars in use in the United States declined from 1991 to 1992. This is the first decline in vehicle stock since the figures were first reported in 1924. However, the data should be viewed with caution. A redesign of Polk's approach in 1992 allowed a national check for duplicate registrations, which was not possible in earlier years. Polk estimates that, due to processing limitations, its vehicle population counts may have been inflated by as much as 1½ percent. Assuming that percentage is correct, the number of cars in use would have declined from 1991 to 1992 under the previous Polk method. The growing popularity of light trucks being used as passenger vehicles could also have had an impact on these figures.

In the early 1980's, researchers had to make a conscience choice of which data series to use, since they differed by as much as 16%. In 2007 the two sources differed by less than 1%.

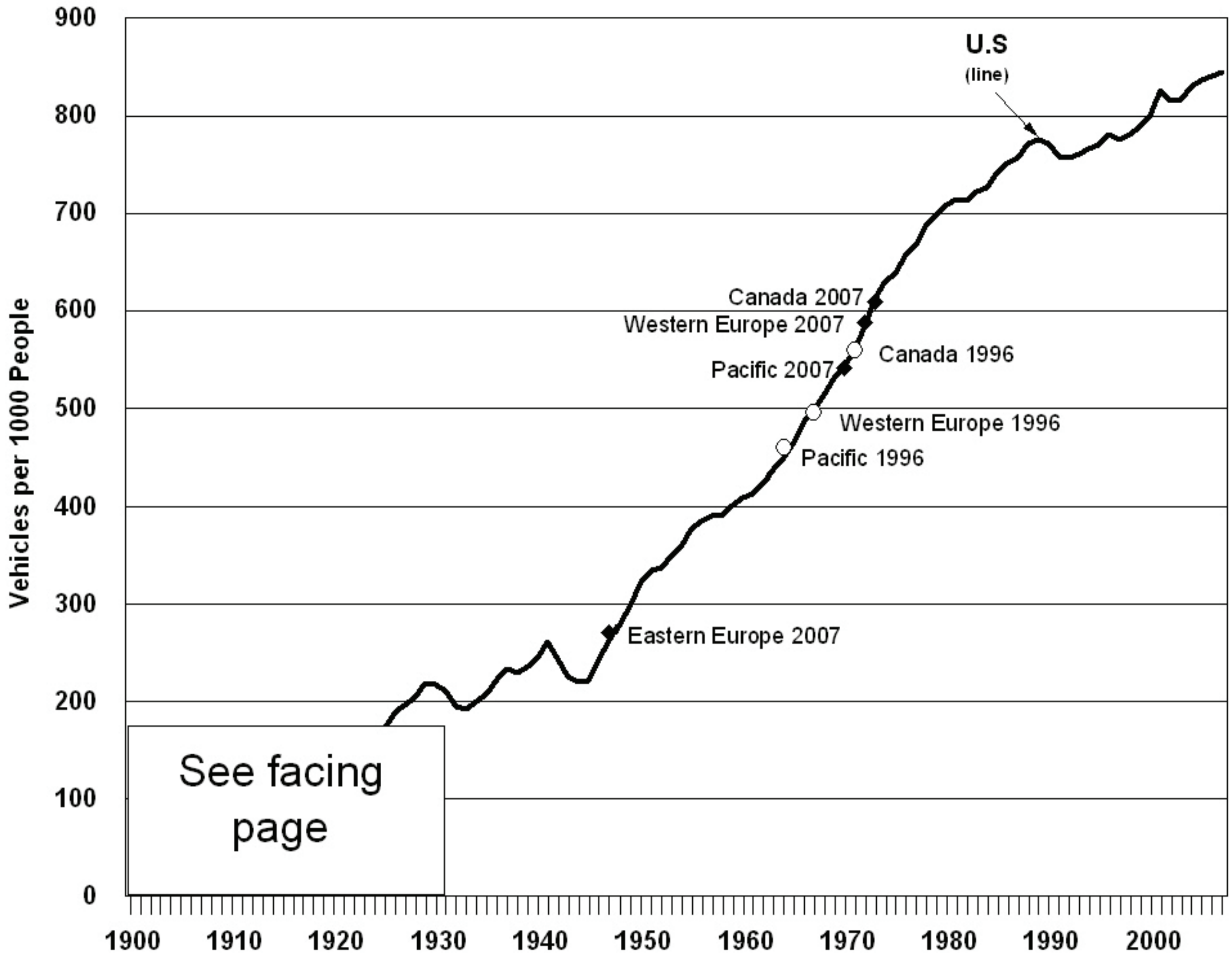
Table 3.3
U.S. Cars and Trucks in Use, 1970–2007
(thousands)

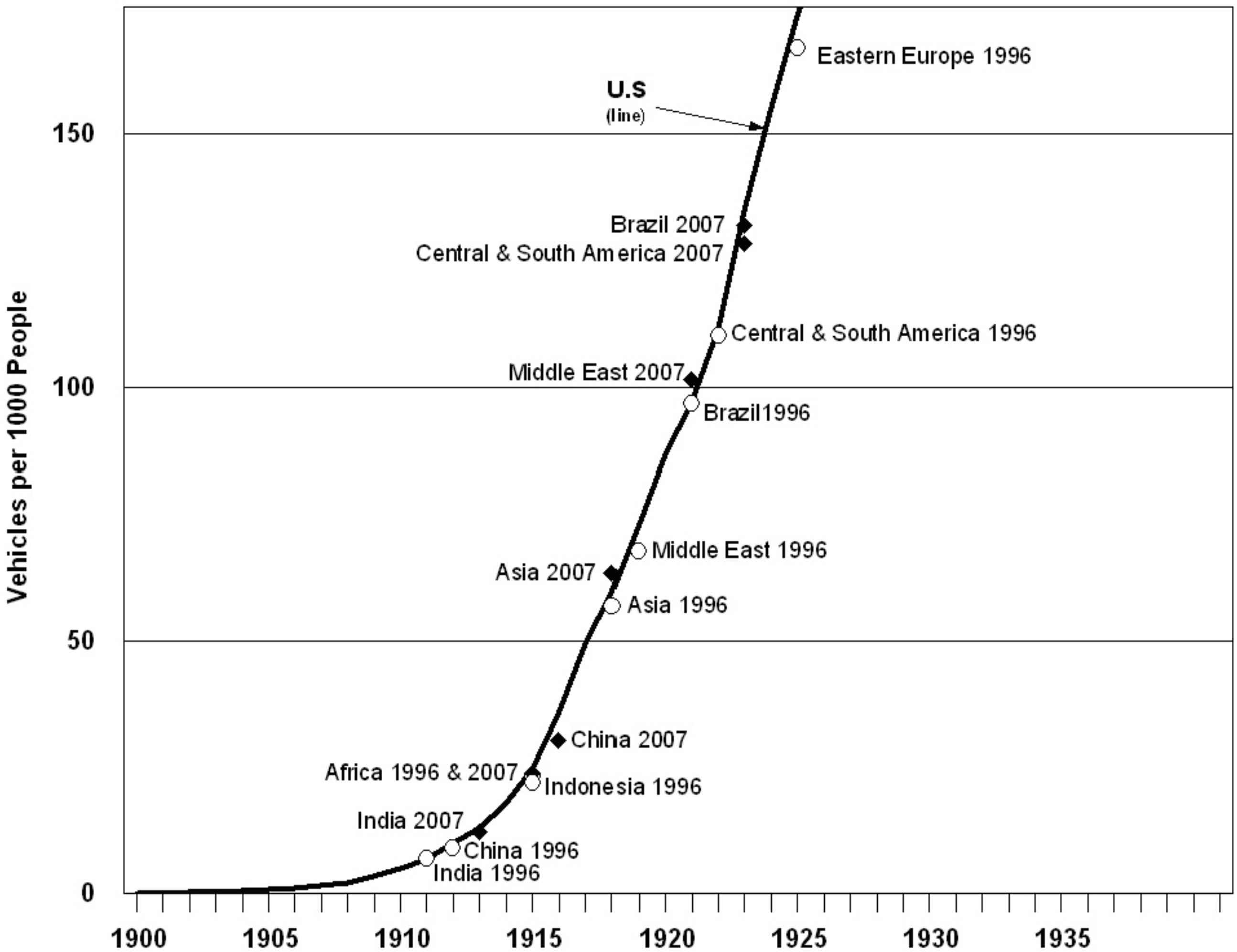
	Cars			Trucks			Total		
Year	FHWA	The Polk Company	Percentage difference	FHWA	The Polk Company	Percentage difference	FHWA	The Polk Company	Percentage difference
1970	89,243	80,448	10.9%	18,797	17,688	6.3%	108,040	98,136	10.1%
1975	106,706	95,241	12.0%	25,781	24,813	3.9%	132,487	120,054	10.4%
1980	121,601	104,564	16.3%	33,667	35,268	-4.5%	155,267	139,832	11.0%
1981	123,098	105,839	16.3%	34,644	36,069	-4.0%	157,743	141,908	11.2%
1982	123,702	106,867	15.8%	35,382	36,987	-4.3%	159,084	143,854	10.6%
1983	126,444	108,961	16.0%	36,723	38,143	-3.7%	163,166	147,104	10.9%
1984	128,158	112,019	14.4%	37,507	40,143	-6.6%	165,665	152,162	8.9%
1985	127,885	114,662	11.5%	43,210	42,387	1.9%	171,095	157,049	8.9%
1986	130,004	117,268	10.9%	45,103	44,826	0.6%	175,106	162,094	8.0%
1987	131,482	119,849	9.7%	46,826	47,344	-1.1%	178,308	167,193	6.6%
1988	133,836	121,519	10.1%	49,941	50,221	-0.6%	183,777	171,740	7.0%
1989	134,559	122,758	9.6%	52,172	53,202	-1.9%	186,731	175,960	6.1%
1990	133,700	123,276	8.5%	54,470	56,023	-2.8%	188,171	179,299	4.9%
1991	128,300	123,268	4.1%	59,206	58,179	1.8%	187,505	181,447	3.3%
1992	126,581	120,347	5.2%	63,136	61,172	3.2%	189,717	181,519	4.5%
1993	127,327	121,055	5.2%	66,082	65,260	1.3%	193,409	186,315	3.8%
1994	127,883	121,997	4.8%	69,491	66,717	4.2%	197,375	188,714	4.6%
1995	128,387	123,242	4.2%	72,458	70,199	3.2%	200,845	193,441	3.8%
1996	129,728	124,613	4.1%	75,940	73,681	3.1%	205,669	198,294	3.7%
1997	129,749	124,673	4.1%	77,307	76,398	1.2%	207,056	201,071	3.0%
1998	131,839	125,966	4.7%	79,062	79,077	0.0%	210,901	205,043	2.9%
1999	132,432	126,869	4.4%	83,148	82,640	0.6%	215,580	209,509	2.9%
2000	133,621	127,721	4.6%	87,108	85,579	1.8%	220,729	213,300	3.5%
2001	137,633	128,714	6.9%	92,045	87,969	4.6%	229,678	216,683	6.0%
2002	135,921	129,907	4.6%	92,939	91,120	2.0%	228,860	221,027	3.5%
2003	135,670	131,072	3.5%	94,944	94,810	0.1%	230,614	225,882	2.1%
2004	136,431	132,469	3.0%	100,016	99,698	0.3%	236,447	232,167	1.8%
2005	136,568	132,909	2.8%	103,819	105,475	-1.6%	240,387	238,384	0.8%
2006	135,400	135,047	0.3%	107,944	109,596	-1.5%	243,344	244,643	-0.5%
2007	135,933	135,222	0.5%	110,498	113,479	-2.6%	246,431	248,701	-0.9%

Source:
FHWA - U.S. Department of Transportation, Federal Highway Administration, *Highway Statistics 2007*, Washington, DC, 2009, Table VM-1 and annual. (Additional resources: www.fhwa.dot.gov)
Polk - The Polk Company, Detroit, Michigan. **FURTHER REPRODUCTION PROHIBITED**. (Additional resources: www.polk.com)

The graphs below show the number of motor vehicles per thousand people for various countries. The data for the United States are displayed in the line which goes from 1900 to 2007. The points labeled on that line show data for the other countries/regions around the world and how their vehicles per thousand people compare to the United States at two different points in time, 1996 and 2007. For instance, the graph shows that in 1996, Western Europe's vehicles per thousand people was about where the United States was in 1967, but by 2007 it is about where the United States was in 1972. The lower part of the graph (1900-1940) is shown enlarged on the facing page.

Figure 3.1. Vehicles per Thousand People: U.S. (Over Time) Compared to Other Countries (in 1996 and 2007)





Source:
See Tables 3.4 and 3.5.

Table 3.4
Vehicles per Thousand People in Other Countries, 1996 and 2007

Country/Region	Vehicles per 1000 people 1996	Vehicles per 1000 people 2007
Africa	23.4	24.0
Asia, Far East	57.1	63.4
Asia, Middle East	67.8	101.4
Brazil	96.7	132.0
Canada	560.0	609.4
Central & South America	110.3	128.3
China	9.3	30.3
Europe, East	167.0	270.8
Europe, West	495.6	587.5
India	7.2	12.3
Indonesia	22.1	32.8
Pacific	459.8	541.1

Table 3.5
Vehicles per Thousand People in the United States, 1990-2007

Year	U.S. vehicles per 1000 people	Year	U.S. vehicles per 1000 people	Year	U.S. vehicles per 1000 people	Year	U.S. vehicles per 1000 people	Year	U.S. vehicles per 1000 people
1900	0.11	1922	111.53	1944	220.23	1966	486.89	1988	771.27
1901	0.19	1923	134.90	1945	221.80	1967	497.50	1989	775.35
1902	0.29	1924	154.35	1946	243.11	1968	513.12	1990	771.82
1903	0.41	1925	173.26	1947	262.56	1969	529.97	1991	758.66
1904	0.67	1926	189.10	1948	280.20	1970	542.51	1992	756.84
1905	0.94	1927	195.77	1949	299.56	1971	560.19	1993	760.95
1906	1.27	1928	204.87	1950	322.86	1972	583.89	1994	766.04
1907	1.65	1929	219.31	1951	335.18	1973	613.59	1995	770.18
1908	2.24	1930	217.34	1952	338.06	1974	630.80	1996	780.37
1909	3.45	1931	210.37	1953	350.96	1975	638.56	1997	775.27
1910	5.07	1932	195.38	1954	358.87	1976	658.04	1998	780.46
1911	6.81	1933	192.38	1955	377.80	1977	667.57	1999	789.35
1912	9.90	1934	199.90	1956	385.71	1978	688.65	2000	800.34
1913	12.94	1935	208.61	1957	390.30	1979	698.90	2001	825.97
1914	17.79	1936	222.62	1958	390.53	1980	709.14	2002	816.08
1915	24.77	1937	233.33	1959	401.25	1981	713.66	2003	816.45
1916	35.48	1938	229.65	1960	408.80	1982	712.34	2004	829.94
1917	49.57	1939	236.93	1961	413.53	1983	722.70	2005	837.06
1918	59.69	1940	245.63	1962	424.31	1984	726.59	2006	840.51
1919	72.50	1941	261.57	1963	436.99	1985	742.80	2007	844.41
1920	86.78	1942	244.73	1964	449.81	1986	751.71		
1921	96.68	1943	225.89	1965	465.03	1987	756.97		

Sources:

Population – (2007) U.S. Census Bureau, Population Division, International Programs Center, April 16, 2009. (Additional resources: www.census.gov/ipc/www/idprint.html)

Vehicles – (2005) U.S.: U.S. Department of Transportation, Federal Highway Administration, *Highway Statistics 2007,* Washington, DC, 2008. All others: Ward's Communications, Ward's Motor Vehicle Data 2008, pp. 239–242. (Additional resources: www.fhwa.dot.gov, www.wardsauto.com)

The trend of using two-axle, four-tire trucks, such as pickups, vans, and sport-utility vehicles, for personal travel is evident in these data; two-axle, four-tire trucks account for 25% more travel in 2007 than in 1970, and cars account for 27% less travel in that time period.

Table 3.6
Shares of Highway Vehicle-Miles Traveled by Vehicle Type, 1970–2007

Year	Cars	Motorcycles	Two-axle, four-tire trucks	Other single-unit trucks	Combination trucks	Buses	Total vehicle-miles traveled (million miles)
1970	82.6%	0.3%	11.1%	2.4%	3.2%	0.4%	1,109,724
1975	77.9%	0.4%	15.1%	2.6%	3.5%	0.5%	1,327,664
1980	72.8%	0.7%	19.0%	2.6%	4.5%	0.4%	1,527,295
1981	72.9%	0.7%	19.1%	2.5%	4.4%	0.4%	1,555,308
1982	72.8%	0.6%	19.2%	2.5%	4.4%	0.4%	1,595,010
1983	72.3%	0.5%	19.8%	2.6%	4.5%	0.3%	1,652,788
1984	71.3%	0.5%	20.8%	2.6%	4.5%	0.3%	1,720,269
1985	70.2%	0.5%	22.0%	2.6%	4.4%	0.3%	1,774,826
1986	69.2%	0.5%	23.1%	2.5%	4.4%	0.3%	1,834,872
1987	68.5%	0.5%	23.8%	2.5%	4.5%	0.3%	1,921,204
1988	67.6%	0.5%	24.8%	2.4%	4.4%	0.3%	2,025,962
1989	66.8%	0.5%	25.6%	2.4%	4.4%	0.3%	2,096,487
1990	65.7%	0.4%	26.8%	2.4%	4.4%	0.3%	2,144,362
1991	62.5%	0.4%	29.9%	2.4%	4.4%	0.3%	2,172,050
1992	61.0%	0.4%	31.5%	2.4%	4.4%	0.3%	2,247,151
1993	59.9%	0.4%	32.5%	2.5%	4.5%	0.3%	2,296,378
1994	59.6%	0.4%	32.4%	2.6%	4.6%	0.3%	2,357,588
1995	59.4%	0.4%	32.6%	2.6%	4.8%	0.3%	2,422,696
1996	59.1%	0.4%	32.8%	2.6%	4.8%	0.3%	2,485,848
1997	58.7%	0.4%	33.2%	2.6%	4.9%	0.3%	2,561,695
1998	58.9%	0.4%	33.0%	2.6%	4.9%	0.3%	2,631,522
1999	58.3%	0.4%	33.5%	2.6%	4.9%	0.3%	2,691,056
2000	58.3%	0.4%	33.6%	2.6%	4.9%	0.3%	2,746,925
2001	58.2%	0.3%	33.8%	2.6%	4.9%	0.3%	2,797,287
2002	58.1%	0.3%	33.8%	2.7%	4.9%	0.2%	2,855,508
2003	57.8%	0.3%	34.0%	2.7%	4.8%	0.2%	2,890,450
2004	57.3%	0.3%	34.6%	2.6%	4.8%	0.2%	2,964,788
2005	57.1%	0.3%	34.8%	2.6%	4.8%	0.2%	2,989,430
2006	56.1%	0.4%	35.9%	2.7%	4.7%	0.2%	3,014,369
2007	55.2%	0.4%	36.7%	2.7%	4.8%	0.2%	3,029,821
			Average annual percentage change				
1970–2007							2.8%
1997–2007							1.7%

Source:
U.S. Department of Transportation, Federal Highway Administration, *Highway Statistics 2007*, Washington, DC, 2009, Table VM-1 and annual. (Additional resources: www.fhwa.dot.gov)

Due to data restrictions, the 2001 data are the latest than can be published.

Table 3.7
Cars in Operation and Vehicle Travel by Age, 1970 and 2001

	1970			2001			2001 Estimated vehicle travel		Average annual
Age (years)	Vehicles (thousands)	Percentage	Cumulative percentage	Vehicles (thousands)	Percentage	Cumulative percentage	Percentage	Cumulative percentage	miles per vehicle
Under 1[a]	6,288	7.8%	7.8%	6,183	4.8%	4.8%	6.9%	6.9%	15,000
1	9,299	11.6%	19.4%	8,882	6.9%	11.7%	9.4%	16.3%	14,300
2	8,816	11.0%	30.3%	8,093	6.3%	18.0%	8.2%	24.6%	13,700
3	7,878	9.8%	40.1%	7,555	5.9%	23.9%	7.2%	31.8%	12,900
4	8,538	10.6%	50.8%	7,860	6.1%	30.0%	7.2%	39.1%	12,400
5	8,506	10.6%	61.3%	7,337	5.7%	35.7%	6.5%	45.6%	12,000
6	7,116	8.8%	70.2%	8,555	6.6%	42.3%	7.4%	53.1%	11,700
7	6,268	7.8%	78.0%	7,471	5.8%	48.1%	6.3%	59.4%	11,400
8	5,058	6.3%	84.3%	7,420	5.8%	53.9%	6.1%	65.5%	11,100
9	3,267	4.1%	88.3%	6,807	5.3%	59.2%	5.4%	71.0%	10,700
10	2,776	3.5%	91.8%	6,810	5.3%	64.5%	5.0%	76.0%	9,900
11	1,692	2.1%	93.9%	6,692	5.2%	69.7%	4.5%	80.5%	9,000
12	799	1.0%	94.9%	6,742	5.2%	74.9%	4.7%	85.2%	9,400
13	996	1.2%	96.1%	6,189	4.8%	79.7%	3.8%	88.9%	8,200
14	794	1.0%	97.1%	5,345	4.2%	83.9%	2.9%	91.8%	7,200
15 and older	2,336	2.9%	100.0%	20,773	16.1%	100.0%	8.2%	100.0%	5,300
Subtotal	**80,427**	**100.0%**		**128,714**	**100.0%**				
Age not given	**22**			**0**					
Total	**80,449**			**128,714**					
Average age		5.6			9.0				
Median age		4.9			8.1				

Source:
The Polk Company, Detroit, MI. **FURTHER REPRODUCTION PROHIBITED.**
Vehicle travel - Average annual miles per auto by age were multiplied by the number of vehicles in operation by age to estimate the vehicle travel. Average annual miles per auto by age - generated by ORNL from the National Household Travel Survey Web site: nhts.ornl.gov. (Additional resources: www.polk.com, nhts.ornl.gov)

[a] Includes cars from model year 2002 and 2001 which were sold prior to July 1, 2002, and similarly, model years 1971 and 1970 sold prior to July 1, 1970.

Due to data restrictions, the 2001 data are the latest than can be published.

Table 3.8
Trucks in Operation and Vehicle Travel by Age, 1970 and 2001

	1970			2001			2001 Estimated vehicle travel		
Age (years)	Vehicles (thousands)	Percentage	Cumulative percentage	Vehicles (thousands)	Percentage	Cumulative percentage	Percentage	Cumulative percentage	Average annual miles per vehicle
Under 1[a]	1,262	7.1%	7.1%	6,213	7.1%	7.1%	8.5%	8.5%	17,500
1	1,881	10.6%	17.8%	7,958	9.0%	16.1%	12.0%	20.6%	19,200
2	1,536	8.7%	26.5%	7,522	8.6%	24.7%	11.7%	32.3%	19,800
3	1,428	8.1%	34.6%	6,398	7.3%	31.9%	9.0%	41.3%	17,900
4	1,483	8.4%	43.0%	6,109	6.9%	38.9%	8.4%	49.7%	17,500
5	1,339	7.6%	50.5%	5,122	5.8%	44.7%	6.8%	56.6%	17,000
6	1,154	6.5%	57.1%	5,574	6.3%	51.0%	6.8%	63.4%	15,600
7	975	5.5%	62.6%	5,042	5.7%	56.8%	6.1%	69.5%	15,400
8	826	4.7%	67.3%	4,148	4.7%	61.5%	4.9%	74.4%	15,100
9	621	3.5%	70.8%	3,395	3.9%	65.3%	3.5%	77.9%	13,200
10	658	3.7%	74.5%	3,221	3.7%	69.0%	2.3%	80.3%	9,200
11	583	3.3%	77.8%	3,039	3.5%	72.5%	2.2%	82.5%	9,200
12	383	2.2%	80.0%	3,345	3.8%	76.3%	2.4%	84.9%	9,200
13	417	2.4%	82.3%	3,112	3.5%	79.8%	2.3%	89.1%	9,200
14	414	2.3%	84.7%	2,544	2.9%	82.7%	1.8%	89.0%	9,200
15 and older	2,710	15.3%	100.0%	15,227	17.3%	100.0%	11.0%	100.0%	9,200
Subtotal	**17,670**	**100.0%**		**87,969**	**100.0%**		**100.0%**		
Age not given	15			0					
Total	**17,685**			**87,969**					
Average age		7.3			7.9				
Median age		5.9			6.8				

Source:
The Polk Company, Detroit, MI. **FURTHER REPRODUCTION PROHIBITED.**
Vehicle travel—The average annual vehicle-miles per truck by age were multiplied by the number of trucks in operation by age to estimate the vehicle travel. Average annual miles per truck by age were generated by ORNL from the *1997 Truck Inventory and Use Survey* public use tape provided by U.S. Department of Commerce, Bureau of the Census, Washington, DC, 2000. (Additional resources: www.polk.com, www.census.gov)

[a] Includes trucks from model year 2002 and 2001 which were sold prior to July 1, 2002, and similarly, model years 1971 and 1970 sold prior to July 1, 1970.

Until the late 1990's the median age of trucks was nearly always higher than that of cars. Since then, the median car age has been higher. The increasing popularity of light trucks as personal passenger vehicles may have had an influence on the median age of trucks.

Table 3.9
Median[a] Age of Cars and Trucks in Use, 1970–2008
(years)

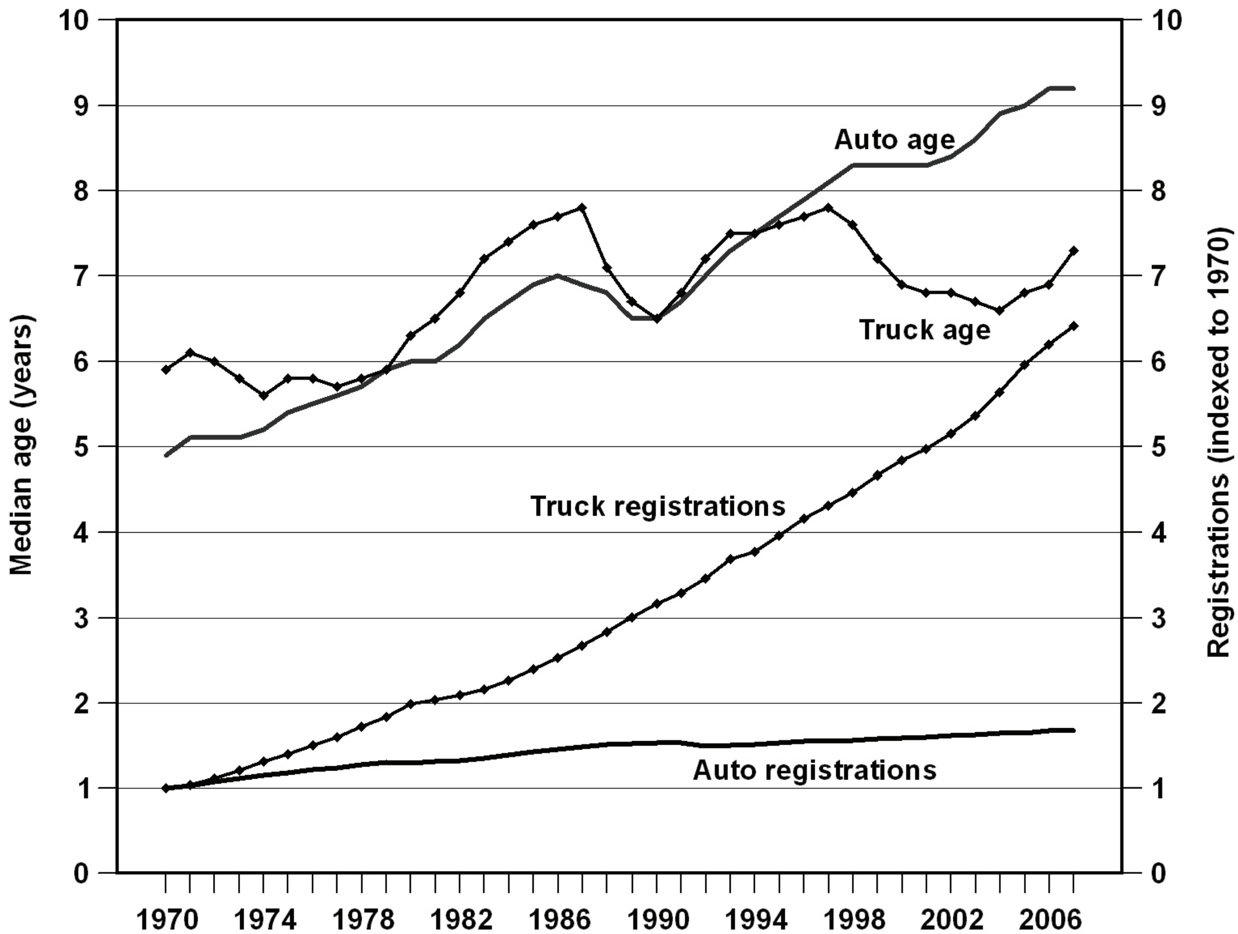
Calendar year	Cars	All trucks	Light trucks
1970	4.9	5.9	b
1971	5.1	6.1	b
1972	5.1	6.0	b
1973	5.1	5.8	b
1974	5.2	5.6	b
1975	5.4	5.8	b
1976	5.5	5.8	b
1977	5.6	5.7	b
1978	5.7	5.8	b
1979	5.9	5.9	b
1980	6.0	6.3	b
1981	6.0	6.5	b
1982	6.2	6.8	b
1983	6.5	7.2	b
1984	6.7	7.4	b
1985	6.9	7.6	b
1986	7.0	7.7	b
1987	6.9	7.8	b
1988	6.8	7.1	b
1989	6.5	6.7	b
1990	6.5	6.5	b
1991	6.7	6.8	b
1992	7.0	7.2	b
1993	7.3	7.5	b
1994	7.5	7.5	b
1995	7.7	7.6	b
1996	7.9	7.7	7.5
1997	8.1	7.8	7.3
1998	8.3	7.6	7.1
1999	8.3	7.2	6.9
2000	8.3	6.9	6.7
2001	8.3	6.8	6.1
2002	8.4	6.8	6.6
2003	8.6	6.7	6.5
2004	8.9	6.6	6.4
2005	9.0	6.8	6.6
2006	9.2	6.9	6.8
2007	9.2	7.3	7.1
2008	9.4	7.6	7.5

Source:
The Polk Company, Detroit, MI. **FURTHER REPRODUCTION PROHIBITED.**
(Additional resources: www.polk.com)

[a] Median is a value in an ordered set of values below and above which there are an equal number of values.
[b] Data are not available.

The median age of trucks (classes 1-8) has historically been higher than the median age of cars. In 1995, however, this trend reversed, with median car age higher than median truck age for the first time. The recent boom in the sales of minivans, sport-utility vehicles, and pick-ups, which are classified as trucks, is influencing the median age of trucks. So many new light trucks are being added into the truck population, that the median age of trucks declined from 1997 to 2004, but the trend reversed in 2005.

Figure 3.2. Median Age and Registrations of Cars and Trucks, 1970–2007



See Tables 3.3 and 3.7.

A typical car will travel more than 150,000 miles in a lifetime, while a typical light truck will travel 179,954 miles.

Table 3.10
Car and Light Truck Survivability Rates and Lifetime Miles

Vehicle age (Years)	Car survivability rate	Light truck survivability rate
1	0.9900	0.9741
2	0.9831	0.9603
3	0.9731	0.9420
4	0.9593	0.9190
5	0.9413	0.8913
6	0.9188	0.8590
7	0.8918	0.8226
8	0.8604	0.7827
9	0.8252	0.7401
10	0.7866	0.6956
11	0.7170	0.6501
12	0.6125	0.6040
13	0.5094	0.5517
14	0.4142	0.5009
15	0.3308	0.4522
16	0.2604	0.4062
17	0.2028	0.3633
18	0.1565	0.3236
19	0.1200	0.2873
20	0.0916	0.2542
21	0.0696	0.2244
22	0.0527	0.1975
23	0.0399	0.1735
24	0.0301	0.1522
25	0.0227	0.1332
26		0.1165
27		0.1017
28		0.0887
29		0.0773
30		0.0673
31		0.0586
32		0.0509
33		0.0443
34		0.0385
35		0.0334
36		0.0290
Lifetime miles	152,137	179,954

Source:
U.S. Department of Transportation, National Highway Traffic Safety Administration, *Vehicle Survivability and Travel Mileage Schedules*, January 2006.

Note: Registration data from 1977 to 2002 were used in developing these estimates. In this analysis, vehicle age was cut off when the estimated survival rate reached approximately a two percent threshold; for cars, this was 25 years, and for trucks it was 36 years.

Chapter 4
Light Vehicles and Characteristics

Summary Statistics from Tables in this Chapter

Source		
Table 4.1	Cars, 2007	
	Registrations (thousands)	*135,933*
	Vehicle miles (million miles)	*1,670,994*
	Fuel economy (miles per gallon)	*22.5*
Table 4.2	Two-axle, four-tire trucks, 2007	
	Registrations (thousands)	*101,470*
	Vehicle miles (million miles)	*1,111,277*
	Fuel economy (miles per gallon)	*18.0*
Table 4.6	Light truck share of total light vehicle sales	
	1970 calendar year	*14.8%*
	2007 calendar year	*52.6%*
Table 4.7	Car sales, 2008 sales period (thousands)	8,537
	Small	*3,731*
	Midsize	*3,084*
	Large	*1,720*
Table 4.9	Light truck sales, 2008 model year (thousands)	*7,871*
	Midsize pickup	*255*
	Large pickup	*1,860*
	Midsize van	*862*
	Large van	*30*
	Small SUV	*143*
	Midsize SUV	*2,701*
	Large SUV	*2,020*
Tables 4.20	Corporate average fuel economy	(mpg)
and 4.21	*Car standard, MY 2009*	*27.5*
	Car fuel economy, MY 2009	*32.6*
	Light truck standard, MY 2009 (unreformed)	*23.1*
	Light truck fuel economy, MY 2009	*24.2*
Table 4.22	Average fuel economy loss from 55 to 70 mph	17.1%

*The data in this table from 1985–on **DO NOT** include minivans, pickups, or sport utility vehicles.*

Table 4.1
Summary Statistics for Cars, 1970–2007

Year	Registrations[a] (thousands)	Vehicle travel (million miles)	Fuel use (million gallons)	Fuel economy[b] (miles per gallon)
1970	89,244	916,700	67,820	13.5
1971	92,718	966,330	71,346	13.5
1972	97,082	1,021,365	75,937	13.5
1973	101,985	1,045,981	78,233	13.4
1974	104,856	1,007,251	74,229	13.6
1975	106,706	1,033,950	74,140	13.9
1976	110,189	1,078,215	78,297	13.8
1977	112,288	1,109,243	79,060	14.0
1978	116,573	1,146,508	80,652	14.2
1979	118,429	1,113,640	76,588	14.5
1980	121,601	1,111,596	69,981	15.9
1981	123,098	1,133,332	69,112	16.4
1982	123,702	1,161,713	69,116	16.8
1983	126,444	1,195,054	70,322	17.0
1984	128,158	1,227,043	70,663	17.4
1985[c]	127,885	1,246,798	71,518	17.4
1986	130,004	1,270,167	73,174	17.4
1987	131,482	1,315,982	73,308	18.0
1988	133,836	1,370,271	73,345	18.7
1989	134,559	1,401,221	73,913	19.0
1990	133,700	1,408,266	69,568	20.2
1991	128,300	1,358,185	64,318	21.1
1992	126,581	1,371,569	65,436	21.0
1993	127,327	1,374,709	67,047	20.5
1994	127,883	1,406,089	67,874	20.7
1995	128,387	1,438,294	68,072	21.1
1996	129,728	1,469,854	69,221	21.2
1997	129,749	1,502,556	69,892	21.5
1998	131,839	1,549,577	71,695	21.6
1999	132,432	1,569,100	73,283	21.4
2000	133,621	1,600,287	73,065	21.9
2001	137,633	1,628,332	73,559	22.1
2002	135,921	1,658,474	75,471	22.0
2003	135,670	1,672,079	74,590	22.2
2004	136,431	1,699,890	75,402	22.5
2005	136,568	1,708,421	77,418	22.1
2006	135,400	1,690,534	75,009	22.5
2007	135,933	1,670,994	74,355	22.5
		Average annual percentage change		
1970–2007	1.1%	1.6%	0.2%	1.4%
1997–2007	0.5%	1.1%	0.6%	0.5%

Source:
U.S. Department of Transportation, Federal Highway Administration, *Highway Statistics 2007*, Washington, DC, 2009, Table VM-1 and annual. (Additional resources: www.fhwa.dot.gov)

[a] This number differs from R.L. Polk's estimates of "number of cars in use." See Table 3.3.
[b] Fuel economy for car population.
[c] Beginning in this year the data were revised to exclude minivans, pickups and sport utility vehicles which may have been previously included.

The Federal Highway Administration released revised historical data back to 1985 which better reflected two-axle, four-tire trucks. The definition of this category includes vans, pickup trucks, and sport utility vehicles. In 2007 there were more than 100 million two-axle, four-tire trucks registered in the United States.

Table 4.2
Summary Statistics for Two-Axle, Four-Tire Trucks, 1970–2007

Year	Registrations (thousands)	Vehicle travel (million miles)	Fuel use (million gallons)	Fuel economy (miles per gallon)
1970	14,211	123,286	12,313	10.0
1971	15,181	137,870	13,484	10.2
1972	16,428	156,622	15,150	10.3
1973	18,083	176,833	16,828	10.5
1974	19,335	182,757	16,657	11.0
1975	20,418	200,700	19,081	10.5
1976	22,301	225,834	20,828	10.8
1977	23,624	250,591	22,383	11.2
1978	25,476	279,414	24,162	11.6
1979	27,022	291,905	24,445	11.9
1980	27,876	290,935	23,796	12.2
1981	28,928	296,343	23,697	12.5
1982	29,792	306,141	22,702	13.5
1983	31,214	327,643	23,945	13.7
1984	32,106	358,006	25,604	14.0
1985[a]	37,214	390,961	27,363	14.3
1986	39,382	423,915	29,074	14.6
1987	41,107	456,870	30,598	14.9
1988	43,805	502,207	32,653	15.4
1989	45,945	536,475	33,271	16.1
1990	48,275	574,571	35,611	16.1
1991	53,033	649,394	38,217	17.0
1992	57,091	706,863	40,929	17.3
1993	59,994	745,750	42,851	17.4
1994	62,904	764,634	44,112	17.3
1995	65,738	790,029	45,605	17.3
1996	69,134	816,540	47,354	17.2
1997	70,224	850,739	49,389	17.2
1998	71,330	868,275	50,462	17.2
1999	75,356	901,022	52,859	17.0
2000	79,085	923,059	52,939	17.4
2001	84,188	943,207	53,522	17.6
2002	85,011	966,034	55,220	17.5
2003	87,187	984,094	60,758	16.2
2004	91,845	1,027,164	63,417	16.2
2005	95,337	1,041,051	58,869	17.7
2006	99,125	1,082,490	60,685	17.8
2007	101,470	1,111,277	61,816	18.0
		Average annual percentage change		
1970–2007	5.5%	6.1%	4.5%	1.6%
1997–2007	3.7%	2.7%	2.3%	0.5%

Source:
U.S. Department of Transportation, Federal Highway Administration, *Highway Statistics 2007*, Washington, DC, 2009, Table VM-1 and annual. (Additional resources: www.fhwa.dot.gov)

[a] Beginning in this year the data were revised to include all vans (including mini-vans), pickups and sport utility vehicles.

Because data on Class 2b trucks are scarce, the U.S. DOE funded a study to investigate available sources of data. In the final report, four methodologies are described to estimate the sales of Class 2b trucks. Until another study is funded, the 1999 data are the latest available.

Table 4.3
Summary Statistics on Class 1, Class 2a, and Class 2b Light Trucks

	CY 1999 truck sales (millions)	MY 2000 truck population (millions)	Percent diesel trucks in population	Average age (years)	Estimated annual miles[a] (billions)	Estimated fuel use (billion[a] gallons)	Estimated fuel economy (miles per gallon)
Class 1	5.7	49.7	0.3%	7.3	672.7	37.4	18.0
Class 2a	1.8	19.2	2.5%	7.4	251.9	18.0	14.0
Class 2b	0.5	5.8	24.0%	8.6	76.7	5.5	13.9

Source: Davis, S.C. and L.F. Truett, *Investigation of Class 2b Trucks (Vehicles of 8,500 to 10,000 lbs GVWR)*, ORNL/TM-2002/49, March 2002, Table 16.

Note: CY - calendar year. MY - model year.

Table 4.4
Sales Estimates of Class 1, Class 2a, and Class 2b Light Trucks, 1989–1999

	Sales estimates (thousands)			
Calendar Year	Class 1 (6,000 lbs and under)	Class 2a (6,001-8,500 lbs)	Class 2b (8,5001-10,000 lbs)	Total
1989	3,313	918	379	4,610
1990	3,451	829	268	4,548
1991	3,246	670	206	4,122
1992	3,608	827	194	4,629
1993	4,119	975	257	5,351
1994	4,527	1,241	265	6,033
1995	4,422	1,304	327	6,053
1996	4,829	1,356	334	6,519
1997	5,085	1,315	397	6,797
1998	5,263	1,694	342	7,299
1999	5,707	1,845	521	8,073
		Percent change		
1989–1999	72.3%	101.0%	37.5%	75.1%

Source: Davis, S.C. and L.F. Truett, *Investigation of Class 2b Trucks (Vehicles of 8,500 to 10,000 lbs GVWR)*, ORNL/TM-2002/49, March 2002, Table 1.

Note: These data were calculated using Methodology 4 from the report.

[a] Estimates derived using 2000 population data and 1997 usage data. See source for details.

Cars sales have been under 8 million since 2002. In 1980, the Big 3 (Chrysler, Ford and General Motors) held 73.8% of the market; by 2007, that had dropped to 38.0%.

Table 4.5
New Retail Car Sales in the United States, 1970–2007

Calendar year	Domestic[a] (thousands)	Import[b] (thousands)	Total (thousands)	Percentage imports	Percentage Big 3 Sales[c]	Percentage diesel
1970	7,119	1,280	8,399	15.2%	[d]	[d]
1975	7,053	1,571	8,624	18.2%	[d]	0.31%
1980	6,580	2,369	8,949	26.5%	73.8%	4.31%
1981	6,181	2,308	8,489	27.2%	71.1%	6.10%
1982	5,757	2,200	7,956	27.7%	71.1%	4.44%
1983	6,795	2,353	9,148	25.7%	71.9%	2.09%
1984	7,952	2,372	10,324	23.0%	74.2%	1.45%
1985	8,205	2,775	10,979	25.3%	72.9%	0.82%
1986	8,215	3,189	11,404	28.0%	70.9%	0.37%
1987	7,085	3,107	10,192	30.5%	67.6%	0.16%
1988	7,543	3,004	10,547	28.5%	69.3%	0.02%
1989	7,098	2,680	9,779	27.4%	67.9%	0.13%
1990	6,919	2,384	9,303	25.6%	65.7%	0.08%
1991	6,162	2,028	8,189	24.8%	64.2%	0.10%
1992	6,286	1,927	8,213	23.5%	65.8%	0.06%
1993	6,742	1,776	8,518	20.8%	67.3%	0.03%
1994	7,255	1,735	8,991	19.3%	65.9%	0.04%
1995	7,129	1,506	8,635	17.4%	65.3%	0.04%
1996	7,255	1,271	8,526	14.9%	64.1%	0.10%
1997	6,917	1,355	8,272	16.4%	62.2%	0.09%
1998	6,762	1,380	8,142	16.9%	59.7%	0.13%
1999	6,979	1,719	8,698	19.8%	58.3%	0.16%
2000	6,831	2,016	8,847	22.8%	55.0%	0.26%
2001	6,325	2,098	8,423	24.9%	51.4%	0.18%
2002	5,878	2,226	8,103	27.5%	48.4%	0.39%
2003	5,527	2,083	7,610	27.4%	47.1%	0.51%
2004	5,396	2,149	7,545	28.5%	44.9%	0.40%
2005	5,533	2,187	7,720	28.3%	43.1%	0.63%
2006	5,476	2,345	7,821	30.0%	41.5%	0.82%
2007	5,253	2,365	7,618	31.0%	38.0%	0.11%
			Average annual percentage change			
1970–2007	-0.8%	1.7%	-0.3%			
1997–2007	-2.7%	5.7%	-0.8%			

Source:
Domestic and import data - 1970–97: American Automobile Manufacturers Association, *Motor Vehicle Facts and Figures 1998*, Detroit, MI, 1998, p. 15, and annual. 1997 data from *Economic Indicators, 4th Quarter 1997*. 1998–2007: Ward's Communication, *Ward's Automotive Yearbook*, Detroit, MI, 2008, p. 248.
Diesel data - Ward's Communications, *Ward's Automotive Yearbook*, Detroit, MI, 2008, p. 34.
Transplant data - Oak Ridge National Laboratory, Light Vehicle MPG and Market Shares Data System, Oak Ridge, TN, 2004. (Additional resources: www.aama.com, www.wardsauto.com)

[a] North American built.
[b] Does not include import tourist deliveries.
[c] Big 3 includes Chrysler, Ford and General Motors. Beginning in 1998, Ford includes Jaguar and Volvo. GM Includes Saab.
[d] Data are not available.

Light trucks, which include pick-ups, minivans, sport-utility vehicles, and other trucks less than 10,000 pounds gross vehicle weight (GVW), accounted for more than half of light vehicle sales since 2001.

Table 4.6
New Retail Sales of Trucks 10,000 Pounds GVW and Less in the United States, 1970–2007

		Percentages				
Calendar year	Light truck sales[a] (thousands)	Import[b]	Big 3 Sales[c]	Diesel[d]	Light trucks of light-duty vehicle sales[e]	Light trucks of total truck sales
1970	1,463	4.5%		[f]	14.8%	80.4%
1975	2,281	10.0%		[f]	20.9%	87.9%
1980	2,440	19.7%		3.6%	21.4%	88.9%
1981	2,189	20.3%		3.1%	20.4%	89.8%
1982	2,470	16.5%		8.5%	23.6%	92.8%
1983	2,984	15.6%		6.7%	24.5%	93.6%
1984	3,863	15.7%	78.8%	4.8%	27.1%	93.0%
1985	4,458	17.2%	78.2%	3.8%	28.8%	93.6%
1986	4,594	20.1%	76.9%	3.7%	28.6%	94.3%
1987	4,610	17.9%	78.3%	2.3%	31.0%	93.9%
1988	4,800	12.6%	81.6%	2.3%	31.1%	93.2%
1989	4,610	10.9%	81.9%	2.9%	31.8%	93.3%
1990	4,548	13.2%	80.9%	3.1%	32.8%	93.9%
1991	4,123	12.8%	79.4%	3.2%	33.5%	94.5%
1992	4,629	8.6%	83.1%	3.3%	36.0%	94.4%
1993	5,351	6.8%	83.4%	3.7%	38.6%	94.2%
1994	6,033	6.5%	82.9%	3.9%	40.2%	94.0%
1995	6,053	6.5%	83.4%	4.1%	41.2%	93.4%
1996	6,519	6.6%	83.8%	3.7%	43.3%	94.1%
1997	6,797	8.4%	81.9%	4.8%	46.6%	94.1%
1998	7,299	8.9%	80.5%	1.7%	47.3%	93.3%
1999	8,073	9.5%	78.0%	5.9%	48.1%	92.6%
2000	8,387	9.9%	76.1%	4.8%	48.7%	93.9%
2001	8,700	11.3%	75.3%	5.3%	50.8%	96.1%
2002	8,713	12.2%	74.7%	4.9%	51.8%	96.4%
2003	8,938	13.5%	72.4%	4.3%	54.0%	95.5%
2004	9,361	13.1%	70.1%	5.5%	55.4%	95.5%
2005	9,281	13.2%	68.2%	3.7%	54.7%	94.9%
2006	8,684	15.6%	64.1%	3.7%	52.6%	94.1%
2007	8,471	16.4%	65.0%	3.9%	52.6%	95.8%
			Average annual percentage change			
1970–2007	4.9%					
1997–2007	2.2%					

Sources:
Four-wheel drive and diesel - 1970–88: Ward's Communications, *Ward's Automotive Yearbook*, Detroit, MI, 1989, p. 168, and annual. 1989–on: Ward's Communications, *Ward's Automotive Yearbook*, Factory Installation Reports, Detroit, MI, 2008, and annual.
Transplants - Oak Ridge National Laboratory, Light-Duty Vehicle MPG and Market Shares System, Oak Ridge, TN, 2004.
All other - 1970–97: American Automobile Manufacturers Association, *Motor Vehicle Facts and Figures 1998*, Detroit, MI, 1998, pp. 8, 15, 24, and annual. 1998–on: Ward's Communications, *Ward's Automotive Yearbook*, Detroit, MI, 2008. (Additional resources: www.aama.com, www.wardsauto.com)

[a] Includes all trucks of 10,000 pounds gross vehicle weight and less sold in the United States.
[b] Excluding transplants.
[c] Big 3 includes Chrysler, Ford and General Motors. Beginning in 1998, Ford includes Land Rover and Volvo light trucks and GM includes Saab. Trucks include light, medium and heavy trucks.
[d] Based on model year factory installations.
[e] Light-duty vehicles include cars and light trucks.
[f] Indicates less than 1 percent.

The sales-weighted fuel economy of cars increased dramatically from 1975 (15.4 mpg) to 1990 (26.2 mpg), but has risen only about 2.5 mpg since then.

Table 4.7
Period Sales, Market Shares, and Sales-Weighted Fuel Economies of New Domestic and Import Cars, Selected Model Years 1975–2008[a]
(thousands)

	Model Year							
	1975	**1980**	**1985**	**1990**	**1995**	**2000**	**2005**	**2008**
CARS								
Small								
Total sales, units	4,088	4,825	5,519	4,999	5,190	4,266	3,185	3,175
Market share, %	49.6%	51.1%	51.1%	56.7%	55.2%	46.7%	39.7%	37.2%
Fuel economy, mpg	18.3	26.1	29.8	29.8	30.7	30.3	31.1	31.6
Midsize								
Total sales, units	1,631	2,987	2,777	2,342	2,515	2,894	2,886	2,911
Market share, %	19.8%	31.6%	25.7%	26.6%	26.8%	31.7%	36.0%	34.1%
Fuel economy, mpg	13.6	21.6	24.9	26.2	26.1	27.0	29.8	31.5
Large								
Total sales, units	1,555	963	1,512	1,092	1,306	1,665	1,234	1,646
Market share, %	18.9%	10.2%	14.0%	12.4%	13.9%	18.2%	15.4%	19.3%
Fuel economy, mpg	13.1	19.1	22.3	23.7	24.5	25.6	26.4	26.8
WAGONS								
Small								
Total sales, units	477	310	496	160	198	68	365	556
Market share, %	5.8%	3.3%	4.6%	1.8%	2.1%	0.7%	4.5%	6.5%
Fuel economy, mpg	22.4	28.6	32.5	29.6	33.3	29.2	32.5	32.1
Midsize								
Total sales, units	289	257	341	184	176	234	238	173
Market share, %	3.5%	2.7%	3.2%	2.1%	1.9%	2.6%	3.0%	2.0%
Fuel economy, mpg	13.2	21.1	25.2	25.3	26.6	27.3	26.0	26.8
Large								
Total sales, units	197	102	145	31	10	0	118	74
Market share, %	2.4%	1.1%	1.3%	0.4%	0.1%	0.0%	1.5%	0.9%
Fuel economy, mpg	11.9	19.1	20.9	22.7	22.8	[b]	22.2	22.0
TOTAL								
Total sales, units	8,237	9,443	10,791	8,810	9,396	9,128	8,027	8,537
Market share, %	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%
Fuel economy, mpg	15.8	23.5	27.0	27.8	28.3	28.2	29.5	30.3

Source:
U.S. Environmental Protection Agency, *Light-Duty Automotive Technology and Fuel Economy Trends: 1975 Through 2008*, September 2008. (Additional resources: www.epa.gov/otaq/fetrends.htm)

[a] The fuel economy data on this table are EPA laboratory test values.
[b] No vehicles in this category were sold in this model year.

The term "wagon" conjures up images of the station wagons from the 1960's. However, most of the cars that are now classified as wagons have little in common with those station wagons. The wagons below make up the category "wagon" on Tables 4.7 through 4.14.

Table 4.8
Definition of Wagons in Model Year 2008

Small Wagon
Audi A3
Audi A3 Quattro
Audi A4 Avant Quattro
Audi S4 Avant
BMW 328I Sport
BMW 328XI Sport
Chrysler PT Cruiser
General Motors HHR FWD
General Motors HHR Panel FWD
General Motors Vibe
GM Daewoo Forenza
Honda Fit
Saab 9-3 Sportcombi
Subaru Impreza WGN-Outback SPT AWD
Suzuki SX4
Suzuki SX4 AWD
Toyota Corolla Matrix
Toyota Scion XB
Volkswagen Jetta Sportwagen
Volvo V50 AWD
Volvo V50 FWD
Midsize Wagon
Audi A6 Avant Quattro
BMW 535XI Sport
Daimler AG E350 4MATIC
Daimler AG E63 AMG
Chrysler Magnum
Chrysler Magnum AWD
Kia Rondo
Mazda Mazda 5
Saab 9-5 Sportcombi
Subaru Outback AWD
Volkswagen Passat
Volkswagen Passat 4MOTIO
Volvo V70 FWD
Volvo XC 70 AWD
Large Wagon
Chrysler Pacifica AWD
Chrysler Pacifica FWD
Daimler AG R320 CDI 4MATIC
Daimler AG R350
Daimler AG R350 4MATIC

Source:
U.S. Environmental Protection Agency, *Light-Duty Automotive Technology and Fuel Economy Trends: 1975 Through 2008*, September 2008. (Additional resources: www.epa.gov/otaq/fetrends.htm)

Sales of light trucks in 2008 are almost four times that of 1975. Similar to the car trend, the sales-weighted fuel economy of light trucks increased during the late '70's and '80's, but has remained fairly constant since then.

Table 4.9
Period Sales, Market Shares, and Sales-Weighted Fuel Economies[a] of New Domestic and Import Light Trucks, Model Years 1975–2008
(thousands)

	Model Year							
	1975	**1980**	**1985**	**1990**	**1995**	**2000**	**2005**	**2008**
PICKUPS								
Small								
Total sales, units	160	452	497	289	298	101	8	[b]
Market share, %	8.1%	24.3%	13.5%	7.6%	5.2%	1.4%	0.1%	[b]
Fuel economy, mpg	22.5	24.3	26.7	24.8	24.4	26.3	25.8	[b]
Midsize								
Total sales, units	56	98	616	600	700	766	216	255
Market share, %	2.8%	5.3%	16.8%	15.8%	12.2%	10.3%	2.7%	3.2%
Fuel economy, mpg	21.1	25.9	25.7	24.7	24.7	22.8	23.6%	24.0
Large								
Total sales, units	1,126	887	964	945	1,273	1,746	2,076	1,860
Market share, %	56.7%	47.6%	26.3%	24.8%	22.1%	23.4%	26.4%	23.6%
Fuel economy, mpg	13.1	17.2	17.7	18.0	18.0	19.3	19.4	19.8
VANS								
Small								
Total sales, units	2	16	93	30	6	[b]	[b]	[b]
Market share, %	0.1%	0.9%	2.5%	0.8%	0.1%	0.0%	0.0%	0.0%
Fuel economy, mpg	20.6	19.0	25.5	23.9	26.5	[b]	[b]	[b]
Midsize								
Total sales, units	302	130	600	1,124	1,552	1,522	1,425	862
Market share, %	15.2%	7.0%	16.4%	29.5%	27.0%	20.4%	18.1%	11.0%
Fuel economy, mpg	13.3	16.9	19.8	21.8	22.2	23.5	24.2	24.7
Large								
Total sales, units	153	96	162	107	104	170	55	30
Market share, %	7.7%	5.2%	4.4%	2.8%	1.8%	2.3%	0.7%	0.4%
Fuel economy, mpg	12.6	16.0	16.1	16.5	17.1	18.0	19.4	20.0
SUVS								
Small								
Total sales, units	53	60	115	189	189	400	215	143
Market share, %	2.7%	3.2%	3.1%	5.0%	3.3%	5.4%	2.7%	1.8%
Fuel economy, mpg	16.1	18.8	22.1	23.4	24.2	22.5	24.3	22.9
Midsize								
Total sales, units	123	100	563	447	1,397	1,863	2,079	2,701
Market share, %	6.2%	5.4%	15.3%	11.7%	24.3%	25.0%	26.4%	34.3%
Fuel economy, mpg	12.1	14.3	19.7	19.1	19.6	21.0	23.0	25.2
Large								
Total sales, units	11	23	57	72	230	879	1,790	2,020
Market share, %	0.6%	1.2%	1.6%	1.9%	4.0%	11.8%	22.8%	25.7%
Fuel economy, mpg	12.2	14.3	16.9	16.7	16.6	17.6	19.9	21.2
TOTAL								
Total sales, units	1,987	1,863	3,669	3,805	5,749	7,447	7,866	7,871
Market share, %	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%
Fuel economy, mpg	13.7	18.6	20.6	20.7	20.5	20.8	21.4	22.5

Source:
U.S. Environmental Protection Agency, *Light-Duty Automotive Technology and Fuel Economy Trends: 1975 Through 2008*, September 2008 (Additional resources: www.epa.gov/otaq/fetrends.htm)

Note: Includes light trucks of 8,500 lbs. or less.

[a] The fuel economy data on this table are EPA laboratory test values.
[b] No vehicles in this category were sold in this model year.

Back in 1975 only 19% of new light vehicle sales were light trucks. Because of the boom in sales of minivans, sport utility vehicles, and pick-up trucks, today almost half of light vehicle sales are light trucks.

Table 4.10
Light Vehicle Market Shares by Size Class, Model Years 1975–2008

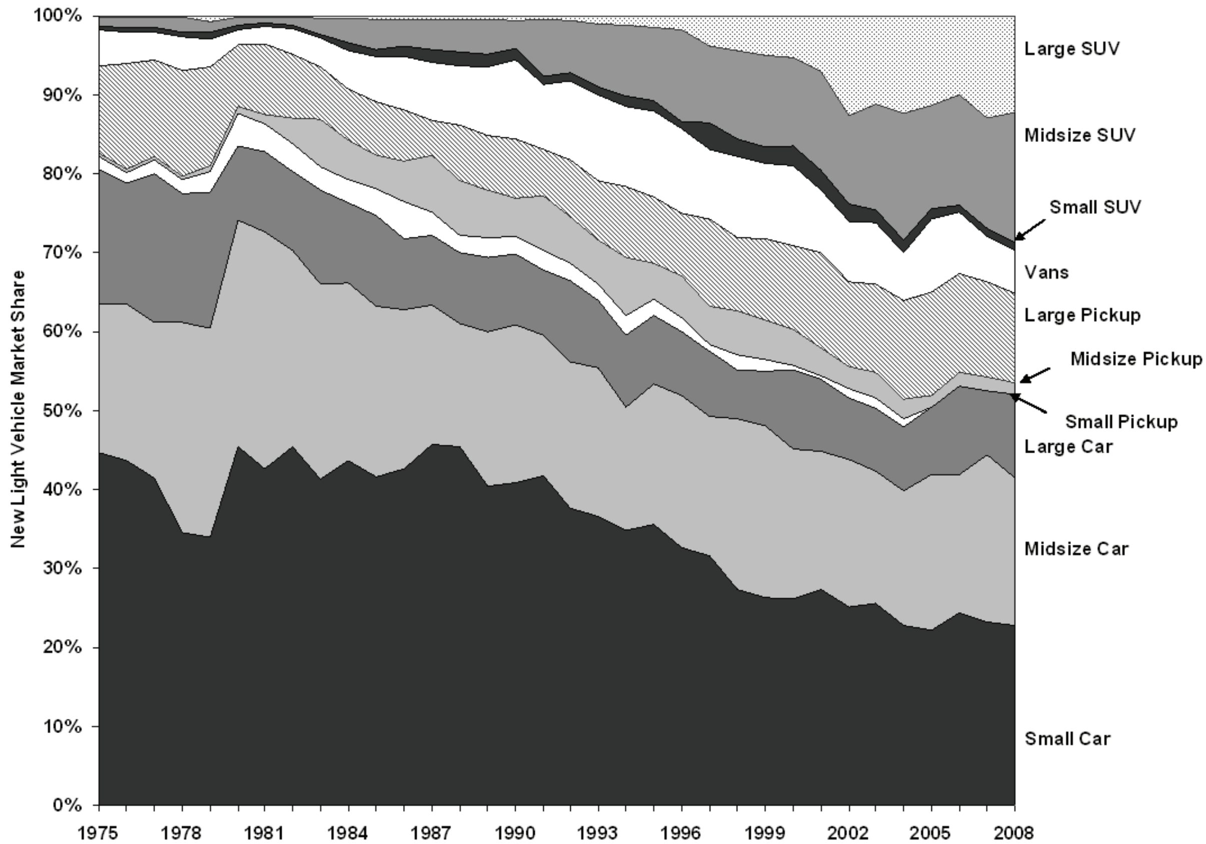
	Model Year							
	1975	1980	1985	1990	1995	2000	2005	2008
Small car	40.0%	42.7%	38.2%	39.6%	34.3%	25.7%	20.0%	19.4%
Midsize car	16.0%	26.4%	19.2%	18.6%	16.6%	17.5%	18.2%	17.7%
Large car	15.2%	8.5%	10.5%	8.7%	8.6%	10.0%	7.8%	10.0%
Small wagon	4.7%	2.7%	3.4%	1.3%	1.3%	0.4%	2.3%	3.4%
Midsize wagon	2.8%	2.3%	2.4%	1.5%	1.2%	1.4%	1.5%	1.1%
Large wagon	1.9%	0.9%	1.0%	0.2%	0.1%	0.0%	0.7%	0.5%
Small pickup	1.6%	4.0%	3.4%	2.3%	2.0%	0.6%	0.1%	0.0%
Midsize pickup	0.5%	0.9%	4.3%	4.8%	4.6%	4.6%	1.4%	1.6%
Large pickup	11.0%	7.8%	6.7%	7.5%	8.4%	10.5%	13.1%	11.3%
Small van	0.0%	0.1%	0.6%	0.2%	0.0%	0.0%	0.0%	0.0%
Midsize van	3.0%	1.1%	4.1%	8.9%	10.2%	9.2%	9.0%	5.3%
Large van	1.5%	0.8%	1.1%	0.9%	0.7%	1.0%	0.3%	0.2%
Small SUV	0.5%	0.5%	0.8%	1.5%	1.3%	2.4%	1.4%	0.9%
Midsize SUV	1.2%	1.0%	3.9%	3.5%	9.2%	11.2%	13.1%	16.5%
Large SUV	0.1%	0.2%	0.4%	0.6%	1.5%	5.3%	11.3%	12.3%
Total light vehicles sold (thousands)	10,224	11,306	14,460	12,615	15,145	16,575	15,893	16,408
Cars	80.6%	83.5%	74.6%	69.8%	62.0%	55.1%	50.5%	52.0%
Light trucks	19.4%	16.5%	25.4%	30.2%	38.0%	44.9%	49.5%	48.0%

Source:
U.S. Environmental Protection Agency, *Light-Duty Automotive Technology and Fuel Economy Trends: 1975 Through 2008*, September 2008. (Additional resources: www.epa.gov/otaq/fetrends.htm)

Note: Includes light trucks of 8,500 lbs. or less.

Light trucks have been gaining market share since the early 1980s, mainly due to increases in the market share of sport utility vehicles (SUVs) and pickup trucks.

Figure 4.1. Light Vehicle Market Shares, Model Years 1975–2008



Source:
See Table 4.9

The midsize and large cars and wagons sales-weighted engine sizes have declined drastically since 1975.

Table 4.11
Sales-Weighted Engine Size of New Domestic and Import Cars by Size Class, Model Years 1975–2008
(liters[a])

	Cars			Wagons		
Model Year	Small	Midsize	Large	Small	Midsize	Large
1975	3.67	5.78	6.70	2.10	5.92	6.72
1976	3.70	5.62	6.72	2.23	5.16	6.82
1977	3.67	5.44	6.00	2.20	4.87	5.98
1978	2.90	4.79	5.85	2.20	4.23	5.80
1979	2.72	4.46	5.56	2.02	4.08	5.46
1980	2.25	3.74	5.15	1.85	3.74	5.29
1981	2.11	3.61	4.98	1.77	3.16	5.11
1982	2.15	3.46	4.79	1.79	3.36	5.01
1983	2.25	3.47	4.79	1.72	3.28	5.03
1984	2.29	3.44	4.82	1.75	2.82	5.00
1985	2.26	3.36	4.57	1.74	2.79	5.00
1986	2.25	3.18	4.26	1.85	2.65	4.98
1987	2.20	3.08	4.24	1.90	2.84	4.98
1988	2.18	3.00	4.29	1.85	2.80	4.98
1989	2.15	2.97	4.28	1.84	2.88	4.98
1990	2.15	3.06	4.23	1.97	2.97	4.98
1991	2.15	3.13	4.33	1.97	2.97	4.98
1992	2.20	3.13	4.29	2.00	3.08	5.54
1993	2.18	3.15	4.20	1.93	3.08	5.57
1994	2.25	3.10	4.06	1.98	2.95	5.74
1995	2.25	3.10	4.06	1.93	2.74	5.74
1996	2.23	2.97	4.10	2.00	2.64	5.74
1997	2.18	3.02	3.97	2.03	2.62	[b]
1998	2.25	2.90	3.93	2.03	2.54	[b]
1999	2.31	2.87	3.85	2.05	2.57	[b]
2000	2.28	2.85	3.62	2.08	2.51	[b]
2001	2.29	2.87	3.62	2.38	2.54	[b]
2002	2.31	2.90	3.57	2.38	2.49	[b]
2003	2.36	2.85	3.67	2.08	2.47	[b]
2004	2.39	2.85	3.69	2.06	2.59	3.52
2005	2.36	2.75	3.69	2.00	3.00	3.56
2006	2.47	2.77	3.75	2.08	2.98	3.59
2007	2.41	2.77	3.72	2.08	2.97	4.05
2008	2.43	2.72	3.62	2.11	2.88	3.82
			Average annual percentage change			
1975–2008	-1.2%	-2.3%	-1.8%	0.0%	-2.2%	-1.7%
1998–2008	0.8%	-0.6%	-0.8%	0.4%	1.3%	-3.3%[c]

Source:
U.S. Environmental Protection Agency, *Light-Duty Automotive Technology and Fuel Economy Trends: 1975 Through 2008*, September 2008. (Additional resources: www.epa.gov/otaq/fetrends.htm)

[a] 1 liter = 61.02 cubic inches.
[b] No vehicles in this category were sold in this model year.
[c] 1996–2008.

The engine size of large sport utility vehicles (SUVs) declined an average of 1.7% per year from 1998 to 2008, while the size of a small SUV engine increased by almost 3%.

Table 4.12
Sales-Weighted Engine Size of New Domestic and Import Light Trucks by Size Class, Model Years 1975–2008
(liters[a])

	Pickups			Vans			SUVs		
Model Year	Small	Midsize	Large	Small	Midsize	Large	Small	Midsize	Large
1975	1.93	1.79	5.62	1.93	5.08	5.47	4.47	5.72	5.97
1976	1.95	1.79	5.64	1.97	5.20	5.49	4.47	5.80	6.11
1977	1.97	2.03	5.69	1.97	5.34	5.62	4.49	5.72	6.08
1978	1.95	2.03	5.56	1.97	5.36	5.49	4.51	5.87	6.11
1979	1.97	2.15	5.41	1.97	5.24	5.51	4.28	5.64	6.15
1980	2.00	2.18	5.00	1.97	4.72	5.16	3.72	5.31	5.57
1981	2.13	2.15	4.80	1.97	4.57	5.08	3.67	5.20	5.54
1982	2.25	2.49	4.90	1.82	4.65	5.15	3.39	5.24	5.64
1983	2.33	2.39	4.95	1.93	4.82	5.15	3.44	4.10	5.82
1984	2.33	2.43	4.93	1.97	4.06	5.15	3.05	3.70	5.75
1985	2.34	2.52	5.00	1.98	3.82	5.11	2.74	3.47	5.74
1986	2.38	2.41	4.88	2.15	3.67	5.01	2.74	3.34	5.74
1987	2.41	2.61	5.06	2.20	3.70	5.06	2.64	3.54	5.74
1988	2.43	2.70	5.21	2.20	3.65	5.06	2.57	3.83	5.75
1989	2.51	2.90	5.21	2.13	3.57	5.06	2.80	4.16	5.75
1990	2.51	2.87	5.24	2.29	3.59	5.15	2.65	3.98	5.75
1991	2.49	3.11	5.16	2.03	3.51	5.11	2.38	3.87	5.38
1992	2.49	3.20	5.11	2.11	3.57	5.16	2.39	3.82	5.42
1993	2.41	3.24	4.97	1.98	3.46	5.16	2.46	3.97	5.65
1994	2.47	3.23	5.18	2.21	3.59	5.21	2.28	3.90	5.62
1995	2.57	3.11	5.18	2.20	3.70	5.15	2.26	3.88	5.69
1996	2.61	3.06	5.16	2.33	3.46	5.33	1.75	4.08	5.64
1997	2.39	3.20	4.97	[b]	3.44	4.92	2.98	3.85	5.38
1998	2.62	3.13	5.05	[b]	3.43	4.87	2.65	3.87	5.13
1999	2.84	3.28	5.13	[b]	3.49	4.87	2.57	3.74	5.29
2000	2.43	3.15	4.74	[b]	3.41	4.85	2.80	3.75	5.11
2001	2.41	3.39	4.79	[b]	3.38	4.97	2.51	3.51	4.64
2002	2.90	3.70	4.82	[b]	3.44	4.80	2.56	3.34	4.54
2003	2.92	3.21	4.82	[b]	3.47	4.74	2.64	3.36	4.72
2004	3.02	3.59	4.93	[b]	3.51	4.79	2.97	3.51	4.74
2005	2.46	3.15	4.82	[b]	3.49	4.72	2.92	3.34	4.46
2006	2.46	3.23	4.75	[b]	3.47	4.64	3.28	3.34	4.24
2007	[b]	3.33	4.88	[b]	3.56	4.65	3.43	3.20	4.42
2008	[b]	3.24	4.98	[b]	3.56	4.85	3.49	3.15	4.31
				Average annual percentage change					
1975-2008	[c]	1.8%	-0.4%	[c]	-1.1%	-0.4%	-0.7%	-1.8%	-1.0%
1998-2008	[c]	0.3%	-0.1%	[c]	0.4%	-0.0%	2.8%	-2.0%	-1.7%

Source:
U.S. Environmental Protection Agency, *Light-Duty Automotive Technology and Fuel Economy Trends: 1975 Through 2008*, September 2008. (Additional resources: www.epa.gov/otaq/fetrends.htm)

Note: Includes light trucks of 8,500 lbs. or less.

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[a] 1 liter = 61.02 cubic inches.
[b] No vehicles in this category were sold in this model year.
[c] Data are not available.

Table 4.13
Sales-Weighted Curb Weight of New Domestic and Import Cars by Size Class, Model Years 1975–2008
(pounds)

	Cars			Wagons		
Model Year	Small	Midsize	Large	Small	Midsize	Large
1975	3,440	4,630	5,142	2,833	4,791	5,453
1976	3,474	4,558	5,156	2,902	4,555	5,444
1977	3,486	4,473	4,482	2,801	4,410	4,713
1978	3,029	3,820	4,394	2,805	3,836	4,664
1979	2,936	3,710	4,210	2,711	3,758	4,466
1980	2,717	3,362	4,130	2,591	3,534	4,423
1981	2,648	3,346	4,108	2,531	3,285	4,394
1982	2,684	3,321	4,034	2,580	3,384	4,396
1983	2,734	3,316	4,041	2,565	3,348	4,379
1984	2,776	3,318	4,022	2,620	3,298	4,371
1985	2,771	3,318	3,841	2,579	3,356	4,354
1986	2,791	3,241	3,719	2,647	3,355	4,381
1987	2,803	3,247	3,696	2,795	3,434	4,348
1988	2,818	3,293	3,730	2,757	3,378	4,349
1989	2,841	3,314	3,721	2,766	3,436	4,334
1990	2,897	3,450	3,799	3,026	3,498	4,337
1991	2,885	3,412	3,893	3,005	3,506	4,402
1992	2,921	3,515	3,872	3,076	3,503	4,500
1993	2,903	3,515	3,831	2,882	3,498	4,500
1994	2,965	3,529	3,858	2,908	3,532	4,500
1995	2,988	3,546	3,830	2,859	3,482	4,500
1996	2,977	3,527	3,894	2,952	3,661	4,500
1997	2,977	3,551	3,821	2,901	3,666	[a]
1998	3,013	3,534	3,784	2,874	3,668	[a]
1999	3,085	3,540	3,854	2,923	3,691	[a]
2000	3,079	3,550	3,782	3,107	3,572	[a]
2001	3,101	3,566	3,774	3,470	3,775	[a]
2002	3,125	3,549	3,767	3,504	3,731	[a]
2003	3,179	3,567	3,841	3,262	3,745	[a]
2004	3,192	3,577	3,858	3,235	3,860	4,769
2005	3,163	3,544	3,993	3,160	3,839	4,791
2006	3,255	3,568	4,014	3,255	3,826	4,806
2007	3,227	3,586	4,022	3,267	3,834	4,800
2008	3,267	3,588	3,980	3,294	3,845	4,851
		Average annual percentage change				
1975-2008	-0.2%	-0.8%	-0.8%	0.5%	-0.7%	-0.4%
1998-2008	0.8%	0.2%	0.5%	1.4%	0.5%	0.6%[b]

Source:
U.S. Environmental Protection Agency, *Light-Duty Automotive Technology and Fuel Economy Trends: 1975 Through 2008*, September 2008. (Additional resources: www.epa.gov/otaq/fetrends.htm)

[a] Data are not available.
[b] 1996–2008.

The interior space of new small and midsize cars in 2008 was about the same as in the early 1990's; large cars, however, had smaller interior space.

Table 4.14
Sales-Weighted Interior Space of New Domestic and Import Cars by Size Class, Model Years 1977–2008
(cubic feet)

	Cars			Wagons		
Model Year	Small	Midsize	Large	Small	Midsize	Large
1977	95.4	112.9	128.1	108.0	143.6	163.1
1978	90.9	113.0	128.5	108.0	140.0	162.4
1979	89.2	113.1	130.0	105.1	139.7	162.5
1980	90.0	113.2	130.9	108.2	139.7	161.5
1981	91.6	113.9	131.0	110.6	136.2	161.4
1982	92.2	113.9	131.0	112.2	136.1	161.3
1983	95.1	113.8	131.3	108.2	136.2	161.6
1984	95.2	113.7	130.9	116.5	135.9	161.7
1985	95.8	113.6	129.3	117.7	134.8	161.7
1986	96.7	113.8	127.4	118.4	137.8	161.4
1987	96.9	113.7	127.0	120.0	140.2	161.8
1988	98.5	113.4	128.1	118.7	139.4	161.7
1989	98.3	113.6	127.4	118.6	139.9	161.8
1990	97.6	113.7	126.7	122.2	141.6	161.6
1991	97.6	113.5	129.0	123.3	142.3	169.1
1992	97.9	113.9	129.6	123.7	142.6	170.3
1993	98.3	113.9	128.9	123.0	137.7	169.3
1994	98.7	113.5	128.3	122.9	137.4	169.2
1995	99.6	114.3	127.9	122.1	135.9	169.3
1996	99.9	114.1	128.1	118.0	136.9	170.2
1997	99.2	114.5	127.4	119.5	136.5	[a]
1998	98.8	114.0	127.4	116.9	135.3	[a]
1999	98.9	114.0	127.0	117.9	136.4	[a]
2000	99.4	113.6	124.9	119.7	134.0	[a]
2001	99.2	113.7	124.8	119.6	133.6	[a]
2002	98.9	114.8	124.0	118.2	133.6	[a]
2003	98.6	114.6	124.8	115.2	133.5	[a]
2004	99.0	114.0	124.7	117.5	133.5	165.0
2005	99.1	114.5	125.0	115.9	133.3	165.0
2006	98.8	114.0	124.7	118.4	135.6	164.4
2007	99.0	113.8	123.7	111.9	135.3	159.3
2008	97.0	113.8	123.4	114.6	133.2	159.4
Average annual percentage change						
1977-2008	0.1%	0.0%	-0.1%	0.2%	-0.2%	-0.1%
1998-2008	-0.2%	0.0%	-0.3%	-0.2%	-0.2%	-0.5%[b]

Source:
U.S. Environmental Protection Agency, *Light-Duty Automotive Technology and Fuel Economy Trends: 1975 Through 2008*, September 2008. (Additional resources: www.epa.gov/otaq/fetrends.htm)

[a] No vehicles in this category were sold in this model year.
[b] 1996-2008.

The average light vehicle in 2007 contained more than 2,000 pounds of steel, most of it conventional steel. High and medium strength steel, however, made up more than 10% of the vehicle. The use of aluminum grew from 1995 to 2007, while the use of iron castings declined.

Table 4.15
Average Material Consumption for a Domestic Light Vehicle, Model Years 1995, 2000, and 2007

	1995		2000		2007	
Material	Pounds	Percentage	Pounds	Percentage	Pounds	Percentage
Regular steel	1,630.0	44.1%	1,655.0	42.4%	1,644.0	40.3%
High and medium strength steel	324.0	8.8%	408.0	10.5%	518.0	12.7%
Stainless steel	51.0	1.4%	62.0	1.6%	75.0	1.8%
Other steels	46.0	1.2%	26.0	0.7%	34.0	0.8%
Iron castings	466.0	12.6%	432.0	11.1%	322.0	7.9%
Aluminum	231.0	6.3%	268.0	6.9%	313.0	7.7%
Magnesium castings	4.0	0.1%	8.0	0.2%	10.0	0.2%
Copper and brass	50.0	1.4%	52.0	1.3%	53.0	1.3%
Lead	33.0	0.9%	36.0	0.9%	42.0	1.0%
Zinc castings	19.0	0.5%	13.0	0.3%	9.0	0.2%
Powder metal parts	29.0	0.8%	36.0	0.9%	43.0	1.1%
Other metals	4.0	0.1%	4.0	0.1%	5.0	0.1%
Plastics and plastic composites	240.0	6.5%	286.0	7.3%	331.0	8.1%
Rubber	149.0	4.0%	166.0	4.3%	189.0	4.6%
Coatings	23.0	0.6%	25.0	0.6%	29.0	0.7%
Textiles	42.0	1.1%	44.0	1.1%	46.0	1.1%
Fluids and lubricants	192.0	5.2%	207.0	5.3%	215.0	5.3%
Glass	97.0	2.6%	103.0	2.6%	106.0	2.6%
Other materials	64.0	1.7%	71.0	1.8%	92.0	2.3%
Total	3,694.0	100.0%	3,902.0	100.0%	4,076.0	100.0%

Source:
Ward's Communications, *Ward's Motor Vehicle Facts and Figures, 2008*, (and updates, 2009), Detroit, MI, 2008, p.63.

The number of franchised dealerships which sell new light-duty vehicles (cars and light trucks) has declined over 30% since 1970, though new vehicle sales have increased. The average number of vehicles sold per dealer in 2007 was 749 vehicles per dealer – more than double the 1970 number.

Table 4.16
New Light Vehicle Dealerships and Sales, 1970–2007

Calendar year	Number of franchised new light vehicle dealerships[a]	New light vehicle sales (thousands)	Light vehicle sales per dealer
1970	30,800	9,862	320
1971	30,300	12,006	396
1972	30,100	13,189	438
1973	30,100	14,184	471
1974	30,000	11,191	373
1975	29,600	10,905	368
1976	29,300	13,066	446
1977	29,100	14,613	502
1978	29,000	15,122	521
1979	28,500	13,984	491
1980	27,900	11,389	408
1981	26,350	10,678	405
1982	25,700	10,426	406
1983	24,725	12,132	491
1984	24,725	14,187	574
1985	24,725	15,437	624
1986	24,825	15,998	644
1987	25,150	14,802	589
1988	25,025	15,347	613
1989	25,000	14,389	576
1990	24,825	13,851	558
1991	24,200	12,312	509
1992	23,500	12,842	546
1993	22,950	13,869	604
1994	22,850	15,024	658
1995	22,800	14,688	644
1996	22,750	15,046	661
1997	22,700	15,069	664
1998	22,600	15,441	683
1999	22,400	16,771	748
2000	22,250	17,234	774
2001	22,150	17,123	773
2002	21,800	16,816	771
2003	21,725	16,548	762
2004	21,650	16,867	779
2005	21,640	16,948	783
2006	21,495	16,505	768
2007	21,200	16,089	749
		Average annual percentage change	
1970–2007	-1.0%	1.3%	2.3%
1997–2007	-0.7%	0.7%	1.2%

Source:
Number of dealers - National Automobile Dealers Association, *Automotive Executive Magazine*, 2009. (Additional resources: http://www.nada.org/Publications/NADADATA/) Light-duty vehicle sales - See tables 4.5 and 4.6.

[a] As of the beginning of the year.

The number of conventional refueling stations is declining while the number of vehicles fueling at those stations continues to rise. In 2007, there were 0.66 fueling stations per thousand vehicles or 1.51 thousand vehicles per station.

Table 4.17
Conventional Refueling Stations, 1993-2007

Year	Number of retail outlets	Vehicles in operation (thousands)	Stations per thousand vehicles	Thousand vehicles per station
	Conventional fuels			
1993	207,416	186,315	1.11	0.90
1994	202,878	188,714	1.08	0.93
1995	195,455	193,441	1.01	0.99
1996	190,246	198,294	0.96	1.04
1997	187,892	201,071	0.93	1.07
1998	182,596	205,043	0.89	1.12
1999	180,567	209,509	0.86	1.16
2000	175,941	213,300	0.82	1.21
2001	172,169	216,683	0.79	1.26
2002	170,018	221,027	0.77	1.30
2003	167,571	225,882	0.74	1.35
2004	167,346	232,167	0.72	1.39
2005	168,987	238,384	0.71	1.41
2006	167,476	244,643	0.69	1.46
2007	164,292	248,701	0.66	1.51

Sources:
Conventional refueling stations: National Petroleum News Survey, 2007.
Conventional vehicles: The Polk Company, Detroit, MI, FURTHER REPRODUCTION PROHIBITED.

Notes: The County Business Patterns (CBP) data published by the Bureau of the Census tells the number of establishments by North American Industry Classification System (NAICS). NAICS is an industry classification system that groups establishments into industries based on the activities in which they are primarily engaged. NAICS 447 represents gasoline stations. However, the CBP gasoline station data differ from the National Petroleum News Survey data by as much as 30% (117,189 stations in 2005); the CBP may not include every gasoline retail outlet due to the classification of the primary activity of the business.

Alternative Fuel Refueling Stations are listed in Chapter 6.

In 2006 the National Highway Traffic Safety Administration (NHTSA) established new requirements for the light truck Corporate Average Fuel Economy (CAFE) standards. In the new rule, there are Unreformed CAFE standards for model years (MY) 2008 through 2010 using the same CAFE calculations as in the past, and there are Reformed CAFE standards for those years as well, using a new methodology for the calculation of CAFE. For MY 2008 through 2010, the manufacturers can choose either standard. See Table 4.19 for details on the Reformed CAFE calculation. Another change with the Reformed CAFE standards is that larger passenger vans and sport utility vehicles (8,500-10,000 lbs gross vehicle weight) are included, whereas they are not included in the Unreformed CAFE calculations.

For MY 2011, new standards for cars and light trucks were established on March 30, 2009, using a methodology similar to the Reformed light truck standards. NHTSA is currently researching future standards.

Table 4.18
Reformed and Unreformed Light Truck Corporate Average Fuel Economy Standards, MY 2008-2011

	CAFE Standard (miles per gallon)		Estimated Fuel Savings (billions of gallons)	
Model Year	Unreformed	Reformed	Unreformed	Reformed
		Light trucks		
2008	22.5	22.7	0.6	0.7
2009	23.1	23.4	1.8	1.9
2010	23.5	23.7	2.0	2.2
2011	None	24.1	Not applicable	Not available
		Cars		
2011	None	30.2	Not applicable	Not available

Source:
Federal Register, vol. 71, No. 66, April 6, 2006.
Federal Register, Vol. 74, No. 59, March 30, 2009.

According to the model year (MY) 2008–2010 Reformed light truck CAFE standards, each manufacturer's required CAFE will be based on target levels set according to the vehicle size. The target levels are assigned based on a vehicle's "footprint" and each footprint has a different target. The vehicle footprint is calculated as:

footprint = track width × wheelbase,

where
track width = lateral distance between the centerlines of the base tires at ground, and
wheelbase = longitudinal distance between the front and rear wheel centerlines.

The CAFE standards for MY 2011, which apply to both cars and light trucks, also use the vehicle footprint to determine target fuel economy.

Table 4.19
Footprints for Selected Vehicles[a]

Light Trucks	Footprint (Square Feet)
Ford F-150 Super Cab	75.8
GM Silverado Extended Cab	65.3
Lincoln Navigator	55.4
Honda Odyssey	54.7
Hummer H3	50.7
GM Equinox	48.2
Saturn Vue	45.2
Ford Escape	43.5

Source:
Federal Register, Vol. 71, No. 66, April 6, 2006.

[a]Footprint calculated using model year 2005 track width and wheelbase.

The Corporate Average Fuel Economy standards were established by the U.S. Energy Policy and Conservation Act of 1975 (PL94-163). These standards must be met at the manufacturer level. Some manufacturers fall short of meeting the standards while others exceed them. Legislation passed in December 2007 will change the CAFE standards beginning in the 2011 model year. The new standards have a target of combined fleet fuel economy of 35 mpg by 2020, for all cars and light trucks.

Table 4.20
Car Corporate Average Fuel Economy (CAFE)
Standards versus Sales-Weighted Fuel Economy Estimates, 1978–2009[a]
(miles per gallon)

	Cars				CAFE estimates
		CAFE estimates[c]			
Model year[b]	CAFE standards	Domestic	Import	Combined	Cars and light trucks combined
1978	18.0	18.7	27.3	19.9	19.9
1979	19.0	19.3	26.1	20.3	20.1
1980	20.0	22.6	29.6	24.3	23.1
1981	22.0	24.2	31.5	25.9	24.6
1982	24.0	25.0	31.1	26.6	25.1
1983	26.0	24.4	32.4	26.4	24.8
1984	27.0	25.5	32.0	26.9	25.0
1985	27.5	26.3	31.5	27.6	25.4
1986	26.0	26.9	31.6	28.2	25.9
1987	26.0	27.0	31.2	28.5	26.2
1988	26.0	27.4	31.5	28.8	26.0
1989	26.5	27.2	30.8	28.4	25.6
1990	27.5	26.9	29.9	28.0	25.4
1991	27.5	27.3	30.1	28.4	25.6
1992	27.5	27.0	29.2	27.9	25.1
1993	27.5	27.8	29.6	28.4	25.2
1994	27.5	27.5	29.6	28.3	24.7
1995	27.5	27.7	30.3	28.6	24.9
1996	27.5	28.1	29.6	28.5	24.9
1997	27.5	27.8	30.1	28.7	24.6
1998	27.5	28.6	29.2	28.8	24.7
1999	27.5	28.0	29.0	28.3	24.5
2000	27.5	28.7	28.3	28.5	24.8
2001	27.5	28.7	29.0	28.8	24.5
2002	27.5	29.1	28.8	29.0	24.7
2003	27.5	29.1	29.9	29.5	25.1
2004	27.5	29.9	28.7	29.5	24.6
2005	27.5	30.5	29.9	30.3	25.4
2006	27.5	30.3	29.7	30.1	25.8
2007	27.5	30.6	32.2	31.2	26.6
2008	27.5	31.0	31.5	31.2	27.0
2009	27.5	32.6	32.6	32.6	28.2

Source:
U.S. Department of Transportation, NHTSA, "Summary of Fuel Economy Performance," Washington, DC, March 2009. (Additional resources: www.nhtsa.dot.gov)

[a] Only vehicles with at least 75 percent domestic content can be counted in the average domestic fuel economy for a manufacturer.

[b] Model year as determined by the manufacturer on a vehicle by vehicle basis.

[c] All CAFE calculations are sales-weighted.

The Corporate Average Fuel Economy standards for light trucks are lower than the car standards. Light trucks include pickups, minivans, sport utility vehicles and vans. New legislation passed in December 2007 will change the CAFE standards beginning in the 2011 model year. The new standards have a target of combined fleet fuel economy of 35 mpg by 2020, for all cars and light trucks.

Table 4.21
Light Truck Corporate Average Fuel Economy (CAFE)
Standards versus Sales-Weighted Fuel Economy Estimates, 1978–2009[a]
(miles per gallon)

	Light trucks[b]				CAFE estimates
		CAFE estimates[d]			
Model year[c]	CAFE standards	Domestic	Import	Combined	Cars and light trucks combined
1978	[e]	[f]	[f]	[f]	19.9
1979	[e]	17.7	20.8	18.2	20.1
1980	[e]	16.8	24.3	18.5	23.1
1981	[e]	18.3	27.4	20.1	24.6
1982	17.5	19.2	27.0	20.5	25.1
1983	19.0	19.6	27.1	20.7	24.8
1984	20.0	19.3	26.7	20.6	25.0
1985	19.5	19.6	26.5	20.7	25.4
1986	20.0	20.0	25.9	21.5	25.9
1987	20.5	20.5	25.2	21.7	26.2
1988	20.5	20.6	24.6	21.3	26.0
1989	20.5	20.4	23.5	21.0	25.6
1990	20.0	20.3	23.0	20.8	25.4
1991	20.2	20.9	23.0	21.3	25.6
1992	20.2	20.5	22.7	20.8	25.1
1993	20.4	20.7	22.8	21.0	25.2
1994	20.5	20.5	22.1	20.8	24.7
1995	20.6	20.3	21.5	20.5	24.9
1996	20.7	20.5	22.2	20.8	24.9
1997	20.7	20.1	22.1	20.6	24.6
1998	20.7	20.5	23.0	21.0	24.7
1999	20.7	20.4	22.5	20.9	24.5
2000	20.7	21.1	19.7	21.3	24.8
2001	20.7	20.6	21.8	20.9	24.5
2002	20.7	20.6	21.9	21.4	24.7
2003	20.7	21.8	22.4	21.8	25.1
2004	20.7	20.7	22.3	21.5	24.6
2005	21.0	[f]	[f]	22.1	25.4
2006	21.6	[f]	[f]	22.5	25.8
2007	22.2	[f]	[f]	23.1	26.6
2008	22.5[g]	[f]	[f]	23.6	27.0
2009	23.1[g]	[f]	[f]	24.2	28.2

Source:
U.S. Department of Transportation, NHTSA, "Summary of Fuel Economy Performance," Washington, DC, March 2009. (Additional resources: www.nhtsa.dot.gov)

[a] Only vehicles with at least 75% domestic content can be counted in the average domestic fuel economy for a manufacturer.
[b] Represents two- and four-wheel drive trucks combined. Gross vehicle weight of 0-6,000 pounds for model year 1978-1979 and 0-8,500 pounds for subsequent years.
[c] Model year as determined by the manufacturer on a vehicle by vehicle basis.
[d] All CAFE calculations are sales-weighted.
[e] Standards were set for two-wheel drive and four-wheel drive light trucks, but no combined standard was set in this year.
[f] Data are not available.
[g] Unreformed standards. See Table 4.18 for reformed standards.

Manufacturers of cars and light trucks whose vehicles do not meet the CAFE standards are fined. Data from the National Highway Traffic Safety Administration show CAFE fine collection dropped under $25 million in 2002 and 2003; this was due to several factors, including the CAFE credit system, manufacturer mergers, and fines not being paid in the same year they were assessed.

Table 4.22
Corporate Average Fuel Economy (CAFE) Fines Collected, 1983-2007[a]
(thousands)

Model year	Current dollars	2007 constant dollars[b]
1983	58	121
1984	5,958	11,890
1985	15,565	29,992
1986	29,872	56,511
1987	31,261	57,056
1988	44,519	78,028
1989	47,381	79,225
1990	48,309	76,636
1991	42,363	64,490
1992	38,287	56,581
1993	28,688	41,164
1994	31,499	44,068
1995	40,787	55,491
1996	19,302	25,507
1997	36,212	46,780
1998	21,740	27,654
1999	27,516	34,245
2000	51,067	61,488
2001	35,507	41,570
2002	20,042	23,098
2003	15,225	17,157
2004	33,637	36,921
2005	27,487	29,181
2006	43,183	44,413
2007	37,386	37,386

Source:
U.S. Department of Transportation, National Highway Traffic Safety Administration, Office of Vehicle Safety Compliance, Washington, DC, January 2009. (Additional resources: www.nhtsa.dot.gov)

[a] These are fines which are actually collected. Fines which are assessed in certain year may not have been collected in that year.
[b] Adjusted using the Consumer Price Inflation Index.

Consumers must pay the Gas Guzzler Tax when purchasing a car that has an Environmental Protection Agency (EPA) fuel economy rating (combined city and highway) less than that stipulated in the table below. The Gas Guzzler Tax doubled in 1991 after remaining constant from 1986 to 1990. The tax has not changed since 1991. This tax does not apply to light trucks such as pickups, minivans, sport utility vehicles, and vans.

Table 4.23
The Gas Guzzler Tax on New Cars
(dollars per vehicle)

Vehicle fuel economy (mpg)	1980	1981	1982	1983	1984	1985	1986–90	1991 – on
Over 22.5	0	0	0	0	0	0	0	0
22.0–22.5	0	0	0	0	0	0	500	1,000
21.5–22.0	0	0	0	0	0	0	500	1,000
21.0–21.5	0	0	0	0	0	0	650	1,300
20.5–21.0	0	0	0	0	0	500	650	1,300
20.0–20.5	0	0	0	0	0	500	850	1,700
19.5–20.0	0	0	0	0	0	600	850	1,700
19.0–19.5	0	0	0	0	450	600	1,050	2,100
18.5–19.0	0	0	0	350	450	800	1,050	2,100
18.0–18.5	0	0	200	350	600	800	1,300	2,600
17.5–18.0	0	0	200	500	600	1,000	1,300	2,600
17.0–17.5	0	0	350	500	750	1,000	1,500	3,000
16.5–17.0	0	200	350	650	750	1,200	1,500	3,000
16.0–16.5	0	200	450	650	950	1,200	1,850	3,700
15.5–16.0	0	350	450	800	950	1,500	1,850	3,700
15.0–15.5	0	350	600	800	1,150	1,500	2,250	4,500
14.5–15.0	200	450	600	1,000	1,150	1,800	2,250	4,500
14.0–14.5	200	450	750	1,000	1,450	1,800	2,700	5,400
13.5–14.0	300	550	750	1,250	1,450	2,200	2,700	5,400
13.0–13.5	300	550	950	1,250	1,750	2,200	3,200	6,400
12.5–13.0	550	650	950	1,550	1,750	2,650	3,200	6,400
Under 12.5	550	650	1,200	1,550	2,150	2,650	3,850	7,700

Source:
Internal Revenue Service, Form 6197, (Rev. 1-91), "Gas Guzzler Tax." (Additional resources: www.irs.ustreas.gov)

Consumers continue to demand gas guzzling cars. The IRS collected over $178 million in 2007 from those buying cars with combined city/highway fuel economy less than 22.5 miles per gallon. This tax does not apply to light trucks such as pickups, minivans, sport utility vehicles, and vans.

Table 4.24
Tax Receipts from the Sale of Gas Guzzlers, 1980–2007
(thousands)

Model year	Current dollars	2007 constant dollars[a]
1980	740	1,862
1981	780	1,779
1982	1,720	3,696
1983	4,020	8,369
1984	8,820	17,601
1985	39,790	76,673
1986	147,660	279,341
1987	145,900	266,293
1988	116,780	204,676
1989	109,640	183,329
1990	103,200	163,715
1991	118,400	180,243
1992	144,200	213,104
1993	111,600	160,132
1994	64,100	89,679
1995	73,500	99,997
1996	52,600	69,510
1997	48,200	62,267
1998	47,700	60,676
1999	68,300	85,002
2000	70,800	85,248
2001	78,200	91,553
2002	79,700	91,857
2003	126,700	142,772
2004	140,800	154,545
2005	163,800	173,898
2006	200,200	205,900
2007	178,700	178,702

Source:
Ward's Communications, *Motor Vehicle Facts and Figures*, 2008, Detroit, MI, 2008, p. 87. Original data source: Internal Revenue Service.

[a] Adjusted using the Consumer Price Inflation Index.

The Powertrain System Analysis Toolkit (PSAT) provides vehicle simulations for a variety of research purposes. It is used by the Department of Energy to evaluate the fuel efficiency potential of advanced powertrain configurations for different driving conditions. Recently, PSAT was used to develop data on the relationship between speed and fuel economy.

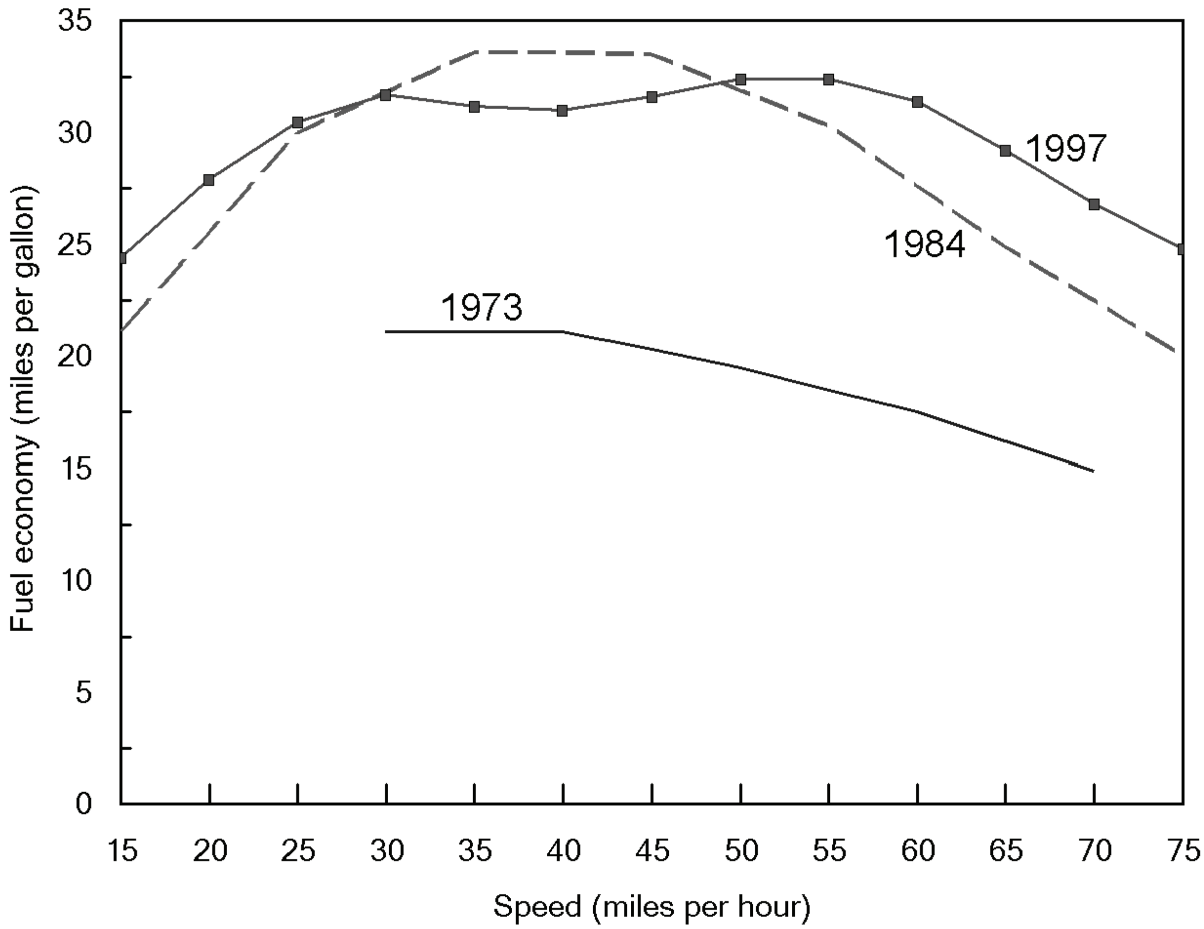
Table 4.25
Fuel Economy by Speed, PSAT Model Results

	Gasoline Conventional			Diesel Conventional			Hybrid Vehicles			
Speed (mph)	Midsize Car	Small SUV	Large SUV	Midsize Car	Small SUV	Large SUV	2000 Insight[a]	2004 Prius	2007 Camry[a]	2008 Tahoe[a]
45	39.1	32.5	29.5	56.4	47.7	43.6	101.3	72.0	52.2	32.2
55	41.7	34.3	30.0	57.0	46.0	39.9	94.3	66.0	46.8	27.1
65	36.9	29.1	23.0	47.9	37.6	32.5	80.0	57.0	40.9	23.7
75	31.9	24.5	19.8	40.2	30.8	26.9	60.6	42.0	35.0	21.1
					Fuel Economy Loss					
55 - 65 mph	11.5%	15.2%	23.5%	16.0%	18.3%	18.5%	15.2%	13.6%	12.6%	12.4%
65 - 75 mph	13.6%	15.8%	13.8%	16.2%	18.1%	17.2%	24.3%	26.3%	14.5%	11.1%
55 - 75 mph	23.5%	28.6%	34.0%	29.6%	33.1%	32.6%	35.8%	36.4%	25.3%	22.1%

Source:
Argonne National Laboratory, Powertrain System Analysis Toolkit, www.transportation.anl.gov/modeling_simulation/PSAT/. (Additional resources: www.transportation.anl.gov)

[a] From Argonne National Laboratory Advanced Powertrain Research Facility (Vehicle Test Data).

Figure 4.2. Fuel Economy by Speed, 1973, 1984, and 1997 Studies



Source:
See Table 4.25.

The two earlier studies by the Federal Highway Administration (FHWA) indicate maximum fuel efficiency was achieved at speeds of 35 to 40 mph. The recent FHWA study indicates greater fuel efficiency at higher speeds. Note that the 1973 study did not include light trucks.

Table 4.26
Fuel Economy by Speed, 1973, 1984, and 1997 Studies
(miles per gallon)

Speed (miles per hour)	1973[a] (13 vehicles)	1984[b] (15 vehicles)	1997[c] (9 vehicles)
15	[d]	21.1	24.4
20	[d]	25.5	27.9
25	[d]	30.0	30.5
30	21.1	31.8	31.7
35	21.1	33.6	31.2
40	21.1	33.6	31.0
45	20.3	33.5	31.6
50	19.5	31.9	32.4
55	18.5	30.3	32.4
60	17.5	27.6	31.4
65	16.2	24.9	29.2
70	14.9	22.5	26.8
75	[d]	20.0	24.8
		Fuel economy loss	
55–65 mph	12.4%	17.8%	9.7%
65–70 mph	8.0%	9.6%	8.2%
55–70 mph	19.5%	25.7%	17.1%

Sources:
1973- U.S. Department of Transportation, Federal Highway Administration, Office of Highway Planning, *The Effect of Speed on Automobile Gasoline Consumption Rates*, Washington, DC, October 1973.
1984 - U.S. Department of Transportation, Federal Highway Administration, *Fuel Consumption and Emission Values for Traffic Models*, Washington, DC, May 1985.
1997 - West, B.H., R.N. McGill, J.W. Hodgson, S.S. Sluder, and D.E. Smith, *Development and Verification of Light-Duty Modal Emissions and Fuel Consumption Values for Traffic Models*, FHWA Report (in press), Washington, DC, April 1997, and additional project data, April 1998. (Additional resources: www.fhwa-tsis.com)

[a] Model years 1970 and earlier cars.
[b] Model years 1981–84 cars and light trucks.
[c] Model years 1988–97 cars and light trucks.
[d] Data are not available.

Table 4.27
Vehicle Specifications for Vehicles Tested in the 1997 Study

Vehicle	Curb weight	Engine	Fuel delivery system[a]	Trans-mission	EPA fuel economy	
					City	Highway
1988 Chevrolet Corsica	2,665	2.8 liter V6	PFI	M5	19	29
1994 Olds Cutlass Supreme	3,290	3.4 liter V6	PFI	L4	17	26
1994 Oldsmobile 88	3,433	3.8 literV6	PFI	L4	19	29
1994 Mercury Villager	4,020	3.0 liter V6	PFI	L4	17	23
1995 Geo Prizm	2,359	1.6 liter I-4	PFI	L3	26	30
1994 Jeep Grand Cherokee	3,820	4.0 liter I-6	PFI	L4	15	20
1994 Chevrolet Pickup	4,020	5.7 liter V8	TBI	L4	14	18
1993 Subaru Legacy	2,800	2.2 liter H4	PFI	L4	22	29
1997 Toyota Celica	2,395	1.8 liter I4	PFI	L4	27	34

Source:
West, B.H., R.N. McGill, J.W. Hodgson, S.S. Sluder, and D.E. Smith, *Development and Verification of Light-Duty Modal Emissions and Fuel Consumption Values for Traffic Models*, Washington, DC, April 1997 and additional project data, April 1998.

[a] PFI = port fuel injection. TBI = throttle- body fuel injection.

Of the tested vehicles, the 1994 Oldsmobile Olds 88 had the greatest fuel economy loss from 55 mph to 75 mpg. The 1997 Toyota Celica tested fuel economy was slightly better at 65 mph than at 55 mph.

Table 4.28
Steady Speed Fuel Economy for Vehicles Tested in the 1997 Study
(miles per gallon)

Speed (mph)	1988 Chevrolet Corsica	1993 Subaru Legacy	1994 Oldsmobile Olds 88	1994 Oldsmobile Cutlass	1994 Chevrolet Pickup	1994 Jeep Grand Cherokee	1994 Mercury Villager	1995 Geo Prizm	1997 Toyota Celica
5	10.0	14.5	10.5	5.1	7.9	8.2	12.3	18.1	19.1
10	16.8	24.7	14.9	7.9	16.0	11.2	19.0	23.1	34.1
15	17.7	31.9	22.2	11.4	16.3	17.5	22.4	38.9	41.7
20	21.7	34.4	26.3	12.5	19.9	24.7	25.8	39.4	46.0
25	23.9	37.4	28.3	15.6	22.7	21.8	30.8	41.7	52.6
30	28.7	39.7	29.0	19.0	26.3	21.6	30.3	40.0	50.8
35	28.6	38.0	30.9	21.2	24.3	25.0	26.1	39.1	47.6
40	29.2	37.0	33.2	23.0	26.7	25.5	29.0	38.9	36.2
45	28.8	33.7	32.4	23.0	27.3	25.4	27.8	42.3	44.1
50	31.2	33.7	34.2	27.3	26.3	24.8	30.1	39.1	44.8
55	29.1	37.7	34.6	29.1	25.1	24.0	31.7	37.7	42.5
60	28.2	35.9	32.5	28.2	22.6	23.2	27.3	36.7	48.4
65	28.7	33.4	30.0	25.0	21.8	21.3	25.3	34.1	43.5
70	26.1	31.0	26.7	22.9	20.1	20.0	23.9	31.7	39.2
75	23.7	28.8	24.0	21.6	18.1	19.1	22.4	28.3	36.8
				Fuel economy loss					
55–65 mph	1.4%	11.4%	13.3%	14.1%	13.1%	11.3%	20.2%	9.5%	-2.4%
65–75 mph	17.4%	13.8%	20.0%	13.6%	17.0%	10.3%	11.5%	17.0%	15.4%
55–75 mph	18.6%	23.6%	30.6%	25.8%	27.9%	20.4%	29.3%	24.9%	13.4%

Source:
B.H. West, R.N. McGill, J.W. Hodgson, S.S. Sluder, D.E. Smith, *Development and Verification of Light-Duty Modal Emissions and Fuel Consumption Values for Traffic Models*, Washington, DC, April 1997, and additional project data, April 1998. (Additional resources: www.fhwa-tsis.com)

Note: For specifications of the tested vehicles, please see Table 4.26.

This table shows the new methodology that the Environmental Protection Agency (EPA) used to determine fuel economy ratings for new vehicles beginning in model year 2008. In addition to the Urban Driving Cycle and the Highway Driving cycle, the EPA will also use three additional tests to adjust fuel economy ratings to account for higher speeds, air conditioner use, and colder temperatures. Though the EPA uses a complex combination of these five cycles to determine the fuel economy that will be posted on a new vehicle window sticker, the manufacturer's Corporate Average Fuel Economy is still calculated using only the city and highway driving cycles. To know more about new vehicle fuel economy ratings, visit www.fueleconomy.gov.

Table 4.29
Driving Cycle Attributes

	Test Schedule				
	City	Highway	High Speed	AC	Cold Temp
Trip type	Low speeds in stop-and-go urban traffic	Free-flow traffic at highway speeds	Higher speeds; harder acceleration & braking	AC use under hot ambient conditions	*City* test w/colder outside temperature
Top speed	56 mph	60 mph	**80 mph**	54.8 mph	56 mph
Average speed	20 mph	48 mph	48 mph	22 mph	20 mph
Max. acceleration	3.3 mph/sec	3.2 mph/sec	**8.46 mph/sec**	5.1 mph/sec	3.3 mph/sec
Simulated distance	11 mi.	10 mi.	8 mi.	3.6 mi.	11 mi.
Time	31 min.	12.5 min.	10 min.	9.9 min.	31 min.
Stops	23	None	4	5	23
Idling time	18% of time	None	7% of time	19% of time	18% of time
Engine startup[a]	**Cold**	Warm	Warm	Warm	**Cold**
Lab temperature	68-86° F	68-86° F	68-86° F	**95° F**	**20° F**
Vehicle air conditioning	Off	Off	Off	**On**	Off

Source:
U.S. Department of Energy and U.S. Environmental Protection Agency, Fuel Economy Web site, www.fueleconomy.gov.

[a] A vehicle's engine doesn't reach maximum fuel efficiency until it is warm.

These driving cycles simulate the performance of an engine while driving in the city and on the highway. Once the city cycle is completed, the engine is stopped, then started again for the 8.5 minute hot start cycle. Three additional cycles also influence new vehicle fuel economy ratings beginning with the 2008 model year.

Figure 4.3. City Driving Cycle

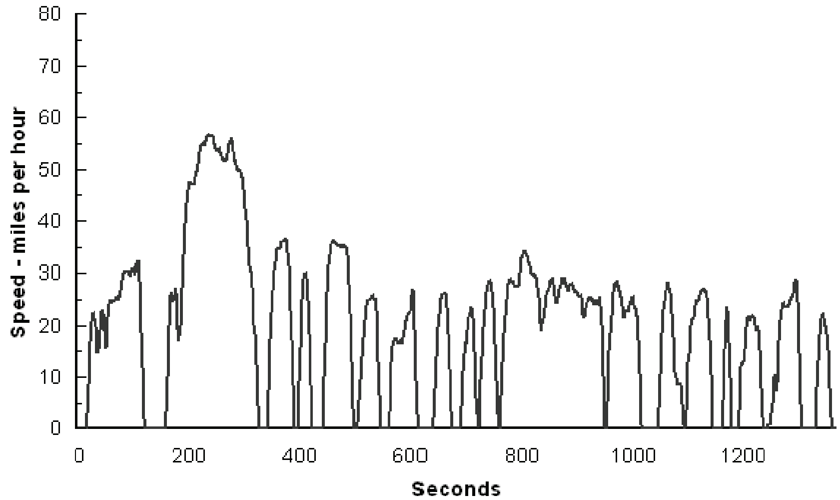
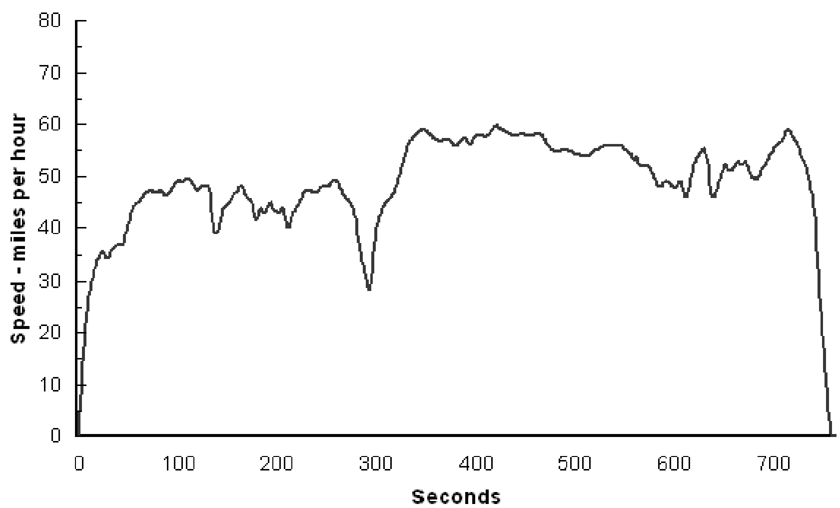


Figure 4.4. Highway Driving Cycle

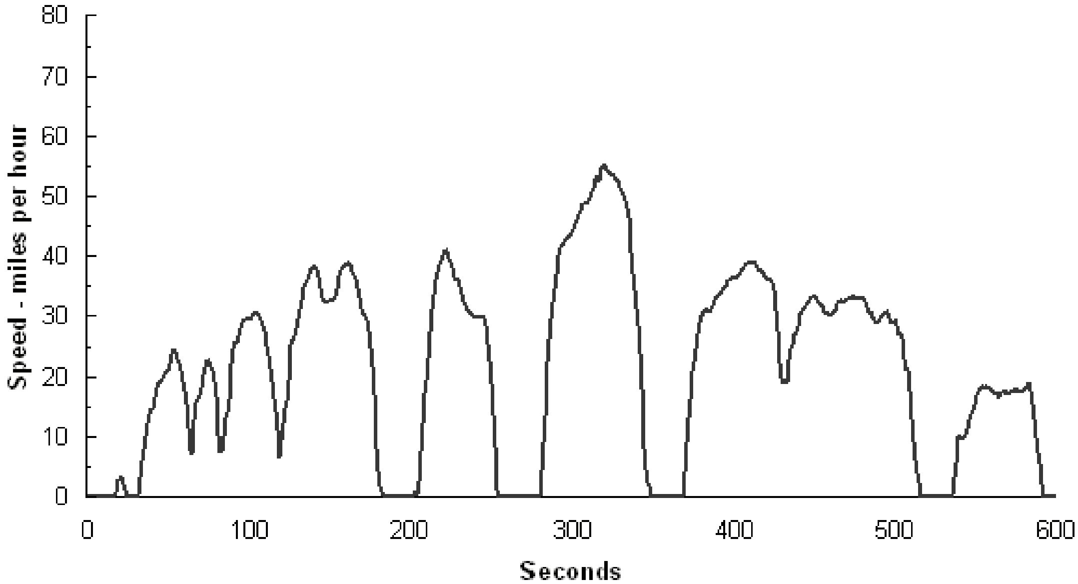


Source:

Code of Federal Regulations, 40CFR, "Subpart B - Fuel Economy Regulations for 1978 and Later Model Year Automobiles - Test Procedures," July 1, 1988 edition, p. 676.

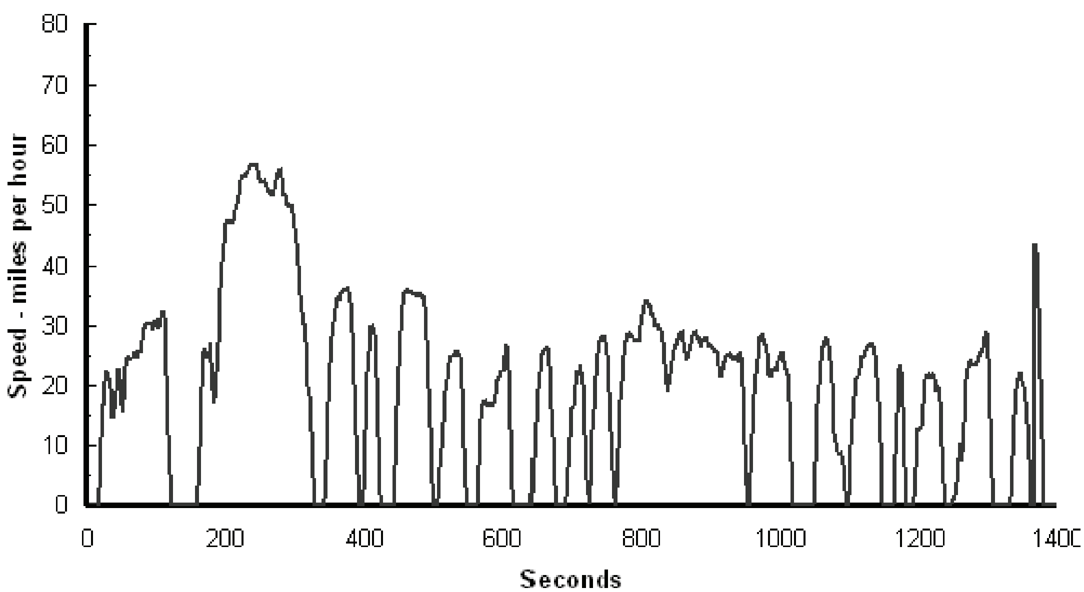
Beginning with the 2008 model year, these cycles influence the new vehicle fuel economy ratings.

Figure 4.5. Air Conditioning (SC03) Driving Cycle



Source:
U.S. Department of Energy and Environmental Protection Agency, Fuel Economy Web site, www.fueleconomy.gov.

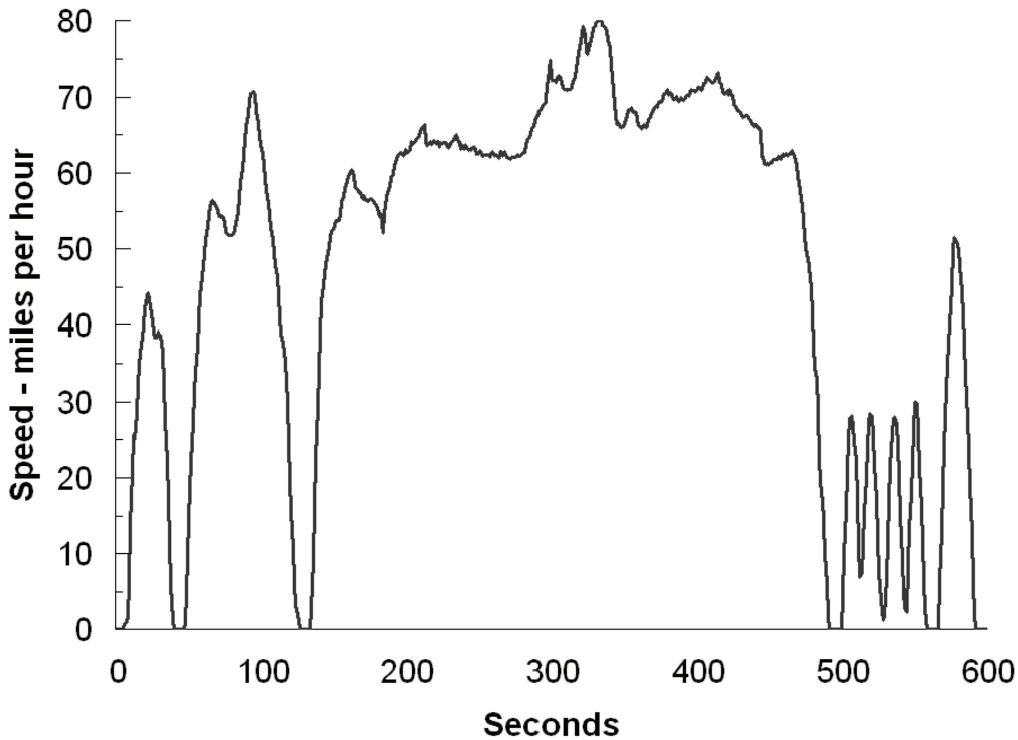
Figure 4.6. Cold Temperature (Cold FTP) Driving Cycle



Source:
U.S. Department of Energy and Environmental Protection Agency, Fuel Economy Web site, www.fueleconomy.gov.

Beginning with the 2008 model year, this cycle influences the new vehicle fuel economy ratings. The US06 driving cycle was originally developed as a supplement to the Federal Test Procedure. It is a short-duration cycle (600 seconds) which represents hard-acceleration driving.

Figure 4.7. High-Speed (US06) Driving Cycle



Source:
U.S. Department of Energy and Environmental Protection Agency, Fuel Economy Web site, www.fueleconomy.gov.

The Environmental Protection Agency also uses other driving cycles to test new vehicles (although these do not affect the fuel economy ratings). The New York Test Cycle was developed in the 1970's in order to simulate driving in downtown congested areas. The Representative Number Five Test Cycle was developed in the 1990's to better represent actual on-road driving by combining modern city and freeway driving.

Figure 4.8. New York City Driving Cycle

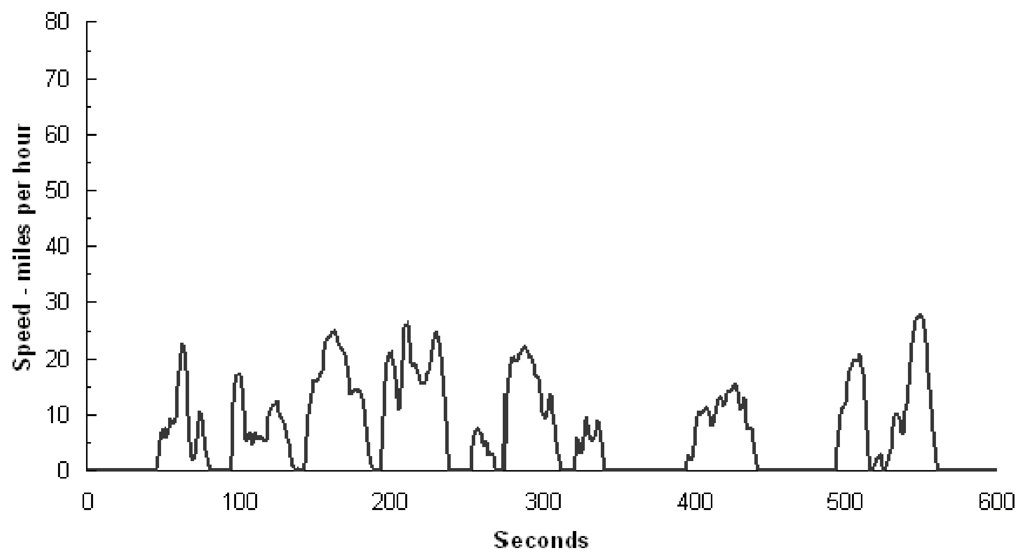
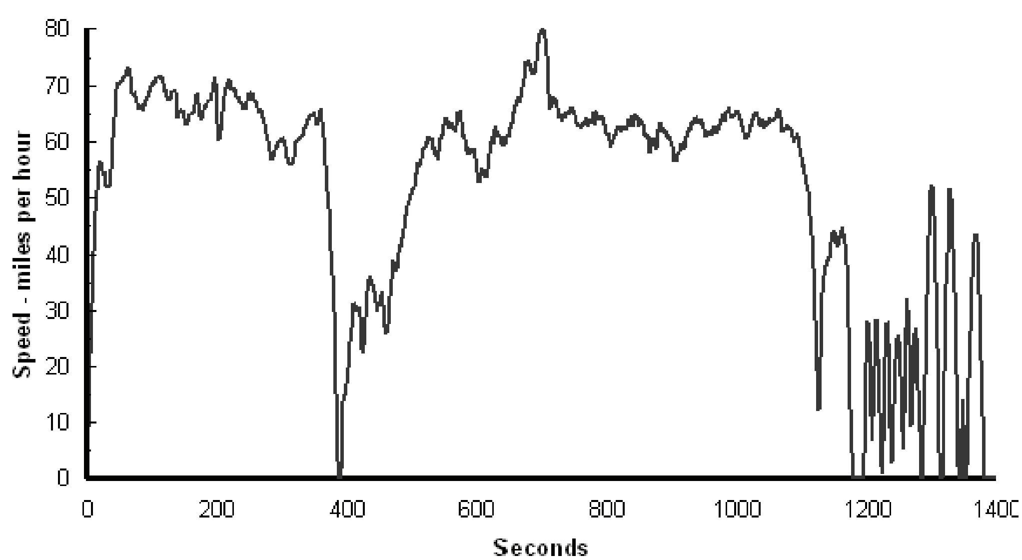


Figure 4.9. Representative Number Five Driving Cycle



Source:
Data obtained from Michael Wang, Argonne National Laboratory, Argonne, IL, 1997.

Researchers at Argonne National Laboratory have estimated the fuel economy of a midsize car using driving cycles from different countries. These results illustrate the difference in fuel economy which can be obtained from the same vehicle using different test cycles.

Table 4.30
Projected Fuel Economies from U.S., European, and Japanese Driving Cycles

Driving Cycle	Projected fuel economy for a 1995 composite midsize vehicle[a]
Japanese 10/15 mode test cycle	17.5 mpg
New European Driving Cycle (NEDC)	22.0 mpg
U.S. EPA city cycle (LA4)	19.8 mpg
U.S. EPA highway cycle	32.1 mpg
U.S. Corporate Average Fuel Economy cycle	23.9 mpg

Source:
Santini, D., A. Vyas, J. Anderson, and F. An, *Estimating Trade-Offs along the Path to the PNGV 3X Goal*, presented at the Transportation Research Board 80[th] Annual Meeting, Washington, DC, January 2001.

Note: China and India both use the European Driving Cycle, though India uses a modified version called the Modified Indian Driving Cycle which accounts for lower maximum speeds that better represent driving conditions in India.

[a] The 1995 composite midsize vehicle is an average of a Chevrolet Lumina, Chrysler Concord, and Ford Taurus. The fuel economies were projected using the National Renewable Energy Laboratory's Advanced Vehicle Simulator (ADVISOR) model.

When comparing data between countries, one must realize that different countries have different testing cycles to determine fuel economy and emissions. This table compares various statistics on the European, Japanese, and U.S. testing cycles [for fuel economy measurements, the United States uses the formula, 1/fuel economy = (0.55/city fuel economy) + (0.45/highway fuel economy)]. Most vehicles will achieve higher fuel economy on the U.S. test cycle than on the European or Japanese cycles.

Table 4.31
Comparison of U.S., European, and Japanese Driving Cycles

	Time (seconds)	Percent of time stopped or decelerating	Distance (miles)	Average speed (mph)	Maximum speed (mph)	Maximum acceleration (mph/s)
Japanese 10/15 mode test cycle	631	52.3	2.6	14.8	43.5	1.78
New European Driving Cycle (NEDC)	1,181	24.9	6.84	20.9	74.6	2.4
U.S. EPA city cycle (LA4)[a]	1,372	43.2	7.5	19.5	56.7	3.3
U.S. EPA highway cycle	765	9.3	17.8	48.2	59.9	3.3
U.S. Corporate Average Fuel Economy cycle	2,137	27.9	10.3	29.9	59.9	3.3

Source:
Santini, D., A. Vyas, J. Anderson, and F. An, *Estimating Trade-Offs along the Path to the PNGV 3X Goal*, presented at the Transportation Research Board 80th Annual Meeting, Washington, DC, January 2001.

Note: China and India both use the European Driving Cycle, though India uses a modified version called The Modified Indian Driving Cycle which accounts for lower maximum speeds that better represent driving conditions in India.

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[a] The actual Federal Procedure (FTP), which is also the test for emissions certification, repeats the first 505 seconds of the Federal Urban Driving Simulation cycle, hot started, after a 10 minute hot soak. Starting with Model Year 2001, the emissions test-but not the fuel economy test-incorporates a supplemental cycle that simulates aggressive urban driving, coupled with an added air conditioning load.

Demand response (also called paratransit or dial-a-ride) are widely used by transit agencies. In 2007, the data changed substantially due to improved estimation methodologies. Unfortunately, those data are no longer comparable to the rest of the historical series.

Table 4.32
Summary Statistics on Demand Response Vehicles, 1994–2007[a]

Year	Number of active vehicles	Vehicle-miles (millions)	Passenger-miles (millions)	Energy use (trillion Btu)
1994	31,090	490	781	9.8
1995	31,773	538	856	9.6
1996	33,472	588	958	10.2
1997	35,657	627	1,075	10.2
1998	33,481	721	1,103	10.9
1999	36,651	784	1,258	11.2
2000	37,957	826	1,274	11.4
2001	40,049	861	1,345	11.9
2002	40,691	879	1,336	12.3
2003	42,578	953	1,471	13.5
2004	42,993	975	1,448	14.1
2005	48,530	1,078	1,663	15.5
2006	51,744	1,129	1,790	16.4
2007[a]	64,865	1,471	1,502	24.7

Source:
American Public Transportation Association, *2009 Public Transportation Fact Book, Part 2: Historical Tables*, Washington, DC, April 2009. (Additional resources: www.apta.com)

Note: See Glossary for detailed definitions of demand response.

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[a] Data are not continuous between 2006 and 2007 due to changes in estimation methodology. See source document for details.

Chapter 5
Heavy Vehicles and Characteristics

Summary Statistics from Tables in this Chapter

Source		
Table 5.1	Heavy single-unit trucks, 2007	
	Registration (thousands)	*6,807*
	Vehicle miles (millions)	*81,954*
	Fuel economy (miles per gallon)	*8.2*
Table 5.2	Combination trucks, 2007	
	Registration (thousands)	*2,221*
	Vehicle miles (millions)	*145,008*
	Fuel economy (miles per gallon)	*5.1*
Tables 5.12	Freight Shipments, 2007 Commodity Flow Survey	
and 5.13	*Value (billion dollars)*	*11,832*
	Tons (millions)	*13,017*
	Ton-miles (billions)	*3,491*
Table 5.14	Transit buses in operation, 2007	65,808

Heavy single-unit trucks include all single-unit trucks which have more than two axles or more than four tires. Most of these trucks would be used for business or for individuals with heavy hauling or towing needs.

Table 5.1
Summary Statistics for Heavy Single-Unit Trucks, 1970–2007

Year	Registrations (thousands)	Vehicle travel (million miles)	Fuel use (million gallons)	Fuel economy (miles per gallon)
1970	3,681	27,081	3,968	6.8
1975	4,232	34,606	5,420	6.4
1980	4,374	39,813	6,923	5.8
1981	4,455	39,568	6,867	5.8
1982	4,325	40,658	6,803	6.0
1983	4,204	42,546	6,965	6.1
1984	4,061	44,419	7,240	6.1
1985	4,593	45,441	7,399	6.1
1986	4,313	45,637	7,386	6.2
1987	4,188	48,022	7,523	6.4
1988	4,470	49,434	7,701	6.4
1989	4,519	50,870	7,779	6.5
1990	4,487	51,901	8,357	6.2
1991	4,481	52,898	8,172	6.5
1992	4,370	53,874	8,237	6.5
1993	4,408	56,772	8,488	6.7
1994	4,906	61,284	9,032	6.8
1995	5,024	62,705	9,216	6.8
1996	5,266	64,072	9,409	6.8
1997	5,293	66,893	9,576	7.0
1998	5,414	67,894	9,741	7.0
1999	5,763	70,304	9,372	7.5
2000	5,926	70,500	9,563	7.4
2001	5,704	72,448	9,667	7.5
2002	5,651	75,866	10,321	7.4
2003	5,849	77,757	8,881	8.8
2004	6,161	78,441	8,959	8.8
2005	6,395	78,496	9,501	8.3
2006	6,649	80,344	9,852	8.2
2007	6,807	81,954	10,035	8.2
		Average annual percentage change		
1970–2007	1.7%	3.0%	2.5%	0.5%
1997–2007	2.5%	2.1%	0.5%	1.6%

Source:
U. S. Department of Transportation, Federal Highway Administration, *Highway Statistics 2007*, Washington, DC, 2008, Table VM1 and annual. (Additional resources: www.fhwa.dot.gov)

Note: *Highway Statistics 1999* data were not used.

Combination trucks include all trucks designed to be used in combination with one or more trailers. The average vehicle travel of these trucks (on a per truck basis) far surpasses the travel of other trucks due to long-haul freight movement.

Table 5.2
Summary Statistics for Combination Trucks, 1970–2007

Year	Registrations (thousands)	Vehicle travel[a] (million miles)	Fuel use (million gallons)	Fuel economy (miles per gallon)
1970	905	35,134	7,348	4.8
1975	1,131	46,724	9,177	5.1
1980	1,417	68,678	13,037	5.3
1981	1,261	69,134	13,509	5.1
1982	1,265	70,765	13,583	5.2
1983	1,304	73,586	13,796	5.3
1984	1,340	77,377	14,188	5.5
1985	1,403	78,063	14,005	5.6
1986	1,408	81,038	14,475	5.6
1987	1,530	85,495	14,990	5.7
1988	1,667	88,551	15,224	5.8
1989	1,707	91,879	15,733	5.8
1990	1,709	94,341	16,133	5.8
1991	1,691	96,645	16,809	5.7
1992	1,675	99,510	17,216	5.8
1993	1,680	103,116	17,748	5.8
1994	1,681	108,932	18,653	5.8
1995	1,696	115,451	19,777	5.8
1996	1,747	118,899	20,192	5.9
1997	1,790	124,584	20,302	6.1
1998	1,831	128,159	21,100	6.1
1999	2,029	132,384	24,537	5.4
2000	2,097	135,020	25,666	5.3
2001	2,154	136,584	25,512	5.4
2002	2,277	138,737	26,480	5.2
2003	1,908	140,160	23,815	5.9
2004	2,010	142,370	24,191	5.9
2005	2,087	144,028	27,689	5.2
2006	2,170	142,169	28,107	5.1
2007	2,221	145,008	28,515	5.1
		Average annual percentage change		
1970–2007	2.5%	3.9%	3.7%	0.2%
1997–2007	2.2%	1.5%	3.5%	-1.8%

Source:
U. S. Department of Transportation, Federal Highway Administration, *Highway Statistics 2007*, Washington, DC, 2008, Table VM1 and annual. (Additional resources: www.fhwa.dot.gov)

Note: *Highway Statistics 1999* data were not used.

[a] The Federal Highway Administration changed the combination truck travel methodology in 1993.

Truck sales in 2007 declined in nearly every class. Trucks under 10,000 lbs. continue to dominate truck sales.

Table 5.3
New Retail Truck Sales by Gross Vehicle Weight, 1970–2007[a]
(thousands)

Calendar year	Class 1 6,000 lbs. or less	Class 2 6,001–10,000 lbs.	Class 3 10,001–14,000 lbs.	Class 4 14,001–16,000 lbs.	Class 5 16,001–19,500 lbs.	Class 6 19,501–26,000 lbs.	Class 7 26,001–33,000 lbs.	Class 8 33,001 lbs. and over	Total
Domestic sales (import data are not available)									
1970[b]	1,049	408	6	12	58	133	36	89	1,791
1975	1,101	952	23	1	9	159	23	83	2,351
1980	985	975	4	[c]	2	90	58	117	2,231
1981	896	850	1	[c]	2	72	51	100	1,972
1982	1,102	961	1	[c]	1	44	62	76	2,248
1983	1,314	1,207	[c]	[c]	1	47	59	82	2,710
1984	2,031	1,224	6	[c]	5	55	78	138	3,538
1985	2,408	1,280	11	[c]	5	48	97	134	3,983
Domestic and import sales									
1986	3,380	1,214	12	[c]	6	45	101	113	4,870
1987	3,435	1,175	14	2	8	44	103	131	4,912
1988	3,467	1,333	14	21	8	54	103	148	5,149
1989	3,313	1,297	19	27	7	39	93	145	4,942
1990	3,451	1,097	21	27	5	38	85	121	4,846
1991	3,246	876	21	24	3	22	73	99	4,365
1992	3,608	1,021	26	26	4	28	73	119	4,903
1993	4,119	1,232	27	33	4	27	81	158	5,681
1994	4,527	1,506	35	44	4	20	98	186	6,421
1995	4,422	1,631	40	53	4	23	107	201	6,481
1996	4,829	1,690	52	59	7	19	104	170	6,930
1997	5,085	1,712	53	57	9	18	114	179	7,226
1998	5,263	2,036	102	43	25	32	115	209	7,826
1999	5,707	2,366	122	49	30	48	130	262	8,716
2000	5,965	2,421	117	47	29	51	123	212	8,965
2001	6,073	2,525	102	52	24	42	92	140	9,050
2002	6,068	2,565	80	38	24	45	69	146	9,035
2003	6,267	2,671	91	40	29	51	67	142	9,357
2004	6,458	2,796	107	47	36	70	75	203	9,793
2005	6,586	2,528	167	49	46	60	89	253	9,777
2006	6,136	2,438	150	50	49	70	91	284	9,268
2007	5,682	2,623	166	51	45	54	70	151	8,842
Average annual percentage change									
1970–1985	5.7%	7.9%	4.1%	-	-15.1%	-6.6%	6.8%	2.8%	5.5%
1986–2007	2.5%	3.7%	13.3%	-	10.1%	0.9%	-1.7%	1.4%	2.9%
1997–2007	1.1%	4.4%	12.1%	-1.1%	17.5%	11.6%	-4.8%	-1.7%	2.0%

Source:
Ward's Communication's, *Motor Vehicle Facts and Figures 2008*, Southfield, MI, 2009, p. 26, and annual. (Additional resources: www.wardsauto.com)

[a] Sales include domestic-sponsored imports.
[b] Data for 1970 is based on new truck registrations.
[c] Data are not available.

Vehicle Inventory and Use Survey

The Vehicle Inventory and Use Survey (VIUS), which was formerly the Truck Inventory and Use Survey (TIUS), provides data on the physical and operational characteristics of the Nation's truck population. It is based on a probability sample of private and commercial trucks registered (or licensed) in each state. In 1997, the survey was changed to the Vehicle Inventory and Use Survey due to future possibilities of including additional vehicle types. The 2002 VIUS, however, only includes trucks. Copies of the 2002 VIUS report or CD may be obtained by contacting the U.S. Bureau of the Census, Transportation Characteristics Surveys Branch (301) 457-2797. Internet site: **www. census.gov/svsd/www/tiusview.html**

Since 1987, the survey has included minivans, vans, station wagons on truck chassis, and sport utility vehicles in addition to the bigger trucks. The 1977 and 1982 surveys did not include those vehicle types. The estimated number of trucks that were within the scope of the 2002 VIUS and registered in the United States as of July 1, 2002, was 85.2 million. These trucks were estimated to have been driven a total of 1,115 billion miles during 2002, an increase of 6.8% from 1997. The average annual miles traveled per truck was estimated at 13,100 miles.

In the 2002 VIUS, there are several ways to classify a truck by weight. The survey respondent was asked the average weight of the vehicle or vehicle-trailer combination when carrying a typical payload; the empty weight (truck minus cargo) of the vehicle as it was usually operated; and the maximum gross weight at which the vehicle or vehicle-trailer combination was operated. The Census Bureau also collected information on the Gross Vehicle Weight Class of the vehicles (decoded from the vehicle identification number) and the registered weight of the vehicles from the State registration files. Some of these weights are only provided in categories, while others are exact weights. Since all these weights could be quite different for a single truck, the tabulations by weight can be quite confusing. In the tables presented here, the Gross Vehicle Weight Class was used.

The Census Bureau has discontinued the Vehicle Inventory and Use Survey; it was not conducted in 2007. The 2002 data remain the latest available.

Table 5.4
Truck Statistics by Gross Vehicle Weight Class, 2002

Manufacturer's gross vehicle weight class	Number of trucks	Percentage of trucks	Average annual miles per truck	Harmonic mean fuel economy	Percentage of fuel use
1) 6,000 lbs and less	51,941,389	61.0%	11,882	17.6	42.7%
2) 6,001 – 10,000 lbs	28,041,234	32.9%	12,684	14.3	30.5%
Light truck subtotal	79,982,623	93.9%	12,163	16.2	73.2%
3) 10,001 – 14,000 lbs	691,342	0.8%	14,094	10.5	1.1%
4) 14,001 – 16,000 lbs	290,980	0.3%	15,441	8.5	0.5%
5) 16,001 – 19,500 lbs	166,472	0.2%	11,645	7.9	0.3%
6) 19,501 – 26,000 lbs	1,709,574	2.0%	12,671	7.0	3.2%
Medium truck subtotal	2,858,368	3.4%	13,237	8.0	5.2%
7) 26,001 – 33,000 lbs	179,790	0.2%	30,708	6.4	0.9%
8) 33,001 lbs and up	2,153,996	2.5%	45,739	5.7	20.7%
Heavy truck subtotal	2,333,786	2.7%	44,581	5.8	21.6%
Total	**85,174,776**	**100.0%**	**13,088**	**13.5**	**100.0%**

Source:
U.S. Department of Commerce, Bureau of the Census, *2002 Vehicle Inventory and Use Survey*, Microdata File on CD, 2005. (Additional resources: www.census.gov/svsd/www.tiusview.html)

Table 5.5
Truck Harmonic Mean Fuel Economy by Size Class, 1992, 1997, and 2002
(miles per gallon)

Manufacturer's gross vehicle weight class	1992 TIUS	1997 VIUS	2002 VIUS
1) 6,000 lbs and less	17.2	17.1	17.6
2) 6,001–10,000 lbs	13.0	13.6	14.3
Light truck subtotal	15.7	15.8	16.2
3) 10,000–14,000 lbs	8.8	9.4	10.5
4) 14,001–16,000 lbs	8.8	9.3	8.5
5) 16,001–19,500 lbs	7.4	8.7	7.9
6) 19,501–26,000 lbs	6.9	7.3	7.0
Medium truck subtotal	7.3	8.6	8.0
7) 26,001–33,000 lbs	6.5	6.4	6.4
8) 33,001 lbs and over	5.5	5.7	5.7
Large truck subtotal	5.6	6.1	5.8

Sources:
Estimates are based on data provided on the following public use files: U.S. Department of Commerce, Bureau of the Census, Census of Transportation, Washington, DC, *1992 Truck Inventory and Use Survey*, 1995; *1997 Vehicle Inventory and Use Survey*, 2000, and *2002 Vehicle Inventory and Use Survey*, 2005. (Additional resources: www.census.gov/svsd/www/tiusview.html)

Note: Based on average fuel economy as reported by respondent.

As expected, most light trucks travel within 50 miles of their home base and refuel at public stations. About sixty percent of heavy trucks travel over 50 miles from their home base and 36% of them refuel at central company-owned refueling stations.

Table 5.6
Truck Statistics by Size, 2002

	Manufacturer's gross vehicle weight class			
	Light (< 10,000 lbs)	Medium (10,001–26,000 lbs)	Heavy (> 26,000 lbs)	Total
	Range of operation			
Under 50 miles	69.2%	61.5%	40.7%	68.2%
51–100 miles	8.5%	11.7%	13.5%	8.7%
101–200 miles	2.4%	3.2%	6.7%	2.5%
201–500 miles	1.1%	1.8%	7.6%	1.3%
501 miles or more	1.4%	2.2%	10.4%	1.7%
Off-road	1.1%	3.5%	3.2%	1.2%
Vehicle not in use	2.2%	4.4%	3.2%	2.3%
Not reported	14.1%	11.7%	14.7%	14.1%
Total	**100.0%**	**100.0%**	**100.0%**	**100.0%**
	Primary refueling facility			
Gas station	96.9%	62.4%	28.4%	93.9%
Truck stop	0.7%	7.7%	31.9%	1.8%
Own facility	2.0%	27.3%	36.2%	3.7%
Other nonpublic facility	0.3%	2.6%	3.5%	0.5%
Other	0.0%	0.0%	0.0%	0.0%
All	**100.0%**	**100.0%**	**100.0%**	**100.0%**

Source:
U.S. Department of Commerce, Bureau of the Census, *2002 Vehicle Inventory and Use Survey*, Microdata. File on CD, 2005. (Additional resources: www.census.gov/svsd/www/tiusview.html)

More medium truck owners listed construction as the truck's major use than any other major use category. Construction was the second highest major use for light trucks and heavy trucks.

Table 5.7
Percentage of Trucks by Size Ranked by Major Use, 2002

Rank	Light (< 10,000 lbs average weight)	Medium (10,001 – 26,000 lbs average weight)	Heavy (> 26,000 lbs average weight)
1	**Personal** 81.5%	**Construction** 18.4%	**For hire** 30.1%
2	**Construction** 4.6%	**Agriculture** 16.2%	**Construction** 15.9%
3	**Other services**[a] 2.5%	**For hire** 9.6%	**Agriculture** 12.2%
4	**Not in use** 2.2%	**Retail** 7.1%	**Retail** 5.4%
5	**Agriculture** 1.9%	**Not in use** 6.4%	**Not in use** 5.1%
6	**Retail** 1.5%	**Leasing** 6.2%	**Waste management** 5.0%
7	**Unknown** 1.3%	**Wholesale** 5.5%	**Manufacturing** 4.9%
8	**Leasing** 0.7%	**Waste management** 5.4%	**Wholesale** 4.8%
9	**Manufacturing** 0.7%	**Utilities** 5.0%	**Leasing** 4.6%
10	**Utilities** 0.6%	**Personal** 4.8%	**Unknown** 3.2%
11	**Waste management** 0.6%	**Unknown** 4.4%	**Personal** 2.5%
12	**Wholesale** 0.6%	**Manufacturing** 3.3%	**Mining** 2.4%
13	**Information services** 0.4%	**Other services**[a] 3.2%	**Other services**[a] 1.3%
14	**For hire** 0.4%	**Food services** 1.6%	**Utilities** 1.1%
15	**Food services** 0.3%	**Information services** 1.3%	**Food services** 1.1%
16	**Arts** 0.2%	**Mining** 1.1%	**Arts** 0.3%
17	**Mining** 0.1%	**Arts** 0.5%	**Information services** 0.1%

Source:
U.S. Department of Commerce, Bureau of the Census, *2002 Vehicle Inventory and Use Survey*, Micro data File on CD, 2005. (Additional resources: www.census.gov/svsd/www/tiusview.html)

[a] Business and personal services.

Nearly half of trucks in fleets of 11-20 and 21-50 vehicles use company-owned facilities. Most trucks in smaller fleets use public gas stations for fueling.

Table 5.8
Percentage of Trucks by Fleet Size and Primary Fueling Facility, 2002

	Primary refueling facility				
Truck fleet size	Gas station	Truck stop	Own facility	Other's facility	Total
1–5	73.8%	6.1%	18.2%	1.9%	100.0%
6–10	55.3%	5.7%	35.5%	3.4%	100.0%
11–20	41.1%	5.1%	48.9%	4.9%	100.0%
21–50	42.9%	3.7%	49.8%	3.6%	100.0%
51 or more	48.3%	6.3%	44.4%	1.0%	100.0%
Fleets of 6 or more vehicles	47.6%	5.2%	43.9%	3.4%	100.0%
No fleet	**96.4%**	**1.6%**	**1.7%**	**0.3%**	**100.0%**

Source:
U.S. Department of Commerce, Bureau of the Census, *2002 Vehicle Inventory and Use Survey*, Microdata File on CD, 2005. (Additional resources: www.census.gov/svsd/www/tiusview.html)

Most trucks are fueled at gas stations but for-hire or warehousing trucks are more often fueled at truck stops. Mining trucks and vehicle leasing or rental trucks fuel at the companies' own facility more than 30% of the time.

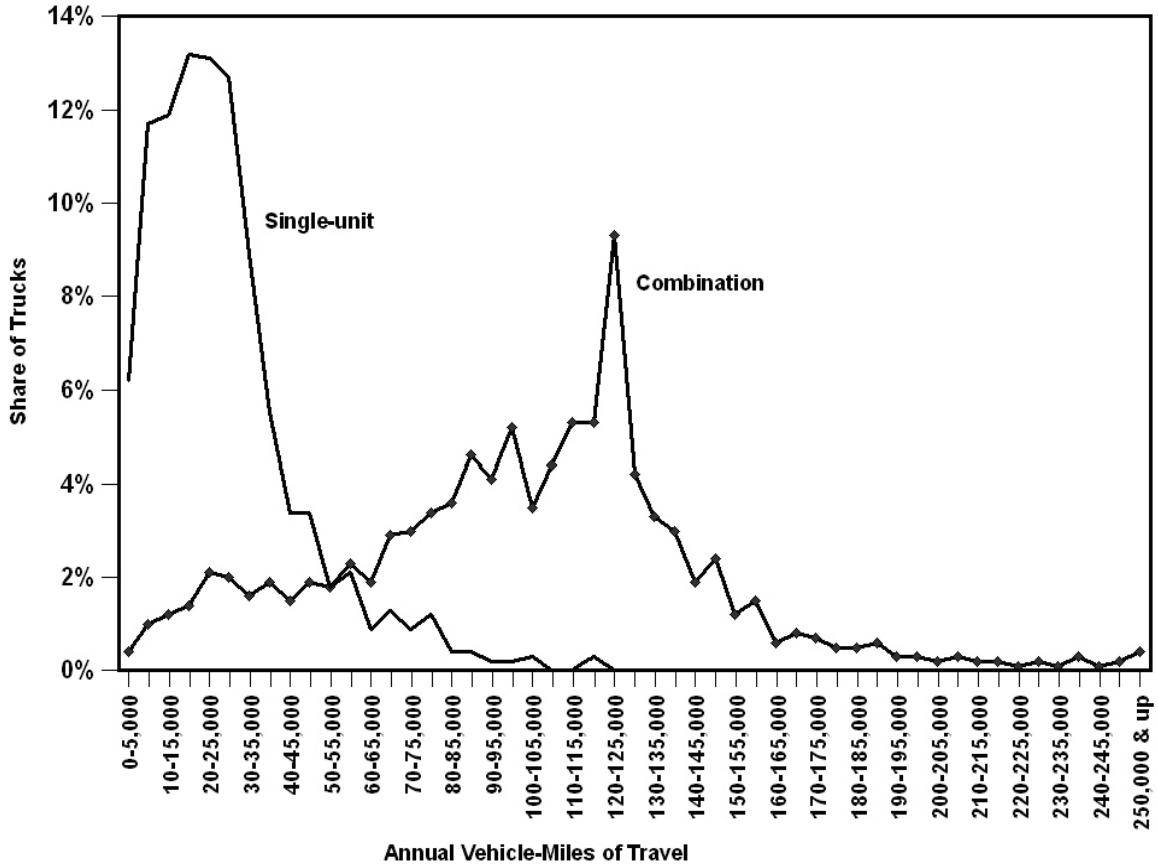
Table 5.9
Share of Trucks by Major Use and Primary Fueling Facility, 2002

Major use	Gas station	Truck stop	Own facility	Others facility	Other	All
Personal	98.6%	0.6%	0.7%	0.1%	0.1%	100.0%
Other services	96.0%	1.4%	1.6%	0.9%	0.1%	100.0%
All	93.9%	1.8%	3.7%	0.5%	0.0%	100.0%
Information services	92.3%	0.4%	7.2%	0.1%	0.0%	100.0%
Retail trade	86.6%	3.5%	8.6%	1.2%	0.0%	100.0%
Construction	84.7%	3.3%	9.8%	2.2%	0.0%	100.0%
Accommodation or food services	82.4%	7.5%	8.8%	1.3%	0.0%	100.0%
Manufacturing	81.5%	5.1%	11.9%	1.5%	0.0%	100.0%
Arts, entertainment, recreation services	81.1%	4.3%	14.2%	0.3%	0.0%	100.0%
Waste mgmt, landscaping, admin/support services	78.2%	3.0%	17.1%	1.6%	0.0%	100.0%
Wholesale trade	76.2%	6.6%	12.0%	5.1%	0.0%	100.0%
Utilities	72.6%	1.8%	24.3%	1.3%	0.0%	100.0%
Agriculture, forestry, fishing, hunting	62.7%	6.7%	29.4%	1.0%	0.1%	100.0%
Vehicle leasing or rental	60.2%	1.3%	31.8%	6.8%	0.0%	100.0%
Mining	48.7%	8.5%	34.3%	8.5%	0.0%	100.0%
For-hire or warehousing	33.3%	38.7%	25.8%	2.3%	0.0%	100.0%
Overall	**93.9%**	**1.8%**	**3.7%**	**0.5%**	**0.0%**	**100.0%**

Source:
U.S. Department of Commerce, Bureau of the Census, *2002 Vehicle Inventory and Use Survey*, Microdata File on CD, 2005. (Additional resources: www.census.gov/svsd/www/tiusview.html)

The figure below shows the distribution of annual travel the two types of Class 7 and 8 vehicles–combination units (separate tractor and trailer) and single units (tractor and trailer on a single chassis). This information is for vehicles two years old or less and comes from the 2002 VIUS. Combination trucks, dominated by box-type trailers, display the greatest amount of annual travel of all heavy vehicle types, as is evidenced both by the range of annual use which is up to 250,000 miles per year, and the peaking that occurs in the 100,000 to 140,000-mile segments. Most of the single-unit trucks in the survey travel 40,000 miles per year or less.

Figure 5.1. Distribution of Trucks over 26,000 lbs. Less than Two Years Old by Vehicle-Miles Traveled



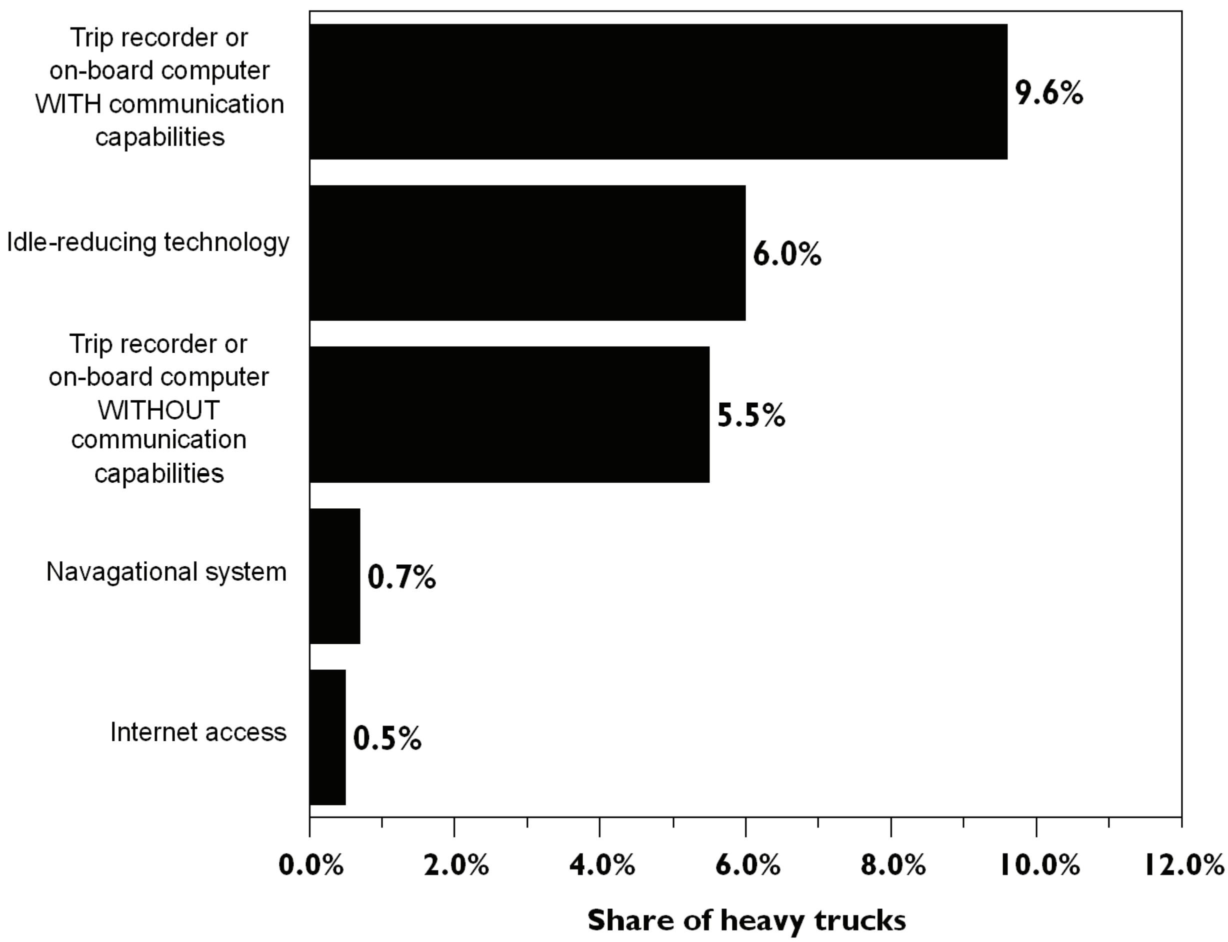
Source:

U.S. Department of Commerce, Bureau of the Census, 2002 Vehicle Inventory and Use Survey, Microdata File on CD, 2005. (Additional resources: www.census.gov/svsd/www/tiusview.html)

Note: Heavy trucks (class 7 & 8) are greater than 26,000 pounds gross vehicle weight based on the manufacturer's rating.

The latest Vehicle Inventory and Use Survey asked truck owners if the truck had certain features as permanent equipment on the truck. Some of the features asked about were onboard computers, idle-reduction devices, navigational systems, and Internet access. Of the 2.3 million heavy trucks (class 7 & 8) in the United States, nearly 10% were equipped with onboard computers that had communication capabilities and another 5% had onboard computers without communication capabilities. Six percent of heavy trucks were equipped with idle-reducing technology. Navigational systems and Internet access were available in less than one percent of heavy trucks.

Figure 5.2. Share of Heavy Trucks with Selected Electronic Features, 2002



Source:
U.S. Department of Commerce, Bureau of the Census, *2002 Vehicle Inventory and User Survey*, Microdata File on CD, 2005.

Note: Heavy trucks (class 7 & 8) are greater than 26,000 pounds gross vehicle weight based on the manufacturer's rating.

Fuel Economy Study for Class 8 Trucks

As part of a long-term study sponsored by the U.S. Department of Energy (DOE) Office of Vehicle Technologies (OVT), the Oak Ridge National Laboratory (ORNL) in conjunction with several industry partners has collected data and information related to heavy-truck operation in real-world highway environments. The primary objective of the project was to collect real-world performance and spatial data for long-haul operations of Class 8 tractor-trailers from a fleet engaged in normal freight operations. Six model year 2005 Class 8 trucks from the selected fleet, which operates within a large area of the country extending from the east coast to Mountain Time Zone and from Canada to the US-Mexican border, were instrumented and 60 channels of data were collected for over a year at a rate of 5 Hz (or 5 readings per second). Those channels included information such as instantaneous fuel rate, engine speed, gear ratio, vehicle speed, and other information read from the vehicle's databus; weather information (wind speed, precipitation, air temperature, etc.) gathered from an on-board weather station; spatial information (latitude, longitude, altitude) acquired from a GPS (Global Positioning System) device; and instantaneous tractor and trailer weight obtained from devices mounted on the six participating tractors and ten trailers. Three of the six instrumented tractors and five of the ten instrumented trailers were mounted with New Generation Single Wide-Based Tires and the others with regular dual tires. Over the duration of this phase of the project (just over a year) the six tractors traveled nearly 700,000 miles.

To find out more about this project, contact Oscar Franzese, franzeseo@ornl.gov, 865-946-1304. The final report on this project is available on-line at:
cta.ornl.gov/cta/Publications/Reports/ORNL_TM_2008-122.pdf.

The type of terrain a truck is traveling on can cause significant differences in fuel efficiency. This study (see page 5–13 for project description) shows fuel economy on severe upslopes is less than half that on flat terrain. On severe downslopes, the fuel economy was three times higher than on flat terrain.

Table 5.10
Effect of Terrain on Class 8 Truck Fuel Economy

	Average Fuel Efficiency (mpg)				
Type of Terrain	Share of Data Records	All Trucks	Tractors with Dual Tires	Tractors with Single (wide) Tires	Difference between Dual and Single Tires (percent)
Severe upslope (>4%)	0.7%	2.90	2.86	2.94	2.91%
Mild upslope (1% to 4%)	13.2%	4.35	4.25	4.44	4.35%
Flat terrain (1% to 1%)	72.4%	7.33	7.08	7.58	7.13%
Mild downslope (-4% to -1%)	12.6%	15.11	14.64	15.57	6.36%
Severe downslope (<-4%)	1.1%	23.50	21.82	25.30	15.97%

Source:
Capps, Gary, Oscar Franzese, Bill Knee, M.B. Lascurain, and Pedro Otaduy. *Class-8 Heavy Truck Duty Cycle Project Final Report*, ORNL/TM-2008/122, Oak Ridge National Laboratory, Oak Ridge, TN, December 2008.

Table 5.10 presents a distribution of distance traveled, fuel consumed, and fuel economy by speed and by type of tires for the vehicles participating in the project (see page 5-13 for project description). The speed bins are divided into 5-mile intervals, going from 0+ mph (i.e., speed > 0.00 mph) to 85 mph, while the four main columns of Table 5.10 are organized by the type of tires that were mounted on the tractor and trailers. The first row of the table contains information about fuel consumed while the vehicle was idling (i.e., the vehicle was static with the engine on) with the following rows presenting information about the distance traveled, fuel consumed, and fuel economy for each one of the speed intervals. The next-to-the-last row shows the totals for both traveled distances and fuel consumed as well as the overall fuel economy for each tire-combination category. The latter are then used to compute the percentage difference in terms of fuel economy from dual tire tractors and trailers, which is the most common tire setup for large trucks at the present time.

Table 5.11
Fuel Economy for Class 8 Trucks as Function of Speed and Tractor-Trailer Tire Combination

Speed (mph)	Dual Tire Tractor - Dual Tire Trailer			Dual Tire Tractor - Single (Wide) Tire Trailer			Single (Wide) Tire Tractor - Dual Tire Trailer			Single (Wide) Tire Tractor - Single (Wide) Tire Trailer		
	Distance Traveled (miles)	Fuel Cons. (gal)	Fuel Econ. (MPG)	Distance Traveled (miles)	Fuel Cons. (gal)	Fuel Econ. (MPG)	Distance Traveled (miles)	Fuel Cons. (gal)	Fuel Econ. (MPG)	Distance Traveled (miles)	Fuel Cons. (gal)	Fuel Econ. (MPG)
Idling	N/A	1,858.5	N/A	N/A	967.9	N/A	N/A	1,676.4	N/A	N/A	706.0	N/A
0+ to 5	281	101.8	2.76	148	50.4	2.93	368	124.2	2.97	156	52.8	2.96
5+ to 10	674	198.8	3.39	368	103.2	3.56	808	245.4	3.30	331	98.8	3.35
10+ to 15	723	192.0	3.77	396	98.3	4.03	848	216.5	3.92	343	87.0	3.95
15+ to 20	744	199.1	3.73	404	100.9	4.00	882	221.6	3.98	361	90.5	3.98
20+ to 25	938	228.4	4.11	489	113.6	4.31	1,111	244.2	4.55	462	101.1	4.57
25+ to 30	1,178	266.9	4.41	609	131.5	4.63	1,420	286.9	4.95	580	117.6	4.93
30+ to 35	1,481	336.8	4.40	753	154.2	4.88	1,774	341.1	5.20	708	141.1	5.02
35+ to 40	1,917	403.5	4.75	1,000	193.6	5.17	2,284	433.6	5.27	941	184.3	5.10
40+ to 45	2,955	584.1	5.06	1,543	285.9	5.40	3,380	603.6	5.60	1,350	254.4	5.31
45+ to 50	4,935	907.9	5.43	2,573	447.7	5.75	5,410	872.8	6.20	2,177	360.4	6.04
50+ to 55	9,397	1,629.8	5.77	4,962	811.5	6.11	10,046	1,622.7	6.19	3,877	625.5	6.20
55+ to 60	20,656	3,297.2	6.26	11,707	1,721.9	6.80	22,373	3,257.8	6.87	8,710	1,246.9	6.99
60+ to 65	38,964	5,879.6	6.63	21,472	2,980.8	7.20	34,517	4,840.0	7.13	14,944	2,049.4	7.29
65+ to 70	58,304	8,313.2	7.01	27,931	3,652.2	7.65	65,063	9,256.4	7.03	27,144	3,880.1	7.00
70+ to 75	56,378	7,483.2	7.53	21,751	2,745.5	7.92	66,882	8,435.6	7.93	32,887	4,056.1	8.11
75+ to 85	7,849	808.2	9.71	3,610	403.2	8.95	11,513	911.1	12.64	6,817	512.2	13.31
Total[a]	207,374	30,831	6.73	99,714	13,994	7.13	228,680	31,913	7.17	101,790	13,858	7.35
Percent increase in fuel economy from dual tire trac/trail			0.00%			5.93%			6.53%			9.20%

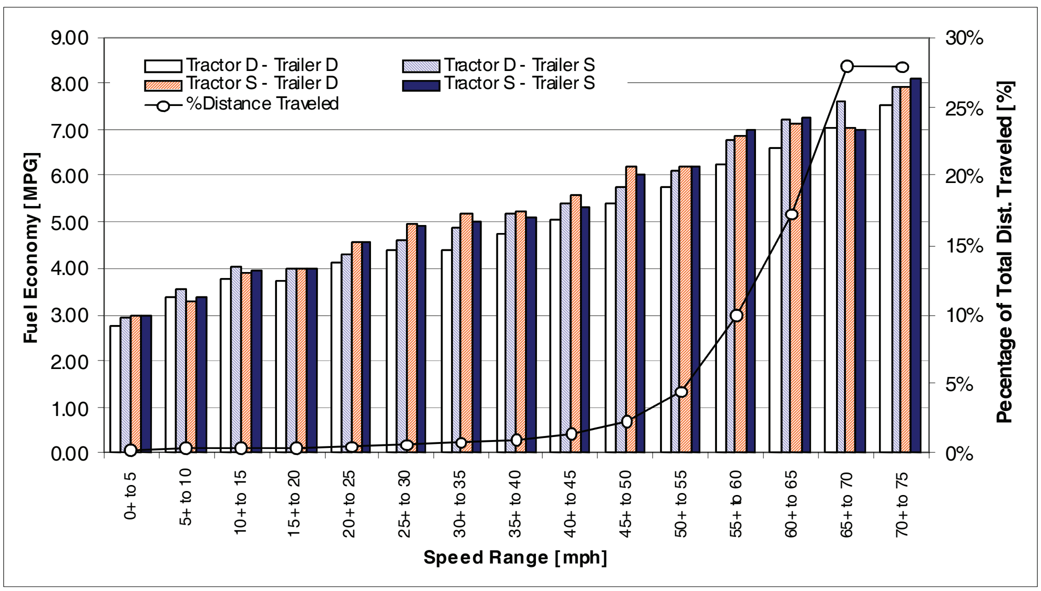
Source:
Capps, Gary, Oscar Franzese, Bill Knee, M.B. Lascurain, and Pedro Otaduy. *Class-8 Heavy Truck Duty Cycle Project Final Report*, ORNL/TM-2008/122, Oak Ridge National Laboratory, Oak Ridge, TN, December 2008.

Note: These data were not adjusted to account for the effects of terrain. The increase in fuel economy for speeds above 70 mph is likely due to the vehicle achieving high speeds while traveling down slope. Therefore, this increase in fuel economy is not expected to be characteristic of all travel at these higher speeds.

[a] Total Fuel Consumed does not include fuel consumed while idling.

The fuel economy information presented in Table 5.10 is on the upper limits of today's large-truck fleets and is mostly a result of driver training and the extensive vehicle maintenance (including constant tire pressure) to which the fleet company participating in this project adheres. Nevertheless, the results of this extensive test indicate that there are substantial gains in terms of fuel economy for large trucks when single (wide) tires are used in combination with dual tires or alone (best case). Figure 5.3 shows the information from Table 5.10 in a graphical form (bars) and also displays for each speed bin the percentage of the total distance that is traveled at that speed (line). It is possible to observe that above 80% of the distance traveled by long-haul Class 8 trucks is done at speeds above 55 mph. Therefore, any gains in fuel economies at these speeds derived from a given tire combination would have a very large impact on the overall fuel economy of these type of trucks. Figure 5.3 shows that, except for the D-S combination within the 65+ to 70 mph, the combinations with all single (wide) tires perform better and, therefore, obtain the largest overall fuel economy.

Figure 5.3. Class 8 Truck Fuel Economy as a Function of Speed and Tractor-Trailer Tire Combination and Percentage of Total Distance Traveled as a Function of Speed



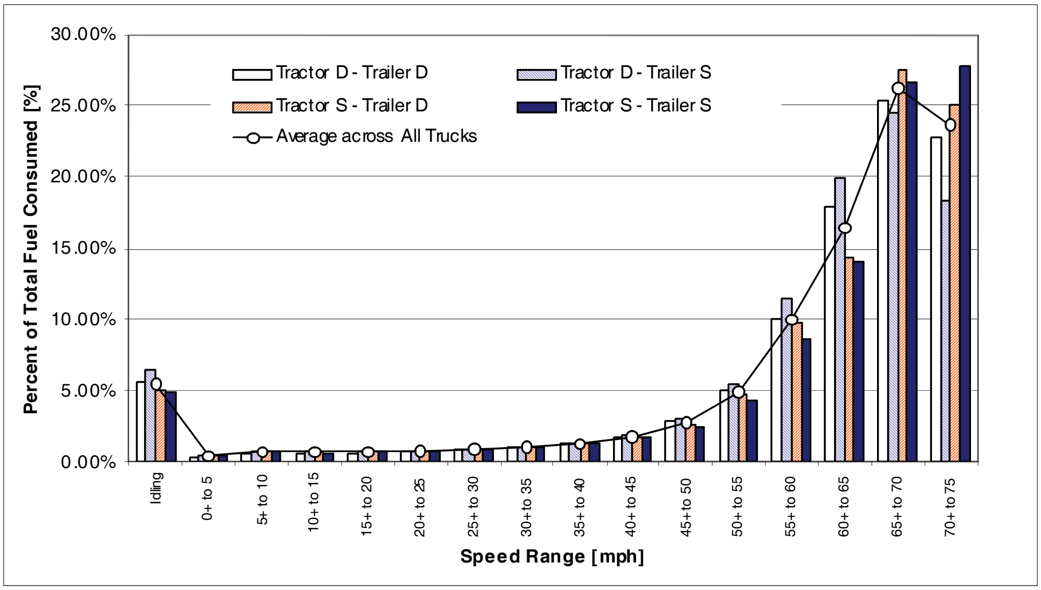
Source:

Capps, Gary, Oscar Franzese, Bill Knee, M.B. Lascurain, and Pedro Otaduy. *Class-8 Heavy Truck Duty Cycle Project Final Report*, ORNL/TM-2008/122, Oak Ridge National Laboratory, Oak Ridge, TN, December 2008.

Note: D = Dual tire. S = Single (wide) tire.
These data were not adjusted to account for the effects of terrain. The increase in fuel economy for speeds above 70 mph is likely due to the vehicle achieving high speeds while traveling down slope. Therefore, this increase in fuel economy is not expected to be characteristic of all travel at these higher speeds.

This graph presents for each one of the four tire-combination categories the percent of total fuel that is consumed when traveling at different speeds (bars) as well as the average percent of fuel consumed for each speed bin (line). As opposed to Table 5.10, the total fuel consumed on this graph includes the fuel consumed while idling.

Figure 5.4. Class 8 Truck Percent of Total Fuel Consumed as a Function of Speed and Tractor-Trailer Tire Combination



Source:
Capps, Gary, Oscar Franzese, Bill Knee, M.B. Lascurain, and Pedro Otaduy. *Class-8 Heavy Truck Duty Cycle Project Final Report*, ORNL/TM-2008/122, Oak Ridge National Laboratory, Oak Ridge, TN, December 2008.

Note: D = Dual tire. S = Single (wide) tire.
These data were not adjusted to account for the effects of terrain. The increase in fuel economy for speeds above 70 mph is likely due to the vehicle achieving high speeds while traveling down slope. Therefore, this increase in fuel economy is not expected to be characteristic of all travel at these higher speeds.

Commodity Flow Survey

The Commodity Flow Survey (CFS) is designed to provide data on the flow of goods and materials by mode of transport. The 1993, 1997, 2002, and 2007 CFS are a continuation of statistics collected in the Commodity Transportation Survey from 1963 through 1977, and include major improvements in methodology, sample size, and scope. The 2007 CFS covers business establishments with paid employees that are located in the United States and are classified using the North American Industry Classification System (NAICS) in mining, manufacturing, wholesale trade, and select retail trade industries, namely, electronic shopping and mail-order houses. Establishments classified in services, transportation, construction, and most retail industries are excluded from the survey. Farms, fisheries, foreign establishments, and most government-owned establishments are also excluded.[a]

The 1993, 1997, 2002, and 2007 CFS differ from previous surveys in their greatly expanded coverage of intermodalism (i.e., shipments which travel by at least two different modes, such as rail and truck). Earlier surveys reported only the principal mode. Route distance for each mode for each shipment was imputed using methodologies developed by Oak Ridge National Laboratory. Distance, in turn, was used to compute ton-mileage by mode of transport.

Preliminary data from the 2007 CFS were released in December 2008. The data can be viewed at: **www.bts.gov/publications/commodity_flow_survey**.

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[a] Bureau of Transportation Statistics and U.S. Bureau of the Census, 2007 Economic Census, *2007 Commodity Flow Survey*, December 2008.

Industries covered by the 2007 Commodity Flow Survey (CFS) shipped over 13 billion tons of goods worth over $11 trillion. Compared to the 1997 CFS, the value of shipments is up 1.3% per year and tons shipped are up 1.6% per year. By value, intermodal shipments increased 4.7% per year from 1997 to 2007.

Table 5.12
Growth of Freight in the United States: Comparison of the 2007, 2002 and 1997 Commodity Flow Surveys
(Detail may not add to total because of rounding)

	Value of goods shipped				Tons			
Mode of Transportation	2007 (billions)	2002 (billion 2007 dollars)	1997 (billion 2007 dollars)	Average annual percent change (1997-2007)	2007 (millions)	2002 (millions)	1997 (millions)	Average annual percent change
All modes	**11,831.5**	**9,678.0**	**8,970.5**	**2.8%**	**13,016.6**	**11,667.9**	**11,089.7**	**1.6%**
Single modes	**9,554.9**	**8,124.6**	**7,388.8**	**2.6%**	**12,087.8**	**11,086.7**	**10,436.5**	**1.5%**
Truck[a]	8,363.7	7,186.0	6,435.3	2.7%	8,957.7	7,842.8	7,700.7	1.5%
For-hire truck	4,764.4	4,330.2	3,748.0	2.4%	4,029.0	3,657.3	3,402.6	1.7%
Private truck	3,599.2	2,818.3	2,630.8	3.2%	4,928.7	4,149.7	4,137.3	1.8%
Rail	387.6	359.5	412.9	-0.6%	1,928.5	1,873.9	1,549.8	2.2%
Water	106.9	102.9	97.9	0.9%	423.3	681.2	563.4	-2.8%
Shallow draft	95.4	66.3	69.6	3.2%	381.6	458.6	414.8	-0.8%
Great Lakes	0.7	0.9	1.9	-9.5%	13.3	38.0	38.4	-10.1%
Deep draft	10.8	35.7	26.4	-8.6%	28.5	184.6	110.2	-12.6%
Air (includes truck and air)	209.6	305.4	296.0	-3.4%	3.5	3.8	4.5	-2.5%
Pipeline[b]	487.1	172.0	146.6	12.8%	774.7	685.0	618.2	2.3%
Multiple modes	**1,938.9**	**1,243.8**	**1,221.9**	**4.7%**	**626.5**	**216.7**	**216.7**	**11.2%**
Parcel, U.S. Postal Service or courier	1,597.9	1,138.5	1,105.7	3.8%	36.0	25.5	23.7	4.3%
Truck and rail	197.7	80.6	97.8	7.3%	213.4	43.0	54.2	14.7%
Truck and water	31.1	16.6	10.6	11.4%	74.4	23.3	33.2	8.4%
Rail and water	7.7	3.8	2.3	12.8%	45.0	105.1	79.3	-5.5%
Other multiple modes	104.4	4.4	5.6	34.0%	257.7	19.8	26.2	25.7%
Other and unknown modes	**337.7**	**309.6**	**359.9**	**-0.6%**	**302.3**	**364.6**	**436.5**	**-3.6%**

Source:
U.S. Department of Transportation, Bureau of Transportation Statistics and U.S. Department of Commerce, Bureau of the Census, *2007 Commodity Flow Survey*, Table 1. (Additional resources: www.bts.gov/cfs)

Note: Data for 2007 are preliminary.

[a] "Truck" as a single mode includes shipments which went by private truck only, for-hire truck only, or a combination of private truck and for-hire truck.

[b] CFS data for pipeline exclude most shipments of crude oil.

Industries covered by the 2007 Commodity Flow Survey (CFS) accounted for about 3.5 trillion ton-miles on the nation's highways, railways, waterways, pipelines, and aviation system. Ton-miles increased an average of 2.7% per year from 1997 to 2007.

Table 5.13
Growth of Freight Miles in the United States: Comparison of the 2007, 2002 and 1997 Commodity Flow Surveys
(Detail may not add to total because of rounding)

	Ton-miles				Average miles per shipment			
Mode of Transportation	2007 (billions)	2002 (billions)	1997 (billions)	Average annual percent change (1997–2007)	2007	2002	1997	Average annual percent change
All modes	**3,490.8**	**3,137.9**	**2,661.4**	**2.7%**	**580**	**546**	**472**	**2.1%**
Single modes	**2,953.1**	**2,867.9**	**2,383.5**	**2.2%**	**213**	**240**	**184**	**1.5%**
Truck[a]	1,390.1	1,255.9	1,023.5	3.1%	187	173	144	2.6%
For-hire truck	1,011.0	959.6	741.1	3.2%	527	523	485	0.8%
Private truck	379.1	291.1	268.6	3.5%	82	64	53	4.5%
Rail	1,294.9	1,261.6	1,022.5	2.4%	691	807	769	-1.1%
Water	176.0	282.7	261.7	-3.9%	330	568	482	-3.7%
Shallow draft	163.6	211.5	189.3	-1.4%	284	450	177	4.8%
Great Lakes	4.8	13.8	13.4	-9.8%	[c]	339	204	[c]
Deep draft	[c]	57.4	59.0	[c]	390	664	1,024	-9.2%
Air (includes truck and air)	4.0	5.8	6.2	-4.3%	1,299	1,919	1,380	-0.6%
Pipeline[b]	[c]	[c]	[c]	[c]	[c]	[c]	[c]	[c]
Multiple modes	**489.8**	**225.7**	**204.5**	**9.1%**	**915**	**895**	**813**	**1.2%**
Parcel, U.S. Postal Service or courier	29.5	19.0	18.0	5.1%	914	894	813	1.2%
Truck and rail	188.5	45.5	55.6	13.0%	1,053	1,413	1,347	-2.4%
Truck and water	48.9	32.4	34.8	3.5%	1,347	1,950	1,265	0.6%
Rail and water	30.4	115.0	77.6	-8.9%	2,608	957	1,092	-9.1%
Other multiple modes	192.4	13.8	18.6	26.3%	2,190	[c]	[c]	[c]
Other and unknown modes	**48.0**	**44.2**	**73.4**	**-4.2%**	**149**	**130**	**122**	**2.0%**

Source:
U.S. Department of Transportation, Bureau of Transportation Statistics and U.S. Department of Commerce, Bureau of the Census, *2007 Commodity Flow Survey*, Table 1. (Additional resources: www.bts.gov/cfs)

[a] "Truck" as a single mode includes shipments which went by private truck only, for-hire truck only, or a combination of private truck and for-hire truck.

[b] CFS data for pipeline exclude most shipments of crude oil.

[c] Denotes data do not meet publication standards because of high sampling variability or other reasons. Some unpublished estimates can be derived from other data published in this table. However, figures obtained in this manner are subject to these same limitations.

In 2007, the data changed substantially due to improved estimation methodologies. Unfortunately, those data are no longer comparable to the rest of the historical series.

Table 5.14
Summary Statistics on Transit Buses and Trolleybuses, 1994–2007

Year	Number of active buses	Vehicle-miles (millions)	Passenger-miles (millions)	Btu/ passenger-mile	Energy use (trillion Btu)
1994	68,766	2,176	19,019	4,261	81.0
1995	67,802	2,198	19,005	4,302	81.8
1996	72,353	2,234	19,280	4,334	83.6
1997	73,425	2,259	19,793	4,425	87.6
1998	77,788	2,188	20,542	4,384	90.1
1999	74,885	2,290	21,391	4,327	92.6
2000	75,665	2,329	21,433	4,509	96.6
2001	76,675	2,389	22,209	4,120	91.5
2002	76,806	2,425	22,029	4,100	90.3
2003	78,000	2,435	21,438	4,171	89.4
2004	81,630	2,484	21,550	4,318	93.0
2005	82,642	2,498	21,998	4,200	92.4
2006	83,689	2,507	22,985	4,259	97.9
2007[a]	65,808	2,314	21,132	4,315	91.2

Source:
American Public Transportation Association, *2009 Public Transportation Fact Book*, Washington, DC, April 2009, Table 17. (Additional resources: www.apta.com)

[a] Data are not continuous between 2006 and 2007 due to changes in estimation methodology. See source document for details.

Chapter 6
Alternative Fuel and Advanced Technology Vehicles and Characteristics

Summary Statistics from Tables in this Chapter

Source		
Table 6.1	Alternative fuel vehicles in use, 2007	695,766
	LPG	*158,254*
	CNG	*114,391*
	E85[a]	*364,384*
	Electric	*55,730*
	M85	*0*
	LNG	*2,781*
Table 6.4	Number of alternative fuel refuel sites, 2009	6,002
	LPG	*2,113*
	CNG	*776*
	Biodiesel	*691*
	Electric	*466*
	Hydrogen	*58*

Fuel type abbreviations are used throughout this chapter.

B20	=	*20% biodiesel, 80% petroleum diesel*
CNG	=	*compressed natural gas*
E85	=	*85% ethanol, 15% gasoline*
E95	=	*95% ethanol, 5% gasoline*
H_2	=	*hydrogen*
LNG	=	*liquified natural gas*
LPG	=	*liquified petroleum gas*
M85	=	*85% methanol, 15% gasoline*
M100	=	*100% methanol*

[a] Includes only those E85 vehicles believed to be used as alternative fuel vehicles (primarily fleet-operated vehicles).

Alternative Fuels

The Energy Policy Act of 1992 defines alternative fuels and allows the U.S. Department of Energy (DOE) to add to the list of alternative fuels if the fuel is substantially nonpetroleum, yields substantial energy security benefits, and offers substantial environmental benefits. DOE currently recognizes the following as alternative fuels:

- methanol, ethanol, and other alcohols,
- blends of 85% or more of alcohol with gasoline,
- natural gas and liquid fuels domestically produced from natural gas,
- liquefied petroleum gas (propane),
- coal-derived liquid fuels
- hydrogen and electricity
- biodiesel,
- P-series.

Alternative Fuels & Advanced Vehicles Data Center

DOE established the Alternative Fuels Data Center (AFDC) in 1991 to support its work aimed at fulfilling the Alternative Motor Fuels Act directives. Since then, the AFDC has exp anded its focus to include all advanced transportation fuels, vehicles, and technologies. It has been renamed the Alternative Fuels & Advanced Vehicles Data Center to reflect this broader scope. The AFDC is operated and managed by the National Renewable Energy Laboratory (NREL) in Golden, Colorado.

The purposes of the AFDC are:

- to gather and analyze information on the fuel consumption, emissions, operation, and durability of alternative fuel vehicles, and

- to provide unbiased, accurate information on alternative fuels and alternative fuel vehicles to government agencies, private industry, research institutions, and other interested organizations.

Much of the AFDC data can be obtained through their Web site: **www.eere.energy.gov/afdc**. Several tables and graphs in this chapter contain statistics which were generated by the AFDC. Below are some links to specific areas of the AFDC Web site.

Alternative & Advanced Fuels - www.eere.energy.gov/afdc/fuels/index.html

Alternative Fueling Station Locator - www.eere.energy.gov/afdc/fuels/stations_locator.html

Alternative & Advanced Vehicles - www.eere.energy.gov/afdc/vehicles/index.html

Fleet Information - www.eere.energy.gov/afdc/fleets/index.html

State & Federal Incentives & Laws - www.eere.energy.gov/afdc/incentives_laws.html

Data Analysis & Trends - www.eere.energy.gov/afdc/data/index.html

There are nearly 700,000 alternative fuel vehicles in the United States, not including flex-fuel E85 vehicles which operate mainly on gasoline. The E85 vehicles in this table are those believed to be regularly fueled with E85.

Table 6.1
Estimates of Alternative Fuel Vehicles in Use[a], 1992–2007

Year	LPG	CNG	LNG	M85	M100	E85[b]	E95	Electricity	Hydrogen[c]	Total
1995	172,806	50,218	603	18,319	386	1,527	136	2,860	0	**246,855**
1996	175,585	60,144	663	20,265	172	4,536	361	3,280	0	**265,006**
1997	175,679	68,571	813	21,040	172	9,130	347	4,453	0	**280,205**
1998	177,183	78,782	1,172	19,648	200	12,788	14	5,243	0	**295,030**
1999	178,610	91,267	1,681	18,964	198	24,604	14	6,964	0	**322,302**
2000	181,994	100,750	2,090	10,426	0	87,570	4	11,830	0	**394,664**
2001	185,053	111,851	2,576	7,827	0	100,303	0	17,847	0	**425,457**
2002	187,680	120,839	2,708	5,873	0	120,951	0	33,047	0	**471,098**
2003	190,369	114,406	2,640	0	0	179,090	0	47,485	9	**533,999**
2004	182,864	118,532	2,717	0	0	211,800	0	49,536	43	**565,492**
2005	173,795	117,699	2,748	0	0	246,363	0	51,398	119	**592,122**
2006	164,846	116,131	2,798	0	0	297,099	0	53,526	159	**634,562**
2007	158,254	114,391	2,781	0	0	364,384	0	55,730	223	**695,766**
					Average annual percentage change					
1995-2007	-0.7%	7.1%	13.6%	-100%	-100%	57.8%	-100%	28.1%		**9.0%**

Source:
U. S. Department of Energy, Energy Information Administration, *Alternatives to Traditional Transportation Fuels*, 2007, Washington, DC, April 2009, Table VI. 1992-2006, *Annual Energy Review*, Table 10.4. Estimated Number of Alternative-Fueled Vehicles in Use and Replacement Fuel Consumption. (Additional resources: www.eia.doe.gov/emeu/aer/renew.html and www.eere.energy.gov/afdc/data/vehicles.html)

[a] Vehicles in Use represent accumulated acquisitions, less retirements, as of the end of each calendar year. They do not include concept and demonstration vehicles.

[b] Includes only those E85 vehicles believed to be used as alternative-fuels vehicles (AFVs), primarily fleet-operated vehicles; excludes other vehicles with E85-fueling capability. In 1997, some vehicle manufacturers began including E85-fueling capability in certain model lines of vehicles. For 2007, the Energy Information Administration (EIA) estimates that the number of E85 vehicles that are capable of operating on E85, motor gasoline, or both, is about 7.1 million. Many of these AFVs are sold and used as traditional gasoline-powered vehicles.

[c] Excludes HEVs.

Table 6.2
Alternative Fuel Vehicles Available by Manufacturer, Model Year 2008

Model	Fuel	Type	Emission class
Daimler Chrysler: 1-800-999-FLEET; www.fleet.chrysler.com			
Chrysler Sebring	E85 flex fuel	Sedan	LEV II, Tier-2 Bin 8A
Chrysler Aspen	E85 flex fuel	SUV	LEV II, Tier-2 Bin 8A
Dodge Avenger	E85 flexfuel	Sedan	ULEV
Dodge Durango	E85 flex fuel	SUV	LEV II, Tier-2 Bin 8A
Dodge Caravan	E85 flex fuel	Minivan	ULEV, Tier-2 Bin 8A
Dodge Grand Caravan	E85 flex fuel	Minivan	ULEV, Tier-2 Bin 8A
Chrysler Town & Country	E85 flex fuel	Minivan	Tier-2 Bin 8A
Dodge Dakota	E85 flex fuel	Pickup	LEV II, Tier-2 Bin 8A
Dodge Ram 1500	E85 flex fuel	Pickup	LEV II, Tier-2 Bin 8A
Jeep Grand Cherokee	E85 flex fuel	SUV	LEV II, Tier-2 Bin 10A
Jeep Commander	E85 flex fuel	SUV	LEV II, Tier-2 Bin 10A
Ford: 1-800-34-FLEET; www.fleet.ford.com; www.fordvehicles.com			
Crown Victoria	E85 flex fuel	Sedan	LEV II, Tier-2 Bin 5
Lincoln Town Car	E85 flex fuel	Sedan	LEV II, Tier-2 Bin 5
Mercury Grand Marquis	E85 flex fuel	Sedan	LEV II, Tier-2 Bin 5
Ford F-150	E85 flex fuel	Pickup	LEV, Tier-2 Bin 8A
General Motors: 1-888-GM-AFT-4U; www.gmaltfuel.com			
Chevrolet Impala	E85 flex fuel	Sedan	LEV II, Tier-2 Bin 5
Chevrolet Tahoe	E85 flex fuel	SUV	LEV II, Tier-2 Bin 5
Chevrolet Police Tahoe	E85 flex fuel	SUV	LEV II, Tier-2 Bin 5
GMC Yukon	E85 flex fuel	SUV	LEV II, Tier-2 Bin 5
Chevrolet Suburban	E85 flex fuel	SUV	LEV II, Tier-2 Bin 5
GMC Yukon XL	E85 flex fuel	SUV	LEV II, Tier-2 Bin 5
Chevy Silverado	E85 flex fuel	Pickup	LEV II, Tier-2 Bin 5
GMC Sierra	E85 flex fuel	Pickup	LEV II, Tier-2 Bin 5
Chevy Avalanche	E85 flex fuel	Pickup	LEV II, Tier-2 Bin 5
Chevy Express	E85 flex fuel	Van	LEV II, Tier-2 Bin 5
GMC Savana	E85 flex fuel	Van	LEV II, Tier-2 Bin 5
Chevrolet Uplander	E85 flex fuel	Minivan	LEV II, Tier-2 Bin 5
Honda: 1-888-CCHonda; www.honda.com			
Civic GX	CNG dedicated	Sedan	ILEV, AT-PZEV, Tier 2 Bin 2
FCX	Hydrogen fuel cell	Sedan	ZEV, Tier-2, Bin 1
Mercedes-Benz USA: 800-FOR-MERCEDES; www.mbusa.com			
C300 Sport Sedan	E85 flex fuel	Sedan	ULEV
Nissan: 1-800-NISSAN-1; www.nissanusa.com			
Armada	E85 flex fuel	SUV	LEV
Titan	E85 flex fuel	Pickup	LEV

Source:
U.S. Department of Energy, National Alternative Fuels Data Center, Web site, www.eere.energy.gov/afdc/pdfs/my2008_afv_atv.pdf, February 2009. (Additional resources: www.eere.energy.gov/afdc/progs_vehicles_search.php)

Note: LEV=low emission vehicle. ILEV=inherently low emission vehicle. ULEV=ultra low emission vehicle. ZEV=zero emission vehicle. TLEV=transitional low emission vehicle. SULEV=super ultra low emission vehicle. See Chapter 12 for details on emissions.

Table 6.3
Hybrid Electric Vehicles Available by Manufacturer, Model Year 2008

Model	Battery Type[a]	Type	Emission class
Ford: 1-800-34-FLEET; www.fleet.ford.com; www.fordvehicles.com			
Ford Escape Hybrid	NiMH	SUV	SULEV II, AT-PZEV
Mercury Mariner Hybrid	NiMH	SUV	SULEV II, AT-PZEV
General Motors: 1-800-25Electric, 313-556-7723 or 1-888-GM-AFT-4U (CNG)			
Chevrolet Malibu	NiMH	Sedan	LEV II, Tier-2 Bin 5
Saturn Aura	NiMH	Sedan	LEV II, Tier-2 Bin 5
Chevrolet Tahoe	NiMH	SUV	LEV II, Tier-2 Bin 5
GMC Yukon	NiMH	SUV	LEV II, Tier-2 Bin 5
Saturn VUE Green Line	NiMH (Mild hybrid)	SUV	LEV II, Tier-2 Bin 5
Honda: 1-888-CCHonda; www.honda.com			
Civic Hybrid	NiMH	Sedan	SULEV, AT-PZEV
Lexus: 800-255-3987; www.lexus.com			
GS 450h	NiMH	Sedan	SULEV
RX 400h	NiMH	SUV	SULEV
LS 600h	NiMH	Sedan	SULEV
Mazda: 1-800-222-5500; www.mazdausa.com			
Tribute	NiMH	SUV	SULEV II, AT-PZEV
Nissan: 1-800-NISSAN-1; www.nissanusa.com			
Altima	NiMH	Sedan	AT-PZEV
Toyota: 1-800-GO-Toyota; www.toyota.com			
Prius	NiMH	Sedan	SULEV, AT-PZEV, Tier-2 Bin 3
Camry	NiMH	Sedan	AT-PZEV
Highlander	NiMH	SUV	SULEV, Tier-2 Bin 3

Source:
U.S. Department of Energy, National Alternative Fuels Data Center, Web site, www.eere.energy.gov/afdc/pdfs/my2008_afv_atv.pdf, February 2009 (Additional resources: www.eere.energy.gov/afdc/progs_vehicles_search.php)

Note: LEV = low emission vehicle; ILEV = inherently low emission vehicle; ULEV = ultra low emission vehicle; ZEV = zero emission vehicle; TLEV = transitional low emission vehicle; SULEV = super ultra low emission vehicle; AT-PZEV = avanced technology - partial zero emissions vehicle. See Chapter 12 for details on emissions.

[a] NiMH = Nickel-Metal Hydride; PbA = Lead-Acid; Mild hybrid = A vehicle that shuts down the engine when coasting, breaking or stopped while continuing to power accessories. There is however, no electric drivetrain like that found on a full hybrid vehicle.

This list includes public and private refuel sites; therefore, not all of these sites are available to the public.

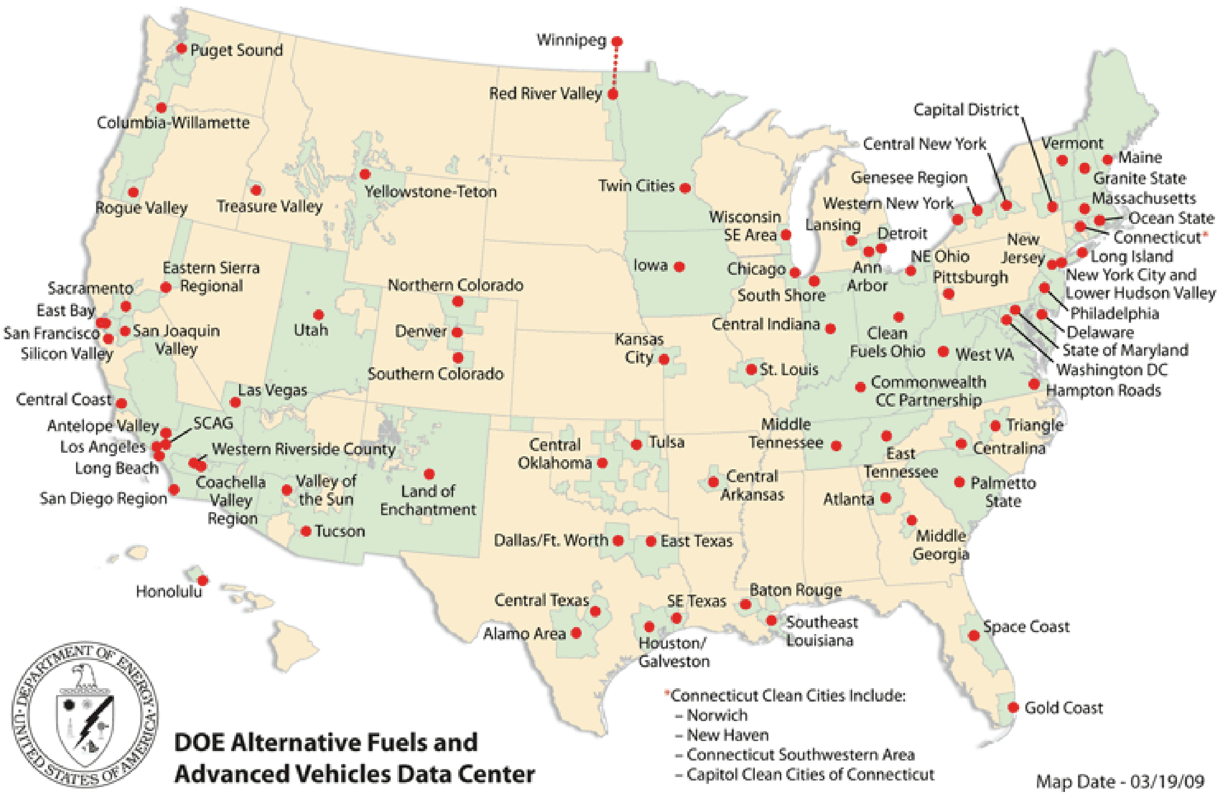
Table 6.4
Number of Alternative Refuel Sites by State and Fuel Type, 2009

State	CNG sites	E85 site	LPG sites	Electric sites	Biodiesel sites	Hydrogen sites	LNG sites	Total
Alabama	3	10	40	0	12	0	0	65
Alaska	1	0	10	0	1	0	0	12
Arizona	39	25	51	15	12	1	5	138
Arkansas	3	7	37	0	3	0	0	50
California	188	19	202	404	48	28	27	916
Colorado	18	72	44	0	23	0	0	157
Connecticut	9	4	13	3	1	2	0	32
Delaware	1	1	2	0	4	0	0	8
Dist. of Columbia	1	3	0	0	1	1	0	6
Florida	15	23	47	3	14	2	0	104
Georgia	19	32	37	0	30	0	0	118
Hawaii	0	0	3	3	6	1	0	13
Idaho	7	5	25	0	8	0	1	46
Illinois	23	187	52	5	5	1	0	273
Indiana	14	119	31	0	7	0	0	171
Iowa	0	108	24	0	5	0	0	137
Kansas	2	32	44	0	5	0	0	83
Kentucky	0	13	13	0	1	0	0	27
Louisiana	5	5	9	0	1	0	0	20
Maine	1	0	8	0	5	0	0	14
Maryland	13	13	13	0	10	0	0	49
Massachusetts	11	2	21	12	5	1	0	52
Michigan	13	73	69	0	19	7	0	181
Minnesota	1	358	31	0	1	0	0	391
Mississippi	2	4	33	0	7	0	0	46
Missouri	6	95	63	0	5	1	0	170
Montana	3	1	29	0	6	0	0	39
Nebraska	1	48	18	0	3	0	0	70
Nevada	11	18	28	0	13	2	0	72
New Hampshire	3	0	11	8	12	0	0	34
New Jersey	11	0	10	0	2	0	0	23
New Mexico	11	9	49	0	7	0	0	76
New York	91	30	30	1	5	4	0	161
North Carolina	12	17	44	0	69	0	0	142
North Dakota	2	31	13	0	2	1	0	49
Ohio	8	68	66	0	24	1	0	167
Oklahoma	49	8	64	0	7	0	0	128
Oregon	12	8	29	14	36	0	0	99
Pennsylvania	25	24	63	0	8	2	0	122
Rhode Island	5	0	4	2	2	0	0	13
South Carolina	4	84	20	0	75	1	0	184
South Dakota	0	80	16	0	2	0	0	98
Tennessee	3	30	41	0	34	0	0	108
Texas	17	39	485	1	54	0	4	600
Utah	60	6	23	0	6	0	0	95
Vermont	1	0	5	2	2	1	0	11
Virginia	11	7	19	1	24	1	0	63
Washington	14	15	52	2	42	0	0	125
West Virginia	1	3	5	0	1	0	0	10
Wisconsin	18	118	41	0	1	0	0	178
Wyoming	8	7	26	0	15	0	0	56
Totals by Fuel:	776	1,861	2,113	466	691	58	37	6,002

Source:
U.S. Department of Energy, Alternative Fuels Data Center Web site, www.eere.energy.gov/afdc/infrastructure/station_counts.html, January 2009.

Clean Cities is a locally-based government/industry partnership, coordinated by the U.S. Department of Energy to expand the use of alternatives to gasoline and diesel fuel. By combining the decision-making with voluntary action by partners, the "grass-roots" approach of Clean Cities departs from traditional "top-down" Federal programs.

Figure 6.1. Clean Cities Coalitions



Source:

U.S. Department of Energy, Alternative Fuel Data Center, February 2008. (Additional resources: www.eere.energy.gov/cleancities)

Vehicle Technologies Program

www.eere.energy.gov/vehiclesandfuels

The Vehicle Technologies Program is administered by the Department of Energy's Office of Energy Efficiency and Renewable Energy. The mission of this program is to develop more energy efficient and environmentally friendly highway transportation technologies that enable America to use less petroleum. The long-term aim is to develop "leap frog" technologies that will provide Americans with greater freedom of mobility and energy security, with lower costs and lower impacts on the environment. For additional information about the Vehicle Technologies Program, visit the Web site listed above.

Hydrogen Analysis Resource Center

hydrogen.pnl.gov/

The Hydrogen Analysis Resource Center was developed to provide reliable data and information for hydrogen-related analytical activities. The Center's Web site includes:

- Hydrogen Data Book - contains a wide range of factual information on hydrogen and fuel cells. hydrogen.pnl.gov/cocoon/morf/hydrogen/article/103
- Related Sites - provides links other sites with data relevant to hydrogen and fuel cell analysis.
- Guidelines and Assumptions for DOE Hydrogen Program Analysis - contains guidelines for conducting analysis (under development) and assumptions.
- Calculator Tools - provides tools to perform conversions of hydrogen and other calculations relevant to hydrogen and fuel cells.
- Analysis Tools - provides links to models and other tools relevant to hydrogen and fuel cells, such as H2A, GREET, PSAT, VISION, MOVES, and other transportation and energy models.

Table 6.5
Properties of Conventional and Alternative Fuels

Property	Gasoline	No. 2 diesel	Methanol	Ethanol
Chemical formula	C_4 to C_{12}	C_8 to C_{25}	CH_3OH	C_2H_5OH
Physical state	Liquid	Liquid	Liquid	Liquid
Molecular weight	100–105	~200	32.04	46.07
Composition (weight %)				
Carbon	85–88	87	37.5	52.2
Hydrogen	12–15	13	12.6	13.1
Oxygen	0	0	49.9	34.7
Main fuel source(s)	Crude oil	Crude oil	Natural gas, coal, or woody biomass	Corn, grains, or agricultural waste
Specific gravity (60˚ F/ 60˚ F)	0.72–0.78	0.85	0.796	0.794
Density (lb/gal @ 60˚ F)	6.0–6.5	7.079	6.63	6.61
Boiling temperature (F˚)	80–437	356–644	149	172
Freezing point (F˚)	-40	-40–30	-143.5	-173.2
Autoiginition temperature (F˚)	495	~600	867	793
Reid vapor pressure (psi)	8–15	<0.2	4.6	2.3

Property	Propane	CNG	Hydrogen
Chemical formula	C_3H_8	CH_4	H_2
Physical state	Compressed gas	Compressed gas	Compressed gas or liquid
Molecular weight	44.1	16.04	2.02
Composition (weight %)			
Carbon	82	75	0
Hydrogen	18	25	100
Oxygen	n/a	n/a	0
Main fuel source	Underground reserves	Underground reserves	Natural gas, methanol, and other energy sources
Specific gravity (60˚ F/ 60˚ F)	0.508	0.424	0.07
Density (lb/gal @ 60˚ F)	4.22	1.07	n/a
Boiling temperature (F˚)	-44	-263.2 to -126.4	-423
Freezing point (F˚)	-305.8	-296	-435
Autoiginition temperature (F˚)	842	900–1,170	932
Reid vapor pressure (psi)	208	2,400	n/a

Source:
Alternative Fuels Data Center, "Properties of Fuel," www.eere.energy.gov/afdc/pdfs/fueltable.pdf and "Fuel Comparison," www.eere.energy.gov/afdc/fuels/properties.html, February 2009.

Note: n/a = not applicable.

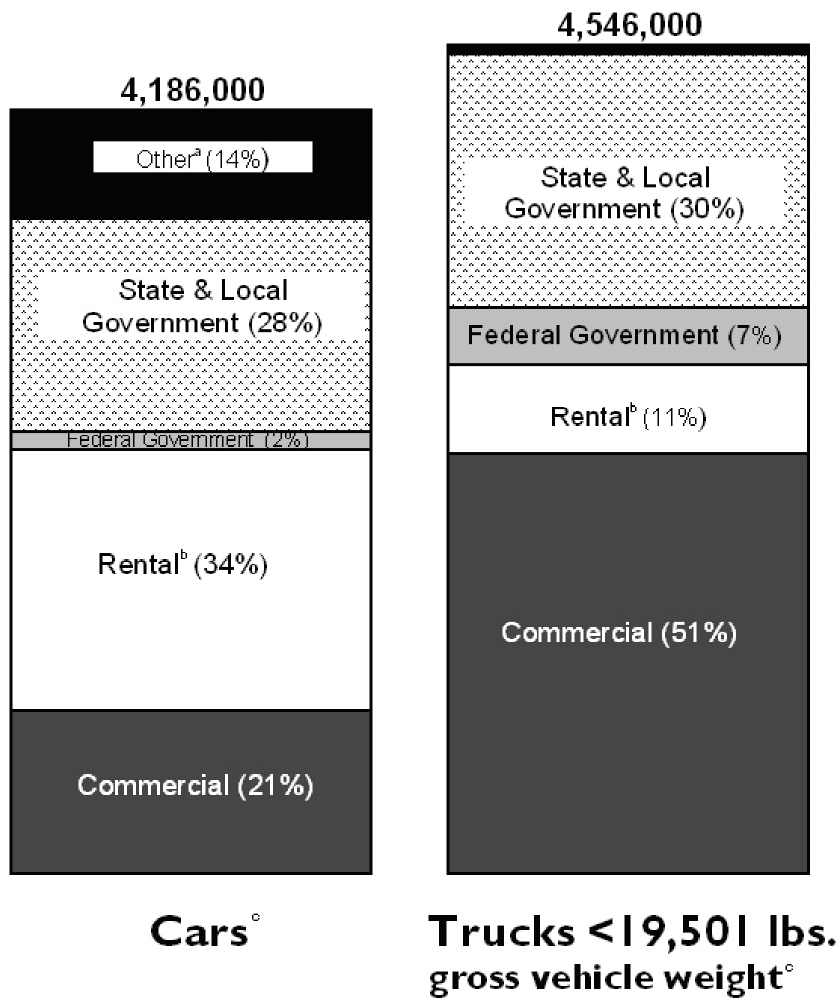
Chapter 7
Fleet Vehicles and Characteristics

Summary Statistics from Tables/Figures in this Chapter

Source		
Figure 7.1	Fleet cars, 2007	4,186,000
Figure 7.1	Fleet trucks ≤ 19,500 lbs. GVW, 2007	4,546,000
Table 7.3	Average annual miles per business fleet vehicle	
	Pick up trucks	*25,704*
	SUVs	*25,164*
	Intermediate cars	*24,840*
Figure 7.2	Average annual miles per Federal Government fleet vehicle, 2007	
	Sedans & station wagons	*13,087*
	SUVs	*8,531*
	Buses	*9,499*
	Heavy trucks	*8,747*
	Medium trucks	*7,184*
	Light trucks	*5,682*
	Ambulances	*7,848*
Table 7.4	Federal government vehicles, FY 2008	645,491
	Light trucks (<8,500 lbs. GVW)	*278,105*
	Cars and other passenger vehicles	*236,607*
	Medium trucks (8,500–26,000 lbs. GVW)	*88,509*
	Heavy trucks (>26,000 lbs. GVW)	*32,752*
	Buses and ambulances	*9,518*

Vehicles in fleets of 15 or more are counted as fleet vehicles, as well as vehicles in fleets where five or more vehicles are purchased annually. Historical data on fleets are not available due to definitional changes of what constitutes a fleet.

Figure 7.1. Fleet Vehicles in Service as of June 1, 2008



Source:
Bobit Publishing Company, Automotive Fleet Research Department, *Automotive Fleet Factbook 2008*, Redondo Beach, CA, 2009. (Additional resources: www.fleet-central.com)

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[a]Taxi category includes vans.
[b]Rental category includes vans and sports utility vehicles under **cars**, not trucks.
[c]Fleets of 15 or more in operation or 5 or more fleet vehicles purchased annually.

Rental companies made the largest light fleet vehicle registrations in 2007 buying nearly 2.0 million vehicles, most of them cars (57.2%). Over 30% of the commercial fleet vehicles registrations were pickups.

Table 7.1
New Light Fleet Vehicle Registrations by Vehicle Type, Model Year 2007

	Commercial	Rental	Government	Total
Cars	26.2%	57.2%	39.5%	47.1%
Pickups	30.1%	3.5%	24.5%	12.6%
Vans	18.3%	10.6%	14.4%	13.0%
Sport utility vehicles	15.2%	26.8%	12.4%	22.3%
Medium trucks	10.2%	2.0%	19.2%	4.9%
Total	855,781	2,010,693	294,754	3,161,228

Source:
Bobit Publishing Company, *Automotive Fleet Factbook 2008*, pp. 28, 29, 31 and Web site. (Additional resources: www.fleet-central.com)

The average length of service for an intermediate size fleet car is 29 months. Of the light vehicle types, full-size vans have the longest average months in service.

Table 7.2
Average Length of Time Business Fleet Vehicles are in Service, 2007

Vehicle type	Average months in service
Compact cars	32
Intermediate cars	29
Pickup trucks	40
Minivans	31
Sport utility vehicles	29
Full-size vans	46

Source:
Bobit Publishing Company, *Automotive Fleet Factbook 2008*, pp. 34-35. (Additional resources: www.fleet-central.com)

Note: Based on data collected from four leading Fleet Management companies.

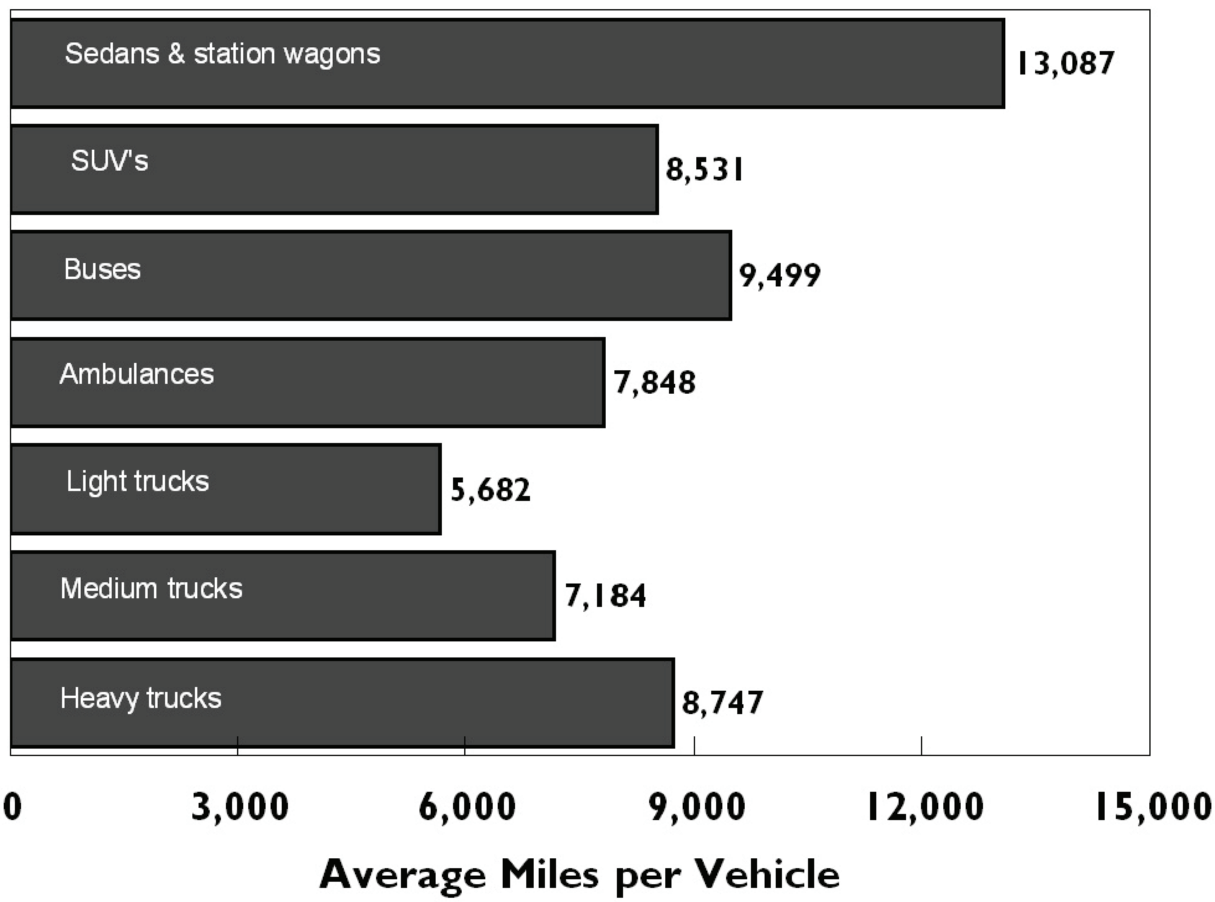
Table 7.3
Average Annual Vehicle-Miles of Travel for Business Fleet Vehicles, 2007

Business fleet vehicles	Average annual miles of travel
Compact cars	24,360
Intermediate cars	24,840
Pickup trucks	25,704
Minivans	27,468
SUVs	25,164
Full-size vans	29,244

Source:
Bobit Publishing Company, *Automotive Fleet Factbook* 2008, pp. 34-35. (Additional resources: www.fleet-central.com)

These data, which apply to domestic Federal fleet vehicles, indicate that sedans and station wagons have the highest average annual miles per vehicle, followed closely by buses and heavy trucks.

Figure 7.2. Average Miles per Domestic Federal Vehicle by Vehicle Type, 2008



Source:
U.S. General Services Administrations, Federal Vehicle Policy Division, *FY 2008 Federal Fleet Report*, Washington, DC, January 2009, Table 4-2. (Additional resources: www.gsa.gov)

The Federal Government vehicle inventory includes more light trucks than passenger vehicles.

Table 7.4
Federal Government Vehicles, 2002-2008

Vehicle Type	2002	2003	2004	2005	2006	2007	2008
Passenger Vehicles							
Subcompact	4,638	5,139	4,485	2,401	2,181	1,968	3,058
Compact	57,002	58,364	55,150	58,284	56,220	48,495	41,482
Midsize	40,779	37,695	35,012	36,656	39,762	48,622	55,157
Large	11,265	11,171	16,235	15,966	11,783	11,907	10,679
Limousines	130	115	227	191	318	217	238
Light passenger vans	61,518	60,030	42,213	42,109	41,911	43,203	43,131
Medium passenger vans	1,701	16,023	13,282	13,252	15,657	15,231	15,696
Light SUVs	48,343	42,316	54,992	50,445	52,393	53,837	56,329
Medium SUVs	0	7,593	7,594	6,096	7,192	7,733	10,837
Total Passenger Vehicles	**225,376**	**238,446**	**229,190**	**225,400**	**227,417**	**231,213**	**236,607**
Trucks and Other Vehicles							
Light 4x2	220,205	232,526	236,123	243,477	241,847	243,720	243,143
Light 4x4	27,108	28,654	32,121	35,417	37,019	40,115	34,962
Medium	86,949	77,569	80,474	83,747	81,721	84,414	88,509
Heavy	31,426	33,089	33,308	35,230	33,383	32,492	32,752
Ambulances	1,710	1,611	1,405	1,580	1,601	1,982	1,474
Buses	7,313	7,493	7,530	7,837	7,752	8,297	8,044
Total Trucks and Other Vehicles	**374,711**	**380,942**	**390,961**	**407,288**	**403,323**	**411,020**	**408,884**
GRAND TOTAL ALL VEHICLES	**600,087**	**619,388**	**620,151**	**632,688**	**630,740**	**642,233**	**645,491**

Source:
U.S. General Services Administration, Federal Supply Service, *FY 2008 Federal Fleet Report*, Washington, DC, 2009, Charts 2-5 and 2-6. (Additional resources: http://www.gsa.gov)

Table 7.5
Federal Fleet Vehicle Acquisitions
by Fuel Type, FY 2002–2008

	Acquisitions by Year						
Fuel Type	2002	2003	2004	2005	2006	2007	2008
Gasoline	44,850	42,844	43,378	41,469	37,758	32,547	30,907
Diesel	8,107	5,831	5,822	6,050	6,809	5,813	5,897
CNG	1,267	1,223	809	188	243	129	123
E-85	8,054	19,626	13,991	16,892	18,168	26,581	27,792
Electric	7	31	88	13	0	7	6
LNG	3	0	0	0	0	0	0
LPG	59	49	26	1	0	4	3
M-85	25	0	0	0	0	0	0
Hydrogen	0	0	0	0	0	0	1
Grand Total	62,372	69,604	64,114	64,613	62,978	65,081	64,729

Source:
U.S. General Services Administrations, Federal Vehicle Policy Division, *FY 2008 Federal Fleet Report*, Washington, DC, 2009 , Chart 5-4. (Additional resources: www.gsa.gov)

Table 7.6
Fuel Consumed by Federal Government Fleets, FY 2001–2008
(thousand gasoline equivalent gallons)

	FY01	FY02	FY03	FY04	FY05	FY06	FY07	FY08
Gasoline	281,791	281,205	296,017	284,460	300,261	288,923	293,848	292,046
Diesel	70,761	68,487	69,109	59,199	53,363	47,489	57,700	55,617
CNG	2,335	1,708	575	1,159	1,245	807	889	731
Electricity	35	56	19	3	6	5	5	4
Biodiesel	1,315	2,252	3,753	6,470	8,052	8,334	9,483	6,976
Methanol/M-85	5	4	3	0	0	0	0	0
LPG	102	108	104	126	231	105	322	399
Ethanol/E-85	5,900	4,673	1,592	1,784	3,060	3,206	3,853	6,293
LNG	52	27	23	91	102	90	95	59
Other	0	0	0	0	0	0	0	0
TOTAL	362,296	358,520	371,195	353,292	366,320	348,959	366,195	362,125

Source:
U.S. General Services Administrations, Federal Vehicle Policy Division, *FY 2008 Federal Fleet Report*, Washington, DC, 2009, Chart 5-1. (Additional resources: www.gsa.gov)

Chapter 8
Household Vehicles and Characteristics

Summary Statistics from Tables/Figures in this Chapter

Source		
Table 8.2	Vehicles per capita, 2007	0.825
Table 8.3	Average household transportation expense, 2007	17.6%
Table 8.4	Share of households owning 3 or more vehicles	
	1960	*2.5%*
	1970	*5.5%*
	1980	*17.5%*
	1990	*17.3%*
	2000	*18.3%*
Table 8.5	Vehicles per licensed driver, 2001	1.06
Figure 8.1	Average occupancy rates by vehicle type, 2001	
	Pickup Truck	*1.46*
	Car	*1.58*
	Sports Utility	*1.74*
	Van	*2.20*
Table 8.9	Average annual miles per household vehicle, 2001	11,100
Table 8.15	Share of workers who car pooled, 2000	11.2%
Table 8.21	Long-distance trips in the United States, 2001	
	Person-trips	*2,554 million*
	Person-miles	*1,138 billion*

The number of vehicles in the United States is growing faster than the population. The growth in vehicle-miles has slowed in recent years. See Table 8.2 for vehicles per capita and vehicle-miles per capita.

Table 8.1
Population and Vehicle Profile, 1950–2007

Year	Resident population[a] (thousands)	Total households (thousands)	Number of vehicles in operation (thousands)	Total vehicle-miles (millions)	Number of licensed drivers (thousands)	Number of civilian employed persons (thousands)
1950	151,326	43,554	43,256	458,246	62,194	58,918
1955	165,069	47,874	55,804	605,646	74,686	62,170
1960	179,979	52,799	66,582	718,762	87,253	65,778
1965	193,526	57,251	82,067	887,812	98,502	71,088
1970	203,984	63,401	98,136	1,109,724	111,543	78,678
1975	215,465	71,120	120,054	1,327,664	129,791	85,846
1980	227,225	80,776	139,832	1,527,295	145,295	99,303
1985	237,924	86,789	157,048	1,774,826	156,868	107,150
1986	240,133	88,458	162,094	1,834,872	159,487	109,597
1987	242,289	89,479	167,193	1,921,204	161,975	112,440
1988	244,499	91,061	171,741	2,025,962	162,853	114,968
1989	246,819	92,830	175,960	2,096,487	165,555	117,342
1990	249,623	93,347	179,299	2,144,362	167,015	118,793
1991	252,981	94,312	181,438	2,172,050	168,995	117,718
1992	256,514	95,689	181,519	2,247,151	173,125	118,492
1993	259,919	96,391	186,315	2,296,378	173,149	120,259
1994	263,126	97,107	188,714	2,357,588	175,403	123,060
1995	266,278	98,990	193,441	2,422,696	176,628	124,900
1996	269,394	99,627	198,294	2,485,848	179,539	126,708
1997	272,647	101,018	201,071	2,561,695	182,709	129,558
1998	275,854	102,528	205,043	2,631,522	184,980	131,463
1999	279,040	103,874	209,509	2,691,056	187,170	133,488
2000	282,194	104,705	213,300	2,746,925	190,625	136,891
2001	285,112	108,209	216,683	2,797,287	191,276	136,933
2002	287,888	109,297	221,027	2,855,508	194,296	136,485
2003	290,448	111,278	225,882	2,890,450	196,166	137,736
2004	293,192	112,000	231,398	2,964,788	198,889	139,252
2005	295,896	113,343	237,697	2,989,430	200,549	141,730
2006	298,755	114,384	244,022	3,014,371	202,810	144,427
2007	301,621	116,011	248,701	3,029,822	205,742	146,047
			Average annual percentage change			
1950–2007	1.2%	1.7%	3.1%	3.4%	2.1%	1.6%
1997–2007	1.0%	1.4%	2.1%	1.7%	1.2%	1.2%

Sources:
Resident population and civilian employed persons - U.S. Department of Commerce, Bureau of the Census, *Statistical Abstract of the United States–2009,* Washington, DC, 2009, tables 2, 58, 567, and annual. (Additional resources: www.census.gov)
Vehicles in operation - The Polk Company. **FURTHER REPRODUCTION PROHIBITED**. (Additional resources: www.polk.com)
Licensed drivers and vehicle-miles - U.S. Department of Transportation, Federal Highway Administration, *Highway Statistics 2007*, Tables DL-1C and VM-1, and annual. (Additional resources: www.fhwa.dot.gov)

[a] Estimates as of July 1. Includes Armed Forces in the United States.

Vehicle-miles per capita reached 10,000 miles in 2004. There were 1.70 vehicles for every employed civilian in the United States in 2007.

Table 8.2
Vehicles and Vehicle-Miles per Capita, 1950–2007[a]

Year	Vehicles per capita	Vehicle-miles per capita	Vehicles per civilian employed persons
1950	0.286	3,029	0.73
1955	0.338	3,656	0.90
1960	0.370	3,994	1.01
1965	0.424	4,587	1.15
1970	0.481	5,440	1.25
1975	0.560	6,191	1.40
1980	0.615	6,722	1.41
1985	0.660	7,460	1.47
1986	0.675	7,641	1.48
1987	0.690	7,929	1.49
1988	0.702	8,286	1.49
1989	0.713	8,494	1.50
1990	0.718	8,590	1.51
1991	0.717	8,586	1.54
1992	0.708	8,760	1.53
1993	0.717	8,835	1.55
1994	0.717	8,960	1.53
1995	0.726	9,098	1.55
1996	0.736	9,228	1.56
1997	0.737	9,396	1.55
1998	0.743	9,540	1.56
1999	0.751	9,644	1.57
2000	0.756	9,734	1.56
2001	0.760	9,811	1.58
2002	0.768	9,919	1.62
2003	0.778	9,952	1.64
2004	0.789	10,112	1.66
2005	0.803	10,103	1.68
2006	0.817	10,090	1.69
2007	0.825	10,045	1.70
		Average annual percentage change	
1950–2007	1.9%	2.1%	1.5%
1997–2007	1.1%	0.7%	0.9%

Sources:
Resident population and civilian employed persons - U.S. Department of Commerce, Bureau of the Census, *Statistical Abstract of the United States–2009*, Washington, DC, 2009, tables 2, 567, and annual. (Additional resources: www.census.gov)
Vehicles in operation - The Polk Company. **FURTHER REPRODUCTION PROHIBITED**. (Additional resources: www.polk.com)
Vehicle-miles - U.S. Department of Transportation, Federal Highway Administration, *Highway Statistics 2007*, Table VM-1 and annual. (Additional resources: www.fhwa.dot.gov)

[a] Includes all vehicles (light and heavy).

Transportation (17.6%) is second only to housing (34.1%) as the largest expenditure for the average household. In 2007, approximately 27.2% of transportation expenditures were for purchasing gasoline and motor oil. There is an average of 1.9 vehicles per household.

Table 8.3
Average Annual Expenditures of Households by Income, 2007[a]

	All households	Income before taxes: Less than $5,000	$5,000–$9,999	$10,000–$14,999	$15,000–$19,999
Total expenditures	$49,638	$19,697	$16,623	$20,611	$24,106
	Percentage of total expenditures[b]				
Food[c]	12.4%	15.2%	15.0%	15.4%	13.4%
Housing	34.1%	38.1%	43.4%	40.4%	39.5%
Apparel and services	3.8%	5.3%	3.8%	3.8%	3.0%
Transportation	17.6%	15.5%	13.9%	15.7%	17.8%
Vehicle purchases (net outlay)	**6.5%**	**3.8%**	**3.7%**	**5.4%**	**7.0%**
Gasoline and motor oil	**4.8%**	**4.7%**	**5.3%**	**4.8%**	**5.5%**
Other vehicle expenditures	**5.2%**	**6.1%**	**4.2%**	**4.8%**	**4.3%**
Public transportation	**1.1%**	**0.8%**	**1.7%**	**0.7%**	**1.1%**
Health care	5.7%	5.3%	5.9%	7.8%	8.5%
Entertainment	5.4%	5.4%	4.2%	4.3%	4.6%
Personal Insurance & pensions	10.8%	2.1%	2.0%	2.5%	3.5%
Others[d]	9.3%	12.2%	11.0%	9.3%	9.1%
Households[e] (thousands)	120,171	4,184	5,406	7,552	7,562
Percentage of households	100%	3.5%	4.5%	6.3%	6.3%
Average number of vehicles in HH	1.9	0.8	0.8	1.0	1.2

Source:
U.S. Department of Labor, Bureau of Labor Statistics, Web site: www.bls.gov/cex/2007/standard/income.pdf, October 2008. (Additional resources: www.bls.gov)

[a] Public assistance monies are included in reported income. Data for those reporting income.
[b] Percentages may not sum to totals due to rounding.
[c] Includes alcoholic beverages.
[d] Includes personal care, reading, education, tobacco and smoking supplies, cash contributions, and miscellaneous items.
[e] The term household refers to a "consumer unit," which is defined differently than households on Table 8.1.

Table 8.3 (Continued)
Average Annual Expenditures of Households by Income, 2007[a]

	Income before taxes				
	$20,000- $29,999	$30,000- $39,999	$40,000- $49,999	$50,000- $69,999	$70,000 and over
Total expenditures	$29,704	$34,739	$41,083	$50,428	$84,072
	Percentage of total expenditures[b]				
Food[c]	13.7%	13.4%	13.8%	12.6%	11.3%
Housing	37.0%	35.7%	34.1%	33.7%	32.6%
Apparel and services	3.4%	3.7%	3.7%	3.7%	3.9%
Transportation	18.3%	18.7%	17.9%	19.5%	17.1%
Vehicle purchases (net outlay)	**6.4%**	**6.4%**	**5.2%**	**7.6%**	**6.7%**
Gasoline and motor oil	**5.7%**	**5.8%**	**5.7%**	**5.5%**	**4.1%**
Other vehicle expenditures	**5.5%**	**5.7%**	**6.1%**	**5.5%**	**5.0%**
Public transportation	**0.7%**	**0.9%**	**0.8%**	**1.8%**	**1.3%**
Health care	8.4%	7.2%	6.8%	6.1%	4.7%
Entertainment	4.6%	5.1%	4.9%	5.3%	5.9%
Personal Insurance & pensions	5.9%	7.1%	8.4%	10.2%	13.8%
Others[d]	7.9%	8.3%	9.3%	8.0%	9.8%
Households[e] (thousands)	14,720	13,211	11,824	18,390	37,322
Percentage of households	12.2%	11.1%	9.8%	15.3%	31.1%
Average number of vehicles in HH	1.5	1.6	1.9	2.3	2.7

Source:
U.S. Department of Labor, Bureau of Labor Statistics, Web site: www.bls.gov/cex/2007/standard/income.pdf, October 2008. (Additional resources: www.bls.gov)

[a] Public assistance monies are included in reported income. Data for those reporting income.
[b] Percentages may not sum to totals due to rounding.
[c] Includes alcoholic beverages.
[d] Includes personal care, reading, education, tobacco and smoking supplies, cash contributions, and miscellaneous items.
[e] The term household refers to a "consumer unit," which is defined differently than households on Table 8.1.

Household vehicle ownership shows a dramatic increase from 1960 to 1990. In 1960, nearly 79% of households owned less than two vehicles; by 1990, it declined to 45%. Census data prior to 1990 indicated that the majority of households owned one vehicle; in 1990 that changed to two vehicles.

Table 8.4
Household Vehicle Ownership, 1960–2000 Census
(percentage)

	No vehicles	One vehicle	Two vehicles	Three or more vehicles	Total vehicles[a]
1960	21.53%	56.94%	19.00%	2.53%	54,766,718
1970	17.47%	47.71%	29.32%	5.51%	79,002,052
1980	12.92%	35.53%	34.02%	17.52%	129,747,911
1990	11.53%	33.74%	37.35%	17.33%	152,380,479
2000	9.35%	33.79%	38.55%	18.31%	179,417,526

Source:

U. S. Department of Transportation, Volpe National Transportation Systems Center, *Journey-to-Work Trends in the United States and its Major Metropolitan Area, 1960–1990*, Cambridge, MA, 1994, p. 2-2.

2000 data - U.S. Bureau of the Census, American Fact Finder, factfinder.census.gov, Table QT-04, August 2001. (Additional resources: www.census.gov)

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[a] Estimates using Census Bureau data; these data on the total number of vehicles do not match the figures on Table 8.1. The figures on Table 8.1, from R.L. Polk and Company, are the preferred data.

2001 National Household Travel Survey Daily Trip Data

The Department of Transportation (DOT) colleted data on daily trips in 1969, 1977, 1983, 1990 and 1995 via the Nationwide Personal Transportation Survey (NPTS). Data on longer trips were collected in 1977 and 1995 via the American Travel Survey (ATS). For 2001, the DOT combined the collection of long trip and daily trip data into one survey – the 2001 National Travel Household Travel Survey (NHTS).

The NHTS is the nation's inventory of daily and long-distance travel. The survey includes demographic characteristics of households, people, vehicles, and detailed information on daily and longer-distance travel for all purposes by all modes. NHTS survey data are collected from a sample of U.S. households and expanded to provide national estimates of trips and miles by travel mode, trip purpose, and a host of household attributes.

The NHTS was designed to continue the NPTS and ATS series, but as with all data surveys, caution should be used when comparing statistics from one survey to another due to changes in terminology, survey procedures, and target population. The 2001 survey collected data on trips of children under 5 years of age, while the previous NPTS did not. Improved methodologies first used in the collection of trip information in the 1995 NPTS make it difficult to compare these data with past NPTS survey data. Thus, the 1990 NPTS trip data have been adjusted to make it comparable with the later surveys.

The Nationwide Household Travel Survey was conducted in 2008 but the data have not been released. The 2001 survey data are the latest available at the current time.

Table 8.5
Demographic Statistics from the 1969, 1977, 1983, 1990, 1995 NPTS and 2001 NHTS

	1969	1977	1983	1990	1995	2001	Percent change 1969–2001
Persons per household	3.16	2.83	2.69	2.56	2.63	2.58	-18%
Vehicles per household	1.16	1.59	1.68	1.77	1.78	1.89	63%
Workers per household	1.21	1.23	1.21	1.27	1.33	1.35	12%
Licensed drivers per household	1.65	1.69	1.72	1.75	1.78	1.77	7%
Vehicles per worker	0.96	1.29	1.39	1.40	1.34	1.39	45%
Vehicles per licensed driver	0.70	0.94	0.98	1.01	1.00	1.06	52%
Average vehicle trip length (miles)	8.89	8.34	7.90	8.98	9.06	9.87	11%

Sources:
U.S. Department of Transportation, Federal Highway Administration, *1990 Nationwide Personal Transportation Survey: Summary of Travel Trends*, FHWA-PL-92-027, Washington, DC, March 1992, Table 2. Data for 1995 and 2001 were generated from the Internet sites *www-cta.ornl.gov/npts,* and *nhts.ornl.gov*. (Additional resources: www.fhwa.dot.gov)

Note: Average vehicle trip length for 1990 and 1995 is calculated using only those records with trip mileage information present. The 1969 survey does not include pickups and other light trucks as household vehicles.

Due to methodology improvements in collecting trip information, the 2001 and 1995 data should be compared only to the 1990 adjusted data. The original 1990 data are comparable to all previous surveys; however, comparisons should always be made with caution because of differing survey methodologies.

Table 8.6
Average Annual Vehicle-Miles, Vehicle Trips and Trip Length per Household
1969, 1977, 1983, 1990, 1995 NPTS and 2001 NHTS

	Journey-to-work[a]	All trips
Average annual vehicle-miles per household		
1969	4,183	12,423
1977	3,815	12,036
1983	3,538	11,739
1990 original	4,853	15,100
1990 adjusted	4,853	18,161
1995	6,492	20,895
2001	5,724	21,171
Average annual vehicle trips per household		
1969	445	1,396
1977	423	1,442
1983	414	1,486
1990 original	448	1,702
1990 adjusted	448	2,077
1995	553	2,321
2001	479	2,171
Average vehicle trip length (miles)		
1969	9.4	8.9
1977	9.0	8.4
1983	8.5	7.9
1990 original	11.0	9.0
1990 adjusted	11.0	8.9
1995	11.8	9.1
2001	12.2	9.9

Sources:
U.S. Department of Transportation, Federal Highway Administration, *1990 Nationwide Personal Transportation Survey: Summary of Travel Trends*, FHWA-PL-92-027, Washington, DC, March 1992, Table 7. Data for 1995 were generated from the Internet site *www-cta.ornl.gov/npts*. 1990 adjusted data - Oak Ridge National Laboratory, Oak Ridge, TN, August 1998. 2001 NHTS data were generated from the Internet site *nhts.ornl.gov*. (Additional resources: www.fhwa.dot.gov, www-cta.ornl.gov/npts)

[a] It is believed that the methodology changes in the 1995 NPTS did not affect journey-to-work trips; therefore, no adjustment is necessary.

In 2001 vehicle-miles traveled (vmt) for a three-person household is over 28,000 miles. The number of drivers in a household makes a big difference in vmt, as does the presence of children in the household. Households with children have 74% more vmt than households without children.

Table 8.7
Average Number of Vehicles and Vehicle Travel per Household, 1990 NPTS and 2001 NHTS

	Average number of vehicles per household		Average vehicle-miles traveled per household	
Number of Licenced Drivers	**1990**	**2001**	**1990**	**2001**
1	1.5	1.2	15,200	9,700
2	2.1	2.2	22,900	25,800
3	2.9	3.0	29,400	37,900
4 or more	3.8	3.8	40,500	47,200
Household size				
1 person	1.2	1.0	11,400	7,500
2 persons	1.9	2.0	19,300	21,200
3 persons	2.2	2.3	23,700	28,400
4 persons	2.4	2.4	25,300	28,600
5 persons	2.4	2.4	24,900	33,200
6 or more persons	2.7	2.5	29,200	33,800
Household urban status				
Urban	1.9	1.8	19,000	19,300
Rural	2.1	2.3	22,200	28,400
Household composition				
With children	2.2	2.2	24,100	28,300
Without children	1.8	1.7	17,600	16,700
All households	**1.8**	**1.9**	**18,300**	**21,200**

Source:
Generated from the Department of Transportation, Federal Highway Administration, Nationwide Personal Transportation Survey Public Use Files, Washington, DC, 2000 and the National Household Travel Survey Internet site: nhts.ornl.gov. (Additional resources: www-cta.ornl.gov/npts)

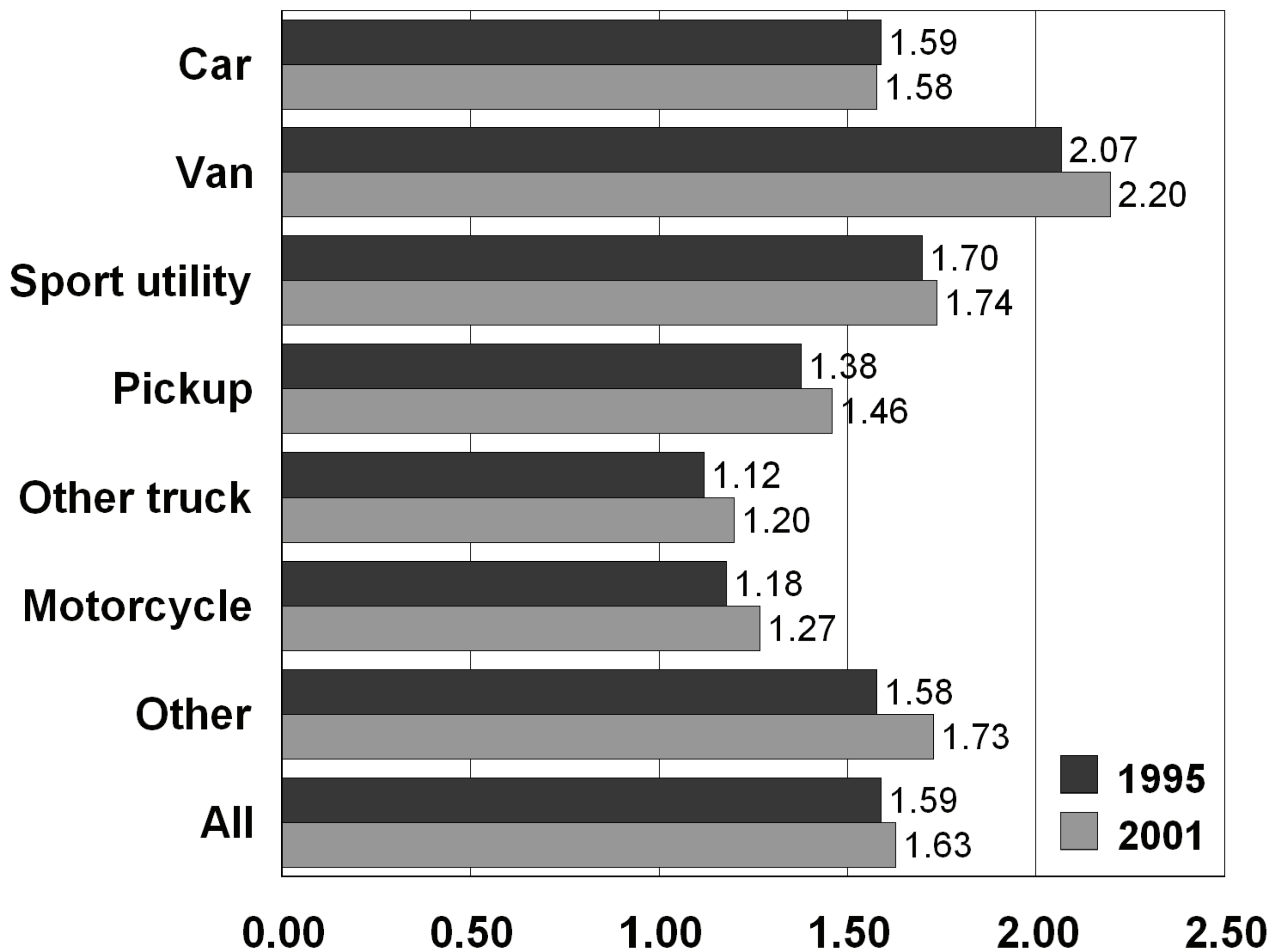
Table 8.8
Trip Statistics by Trip Purpose, 2001 NHTS

Trip Purpose	Share of trips	Share of vehicle-miles traveled	Trip length (miles)	Trip duration (minutes)
To/from work	22.1%	27.0%	12.1	22.3
Work-related business	4.1%	8.4%	20.3	30.9
Shopping	21.1%	14.5%	6.7	14.4
Other family/personal business	24.7%	18.7%	7.5	15.2
School/church	4.9%	3.7%	7.5	15.8
Medical/dental	2.2%	2.2%	9.9	20.7
Vacation	0.4%	1.8%	47.4	59.6
Visit friends/relatives	6.3%	9.4%	14.9	24.4
Other social/recreational	13.7%	13.2%	9.6	18.2
Other	0.5%	1.0%	18.1	31.4
All	99.9%	100.0%	9.9	18.7

Source:
Generated from the National Household Travel Survey Internet site: nhts.ornl.gov.

While car occupancy declined slightly from 1995 to 2001, all other vehicle types showed increased occupancy. Vans and sport utility vehicles have higher vehicle occupancies than cars.

Figure 8.1. Average Vehicle Occupancy by Vehicle Type, 1995 NPTS and 2001 NHTS

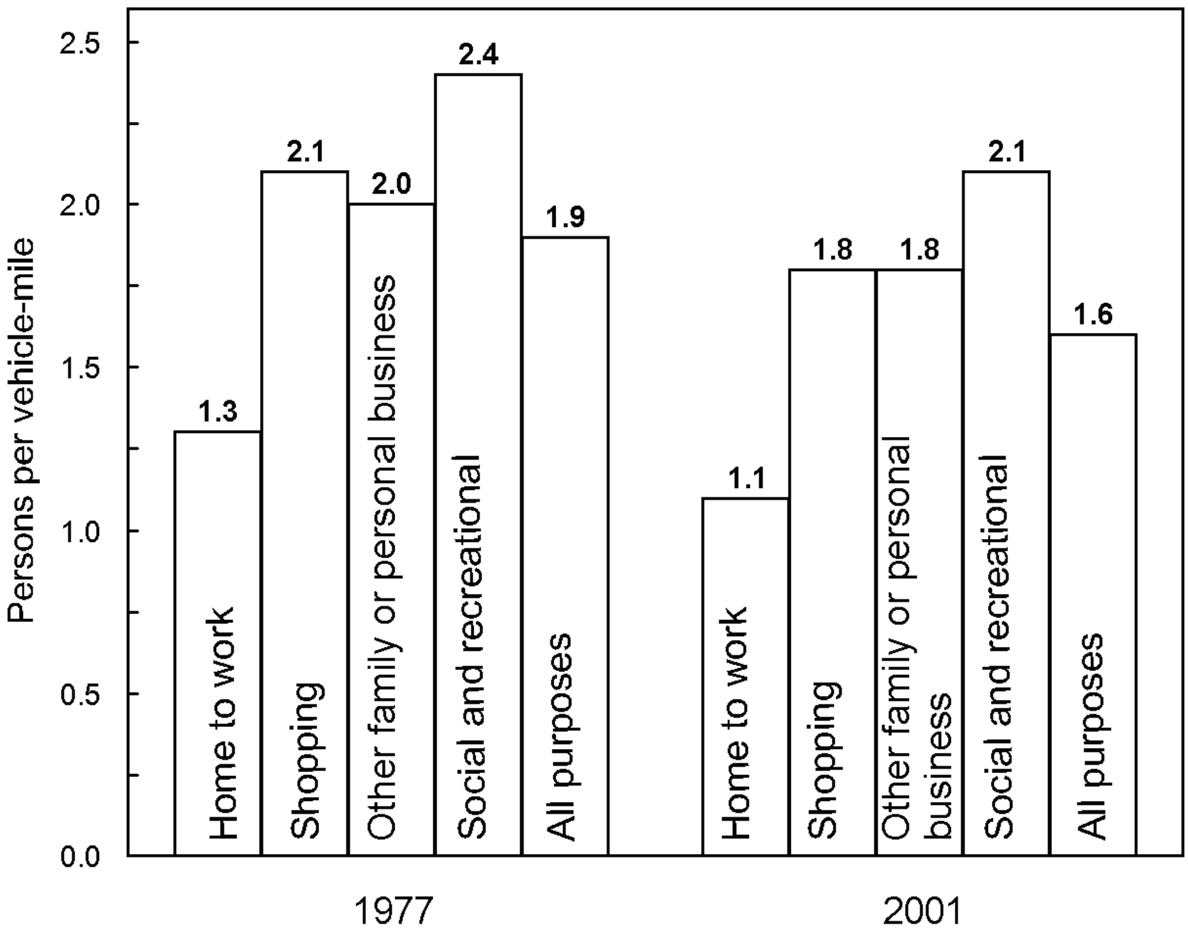


Sources:

U.S. Department of Transportation, Federal Highway Administration, 1995 Nationwide Personal Transportation Survey, Washington, DC, 1997, and 2001 National Household Travel Survey, Washington, DC, 2004. (Additional resources: www.fhwa.dot.gov, www-cta.ornl.gov/npts, nhts.ornl.gov)

The average vehicle occupancy, calculated as person-miles per vehicle-mile, is highest for social and recreational purposes. The highest vehicle occupancy levels for all purposes were in 1977. The increase in number of vehicles per household and the decrease in average household size could have contributed to the decline since then.

Figure 8.2. Average Vehicle Occupancy by Trip Purpose 1977 NPTS and 2001 NHTS



Sources:

U.S. Department of Transportation, Federal Highway Administration, *1990 Nationwide Personal Transportation Survey: Summary of Travel Trends*, FHWA-PL-92027, Washington, DC, March 1992, Figure 6. Data from 2001 NHTS were generated from the Internet site nhts.ornl.gov, June 2003. (Additional resources: www.fhwa.dot.gov, nhts.ornl.gov)

The 1990 household survey reports the highest average annual miles per vehicle. These data show that younger vehicles are typically driven more miles than older vehicles.

Table 8.9
Average Annual Miles Per Household Vehicle by Vehicle Age

Vehicle age (years)	1983 self-reported	1990 self-reported	1995 self-reported	2001 self-reported
Under 1	8,200	19,600	15,900	15,500
1	15,200	16,800	16,800	14,300
2	16,800	16,600	15,500	14,000
3	14,500	14,700	14,400	13,100
4	13,000	13,600	14,100	12,500
5	12,100	12,900	13,500	12,000
6	11,300	13,200	13,200	11,800
7	10,000	12,400	12,800	11,600
8	9,800	12,600	12,200	10,900
9	9,000	11,500	12,200	10,800
10 and older	7,300	9,200	8,900	7,400
All household vehicles	**10,400**	**12,500**	**12,200**	**11,100**

Sources:
Nationwide Personal Transportation Study—1983: D. Klinger and J. Richard Kuzmyak, COMSIS Corporation, Personal Travel in the United States, Volume 1: 1983–84 Nationwide Personal Travel Study, prepared for the U.S. Department of Transportation, Washington, DC, August 1986, Table 4-22, p.4-21. 1990: Generated from the 1990 Nationwide Personal Transportation Study Public Use Tape, March 1992. 1995: Generated from the Internet site: www-cta.ornl.gov/npts. 2001: Generated from the Internet site: nhts.ornl.gov. (Additional resources: www.fhwa.dot.gov, www.eia.doe.gov)

Note: Data include all household vehicles, and have been rounded to the nearest hundred.

Historically, the data from the Nationwide Personal Transportation Survey (NPTS) are based on estimates reported by survey respondents. For the 1995 NPTS and the 2001 National Household Travel Survey (NHTS), odometer data were also collected. The 1995 data indicate that respondents overestimate the number of miles they drive in a year, but the 2001 data do not show that same trend.

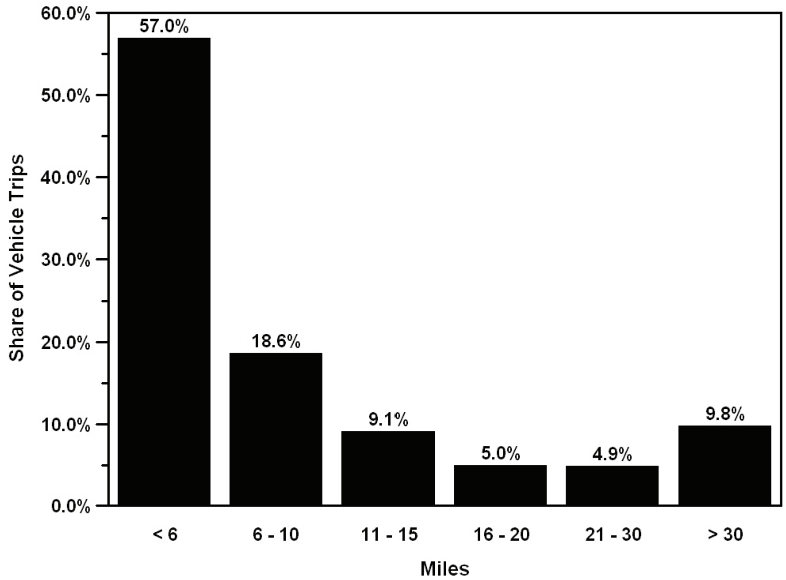
Table 8.10
Self-Reported vs. Odometer Average Annual Miles, 1995 NPTS and 2001 NHTS

Vehicle age (years)	1995 self-reported	1995 odometer	2001 self-reported	2001 odometer
Under 1	15,900	15,600	15,500	14,500
1	16,800	14,500	14,300	14,200
2	15,500	14,800	14,000	13,700
3	14,400	13,800	13,100	14,100
4	14,100	12,900	12,500	13,400
5	13,500	12,700	12,000	12,900
6	13,200	12,400	11,800	12,400
7	12,800	11,600	11,600	12,100
8	12,200	11,300	10,900	11,300
9	12,200	11,200	10,800	10,500
10 and older	8,900	9,000	7,400	8,100
All household vehicles	12,200	11,800	11,100	11,800

Source:
Generated from the Internet site: www-cta.ornl.gov/npts and 2001 NHTS public use file.

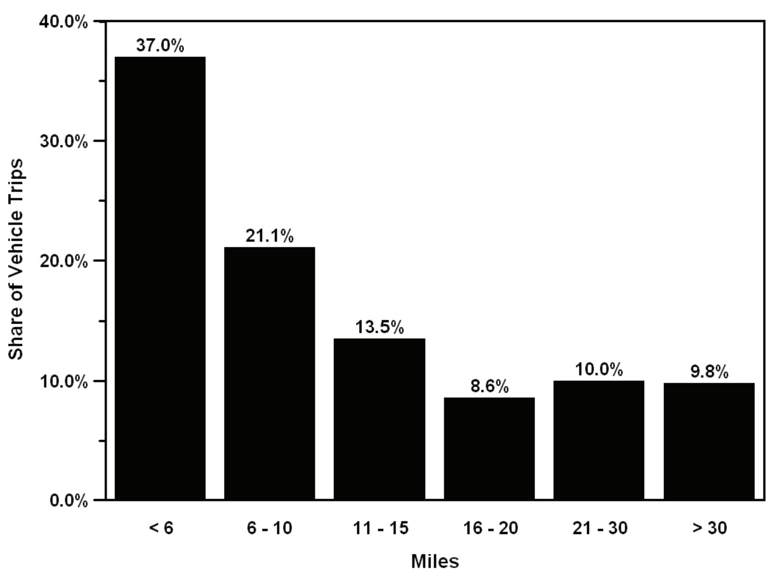
Note: Survey methodology on odometer reading data differs from 1995 to 2001 data.

Figure 8.3. Share of Vehicle Trips by Trip Distance, 2001 NHTS



Source:
National Household Travel Survey, https://nhts.ornl.gov

Figure 8.4. Share of Vehicle Trips to Work by Trip Distance, 2001 NHTS



Source:
National Household Travel Survey, https://nhts.ornl.gov

Twenty-two percent of new vehicles (1 year old and under) travel over 20,000 miles per year. Nearly half of vehicles over 20 years old travel less than 1,000 miles in a year.

Table 8.11
Share of Vehicles by Annual Miles of Travel and Vehicle Age, 2001 NHTS

	Vehicle age (years)						
Annual vehicle miles of travel	1 and under	2	3	4	5	6	7
< 1,000 miles	2%	3%	3%	3%	4%	6%	5%
1 - 2,000 miles	2%	2%	3%	3%	3%	3%	3%
2 - 4,000 miles	7%	7%	9%	10%	11%	12%	12%
4 - 6,000 miles	7%	7%	8%	8%	9%	10%	11%
6 - 8,000 miles	9%	10%	10%	12%	11%	10%	12%
8 - 10,000 miles	10%	11%	13%	12%	14%	14%	13%
10 - 12,000 miles	12%	13%	12%	12%	12%	10%	11%
12 - 15,000 miles	13%	16%	16%	14%	13%	12%	13%
15 - 20,000 miles	16%	15%	14%	13%	12%	12%	10%
20 - 30,000 miles	14%	11%	10%	8%	7%	7%	7%
>30,000 miles	8%	5%	5%	5%	4%	4%	4%
All	100%	100%	100%	100%	100%	100%	100%

	Vehicle age (years)					
	8	9	10	11-15	16-20	Over 20
< 1,000 miles	6%	6%	7%	12%	22%	47%
1 - 2,000 miles	3%	5%	6%	7%	10%	10%
2 - 4,000 miles	14%	15%	16%	20%	22%	18%
4 - 6,000 miles	11%	12%	11%	13%	12%	8%
6 - 8,000 miles	13%	11%	13%	12%	9%	4%
8 - 10,000 miles	13%	12%	12%	10%	8%	5%
10 - 12,000 miles	8%	9%	8%	6%	4%	2%
12 - 15,000 miles	13%	12%	11%	8%	5%	3%
15 - 20,000 miles	10%	10%	8%	6%	4%	2%
20 - 30,000 miles	6%	5%	4%	4%	3%	2%
>30,000 miles	3%	3%	3%	2%	2%	1%
All	100%	100%	100%	100%	100%	100%

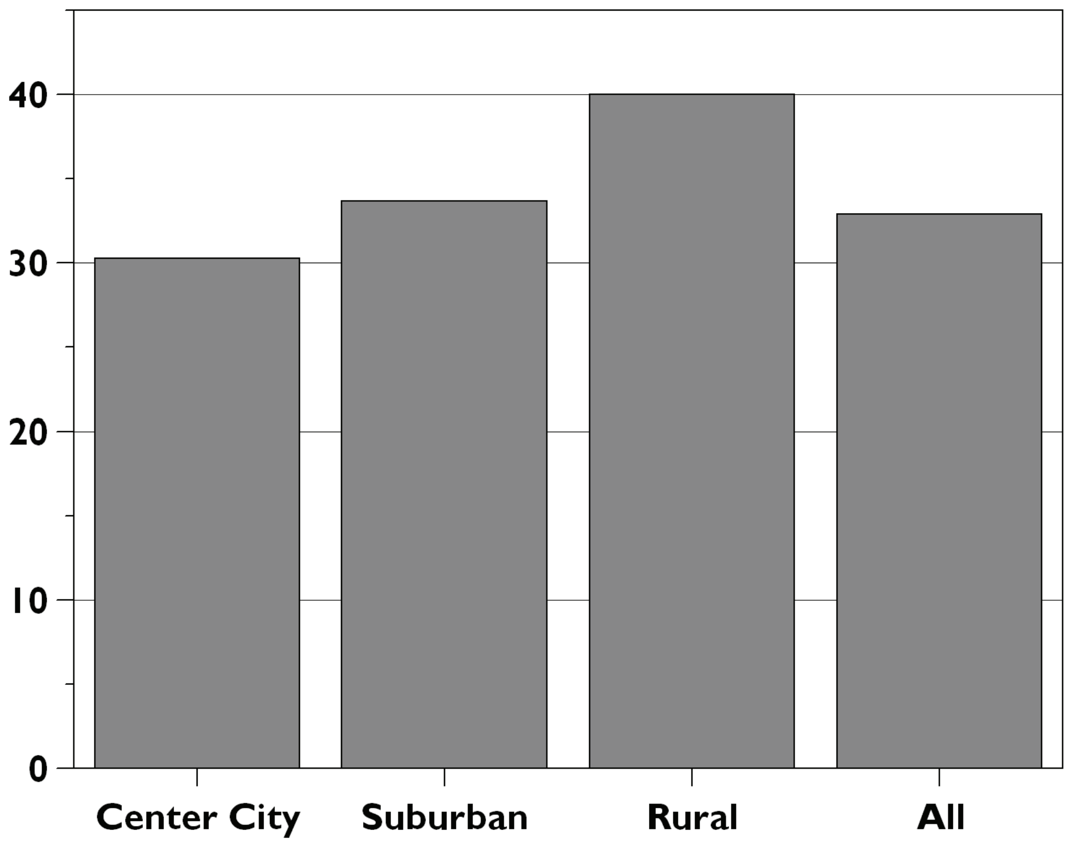
Source:
Generated from the Department of Transportation, Federal Highway Administration, National Household Travel Survey Internet site: nhts.ornl.gov. (Additional resources: nhts.ornl.gov)

Table 8.12
Household Vehicle Trips, 2001 NHTS

	Number of daily vehicle trips	Average vehicle trip length (miles)	Daily vehicle miles of travel
1990	3.3	8.9	28.5
1995	3.6	9.1	32.1
2001	3.4	9.9	32.7

Source:
U.S. Department of Transportation, *Summary of Travel Trends, 2001 Household Travel Survey*, December 2004, p. 12.

Figure 8.5. Average Daily Miles Driven (per Driver), 2001 NHTS



Source:
National Household Travel Survey, nhts.ornl.gov

Table 8.13
Daily Vehicle Miles of Travel (per Vehicle) by Number of Vehicles in the Household, 2001 NHTS

Number of household vehicles	Miles
1	25.6
2	27.5
3	24.2
4	23.0
5	21.1
More than 5	18.4
All	25.2

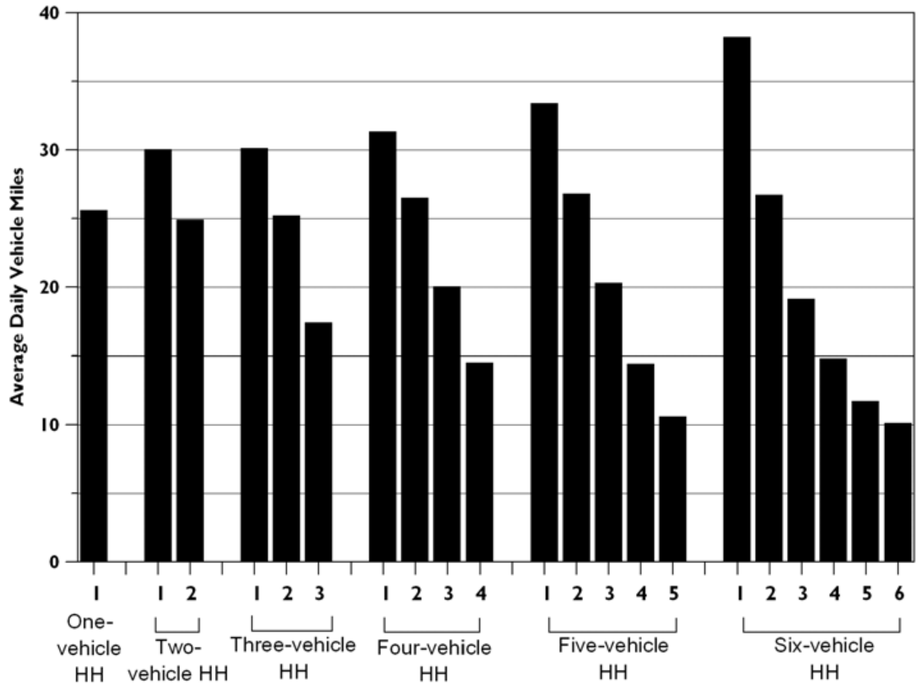
Source:
2001 National Household Travel Survey, nhts.ornl.gov

Table 8.14
Daily and Annual Vehicle Miles of Travel and Average Age for Each Vehicle in a Household, 2001 NHTS

Vehicle number	Average daily miles	Average annual miles	Average age (years)
One-vehicle household			
1	25.6	9,339	8.2
Two-vehicle household			
1	30.0	10,966	5.5
2	24.9	9,090	10.0
Three-vehicle household			
1	30.1	10,983	5.1
2	25.2	9,202	9.2
3	17.4	6,359	13.6
Four-vehicle household			
1	31.3	11,407	5.0
2	26.5	9,668	8.4
3	20.0	7,282	12.7
4	14.5	5,278	15.6
Five-vehicle household			
1	33.4	12,181	4.9
2	26.8	9,793	8.2
3	20.3	7,423	11.6
4	14.4	5,237	15.6
5	10.6	3,863	16.6
Six-vehicle household			
1	38.2	13,946	5.2
2	26.7	9,737	9.3
3	19.1	6,955	13.3
4	14.8	5,396	15.2
5	11.7	4,286	17.6
6	10.1	3,685	18.5

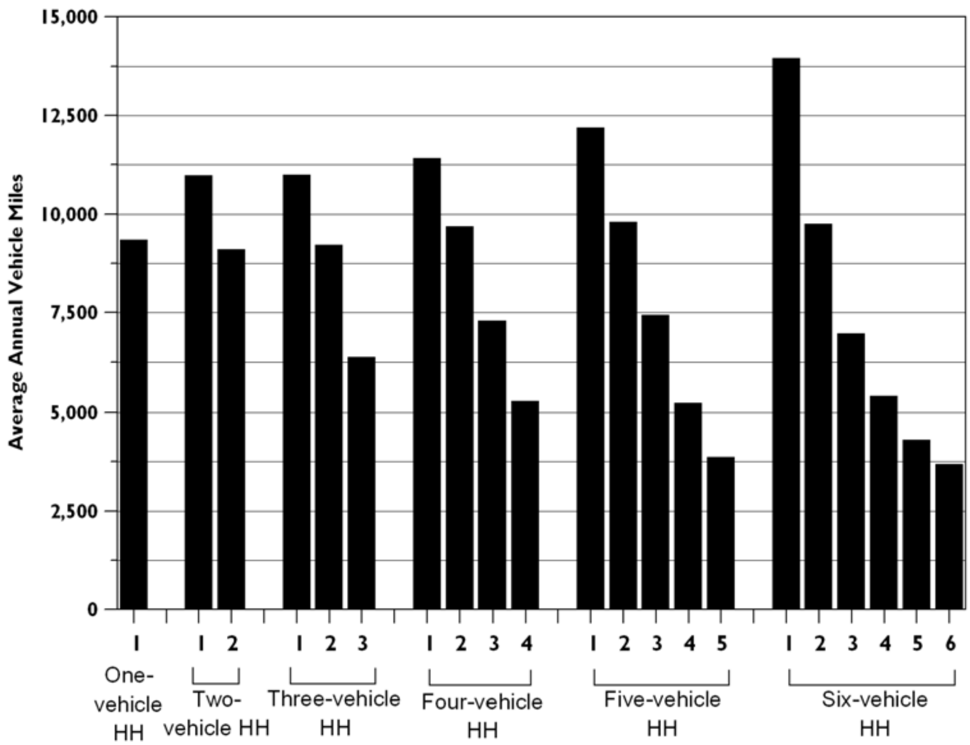
Source:
2001 National Household Travel Survey, nhts.ornl.gov

Figure 8.6. Daily Vehicle Miles of Travel for Each Vehicle in a Household, 2001 NHTS



Source:
2001 National Household Travel Survey, nhts.ornl.gov

Figure 8.7. Annual Vehicle Miles of Travel for Each Vehicle in a Household, 2001 NHTS



Source:
2001 National Household Travel Survey, nhts.ornl.gov

According to the U.S. Census data, the percentage of workers who car pooled has dropped from 19.7% in 1980 to 11.2% in 2000. The percent of workers using public transit declined from 6.4% to 5.3% in the ten-year period between 1980 and 1990, but stayed relatively the same from 1990 to 2000 (5.2%). The average travel time increased by 2.6 minutes from 1980 to 2000.

Table 8.15
Means of Transportation to Work, 1980, 1990 and 2000 Census

	1980 Census		1990 Census		2000 Census	
Means of transportation	Number of workers (thousands)	Share	Number of workers (thousands)	Share	Number of workers (thousands)	Share
Private vehicle	81,258	84.1%	99,593	86.5%	111,554	87.5%
Drove alone	*62,193*	*64.4%*	*84,215*	*73.2%*	*97,247*	*76.3%*
Car pooled	*19,065*	*19.7%*	*15,378*	*13.4%*	*14,307*	*11.2%*
Public transportation	6,175	6.4%	6,070	5.3%	6,575	5.2%
Bus or trolley bus[a]	*3,925*	*4.1%*	*3,445*	*3.0%*	*3,572*	*2.8%*
Streetcar or trolley car[a]	[b]	[b]	*78*	*0.1%*	*88*	*0.1%*
Subway or elevated	*1,529*	*1.6%*	*1,755*	*1.5%*	*1,981*	*1.6%*
Railroad	*554*	*0.6%*	*574*	*0.5%*	*696*	*0.5%*
Ferryboat	[b]	[b]	*37*	*0.0%*	*43*	*0.0%*
Taxicab	*167*	*0.2%*	*179*	*0.2%*	*194*	*0.2%*
Motorcycle	419	0.4%	237	0.2%	158	0.1%
Bicycle	468	0.5%	467	0.4%	563	0.4%
Walked only	5,413	5.6%	4,489	3.9%	3,413	2.7%
Other means	703	0.7%	809	0.7%	1,099	0.9%
Worked at home	2,180	2.3%	3,406	3.0%	4,075	3.2%
Total workers	96,617	100.0%	115,070	100.0%	127,437	100.0%
Average travel time (minutes)	21.7		22.4		24.3	

Sources:
1980-1990 data - Provided by the Journey-to-Work and Migration Statistics Branch, Population Division, U.S. Bureau of the Census
2000 data - U.S. Bureau of the Census, American Fact Finder, factfinder.census.gov, Tables QT-03 and P047, August 2001. (Additional resources: www.census.gov)

[a] This category was "Bus or streetcar" in 1980.
[b] Data are not available.

Table 8.16
U.S. Travel Statistics as a Function of Daily Distance Driven

Daily distance (miles)	0-20	20-40	>40	All
Trip share (%)	60.0	21.4	18.6	100.0
Share of time spent	40.8	23.5	35.7	100.0
Share of total	28.1	23.3	48.6	100.0
Miles per hour	21.1	31.3	42.3	31.1
Miles per trip	4.2	9.4	23.4	9.0

Source:
Santini, Danilo J. and Anant D. Vyas, "How to Use Life Cycle Analysis Comparisons of PHEVs to Competing Powertrains." Original Data: 2001 National Household Travel Survey.

Table 8.17
Characteristics of U.S. Daily per Vehicle Driving vs. Dwelling Unit Type and Density

	Share of vehicles in density type	Hours per vehicle per day	Average vehicle speed (miles/hour)	Miles per vehicle per day
All classes detached single	79.0%	1.24	31.4	39.0
All classes other	21.0%	1.28	29.3	37.3
<1,000/sq. mile detached single	84.2%	1.27	34.3	43.5
<1,000/sq. mile all other	15.8%	1.30	33.1	42.8
1,000-4,000/sq. mile detached single	80.2%	1.21	29.3	35.5
1,000-4,000/sq. mile all other	19.8%	1.24	29.7	36.8
4,000-10,000/sq. mile detached single	72.9%	1.19	27.1	32.3
4,000-10,000/sq. mile all other	27.1%	1.25	26.6	33.2
10,000-25,000/sq. mile detached single	46.5%	1.31	23.3	30.6
10,000-25,000/sq. mile all other	53.5%	1.32	23.7	31.3
>25,000/sq. mile detached single	20.5%	1.41	20.1	28.5
>25,000/sq. mile all other	79.5%	1.40	20.8	29.1

Source:
Vyas, Anant, Danilo Santini, Michael Duoba, and Mark Alexander, "Plug-In Hybrid Electric Vehicles: How Does One Determine Their Potential for Reducing U.S. Oil Dependence?" Original Data: 2001 National Household Survey.

Table 8.18
Housing Unit Characteristics, 2005

	Share of occupied housing units	% with garage or carport
Type of Housing Unit		
New construction (< = 4 years)	5.5%	79.3%
Manufactured/mobile homes	6.4%	30.3%
With physical problems[a]	5.7%	37.9%
All other	82.4%	65.8%
Geographic Location (Census Region)		
Northeast	18.7%	49.0%
Midwest	22.9%	72.0%
South	36.5%	54.8%
West	21.9%	77.6%
Type of Location		
MSA - Central City	29.2%	53.7%
MSA - Suburbs	**48.5%**	**69.1%**
Outside MSA	22.3%	60.4%

Source:
Vyas, Anant, Danilo Santini, Michael Duoba and Mark Alexander, "Plug-In Hybrid Electric Vehicles: How Does One Determine Their Potential for Reducing U.S. Oil Dependence?" Original Data: 2005 American Housing Survey.

[a] Physical problems include problems with plumbing, heating, electric, upkeep, and/or hallways. For detailed definitions of "moderate" and "severe" physical problems, see *American Housing Survey for the United States*, 1993, page A-13.

More than half of workers had 15-29 minute commutes in 1990, but that dropped to 35% by 2000. The share of workers commuting less than 15 minutes increased the most in the ten-year period (14 percentage points), but the share of workers commuting 30 minutes or more also saw small increases.

Table 8.19
Workers by Commute Time, 1990 and 2000 Census

Commute time	1990	2000
Less than 15 minutes	15.9%	30.1%
15–29 minutes	51.6%	36.3%
30–39 minutes	14.7%	15.7%
40–59 minutes	9.0%	10.7%
60 minutes or more	5.9%	7.3%
Average travel time (minutes)	22.4	24.3

Sources:
1990 - U. S. Department of Transportation, Volpe National Transportation Systems Center, *Journey-to-Work Trends in the United States and its Major Metropolitan Area, 1960–1990*, FHWA-PL-94-012, Cambridge, MA, 1994, p. 2-6.
2000 - U.S. Bureau of the Census, American Fact Finder, factfinder.census.gov, Tables QT-03 and P048, August 2001. (Additional resources: www.census.gov)

Sales of bicycles with wheel sizes of 20 inches and over have grown at an average annual rate of 1.4% from 1981 to 2007. The largest growth in bicycle sales, however, were bicycles with wheel sizes under 20 inches which grew at an average annual rate of 2.5%.

Table 8.20
Bicycle Sales, 1981–2007
(millions)

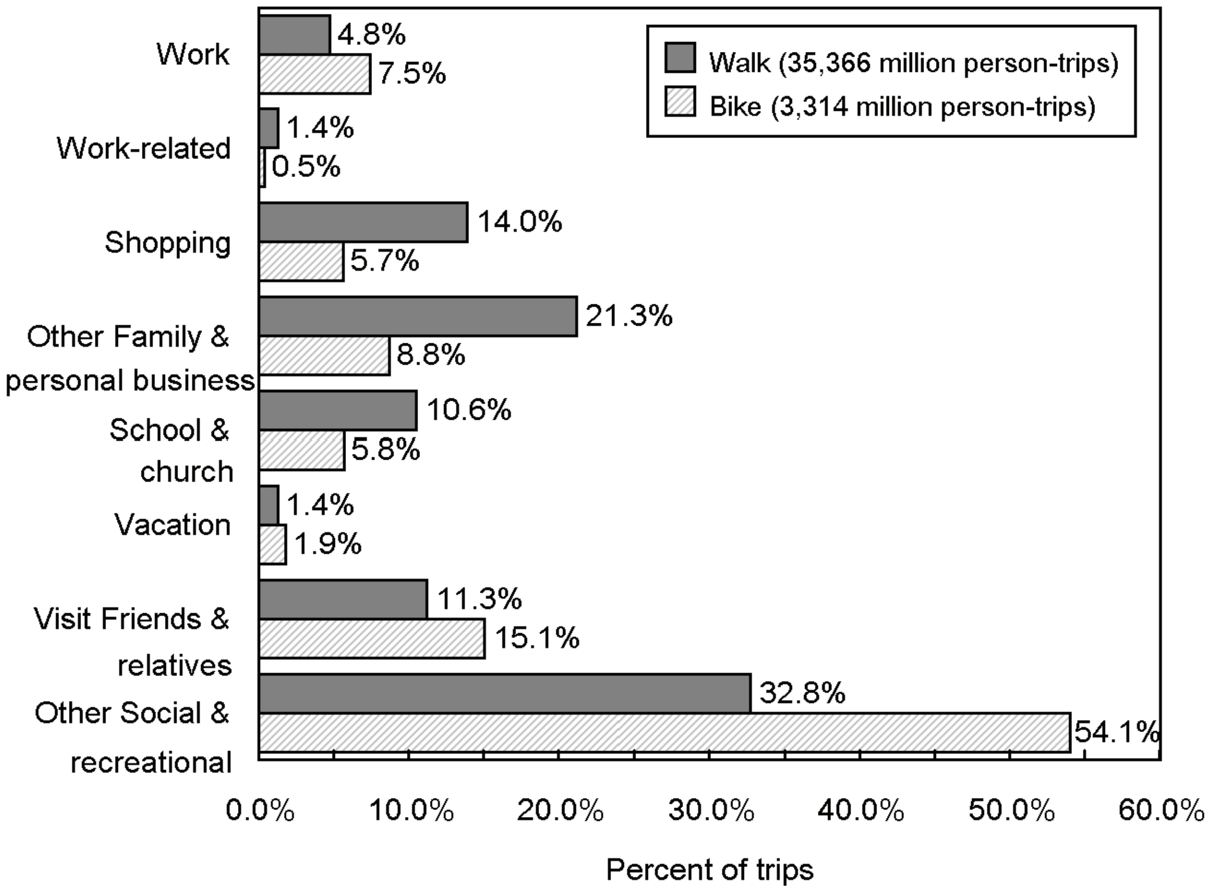
	Wheel sizes under 20 inches	Wheel sizes of 20 inches and over	All wheel sizes
1981	[a]	8.9	[a]
1982	[a]	6.8	[a]
1983	[a]	9.0	[a]
1984	[a]	10.1	[a]
1985	[a]	11.4	[a]
1986	[a]	12.3	[a]
1987	[a]	12.6	[a]
1988	[a]	9.9	[a]
1989	[a]	10.7	[a]
1990	[a]	10.8	[a]
1991	[a]	11.6	[a]
1992	3.7	11.6	15.3
1993	3.8	13.0	16.8
1994	4.2	12.5	16.7
1995	4.1	12.0	16.1
1996	4.5	10.9	15.4
1997	4.2	11.0	15.2
1998	4.7	11.1	15.8
1999	5.9	11.6	17.5
2000	9.0	11.9	20.9
2001	5.4	11.3	16.7
2002	5.9	13.6	19.5
2003	5.6	12.9	18.5
2004	5.3	13.0	18.3
2005	5.8	14.0	19.8
2006	5.5	12.7	18.2
2007	5.4	12.8	18.2
	Average annual percentage change		
1981–2007	[a]	1.4%	[a]
1997–2007	2.5%	1.5%	1.8%

Source:
1981–1996: Bicycle Manufacturers Association. 1997–on: National Bicycle Dealers Association. (Additional resources: www.nbda.com)

[a] Data are not available.

In 2001, 4.8% of walk trips and 7.5% of bike trips were to/from work. More than half of all bike trips were for social/recreational purposes. Fourteen-percent of walk trips were shopping trips.

Figure 8.8. Walk and Bike Trips by Trip Purpose, 2001 NHTS



Source:
U.S. Department of Transportation, Federal Highway Administration, National Household Travel Survey Web site: nhts.ornl.gov.

In 2008 only data on daily trips were collected in the NHTS. The 2001 data are still the latest available on long-distance trips.

Long Distance Trips – 2001 National Household Travel Survey

The 2001 National Household Travel Survey (NHTS) collected data on long-distance trips as well as everyday travel. The everyday travel data is a continuation of the Nationwide Personal Transportation Survey (NPTS), while the long-distance travel data is a continuation of the American Travel Survey (ATS) which was collected in 1977 and 1985. The survey collected trip-related data such as mode of transportation, duration, distance and purpose of trip. It also gathered demographic, geographic, and economic data for analysis purposes.

A long-distance trip is defined as a trip of 50 miles or more, one-way. Long-trip data from the 2001 NHTS were released in the summer of 2004. For additional information about the 2001 NHTS data, contact the Bureau of Transportation Statistics at 202-366-3282 or visit the following Inernet site: www.bts.gov/programs/national_household_travel_survey.

Table 8.21
Long-Distance Trip[a] Characteristics, 2001 NHTS

	Person trips		Person miles	
Trip characteristic	(thousands)	(percent)	(thousands)	(percent)
Total	2,554,068	100.0	1,138,322,697	100.0
Principal means of transportation:				
Personal use vehicles	2,310,376	90.5	735,882,255	64.7
Airplane	165,039	6.5	367,888,741	32.3
Commercial airplane	158,880	6.2	361,717,015	31.8
Bus[b]	52,962	2.1	23,747,433	2.1
Intercity bus	3,456	0.1	1,765,696	0.2
Charter, tour, or school bus	45,952	1.8	21,019,942	1.9
Train	20,672	0.8	9,266,373	0.8
Round trip distance:				
100 to 300 miles	1,688,358	66.1	284,586,370	25.0
300 to 499 miles	373,550	14.6	143,571,597	12.6
500 to 999 miles	261,802	10.3	180,669,482	15.9
1,000 to 1,999 miles	125,665	4.9	178,629,838	15.7
2,000 miles or more	104,694	4.1	350,865,409	30.8
Mean (miles)	446	[c]	[c]	[c]
Median (miles)	206	[c]	[c]	[c]
Calendar quarter:				
1st quarter	566,502	22.2	246,556,190	21.7
2nd quarter	653,310	25.6	298,154,812	26.2
3rd quarter	734,878	28.8	341,021,290	30.0
4th quarter	599,378	23.5	252,590,405	22.2
Main purpose of trip:				
Commuting	329,395	12.9	65,877,968	5.8
Other business	405,866	15.9	242,353,212	21.3
Personal/leisure	1,406,411	55.1	667,471,358	58.7
Personal business	322,645	12.6	130,020,982	11.4
Other	88,230	3.5	32,031,679	2.8
Nights away from home:				
None	1,454,847	57.0	304,469,524	26.8
1 to 3 nights	808,281	31.7	414,219,147	36.4
4 to 7 nights	214,464	8.4	269,265,597	23.7
8 or more nights	76,475	3.0	150,368,429	13.2
Destination:				
Within Census division	2,077,810	81.4	549,651,116	48.3
Across Census division, within Census	196,890	7.7	134,930,113	11.9
Across Census region	279,367	10.9	453,741,468	39.9

Source:
U.S. Bureau of Transportation Statistics and the U.S. Federal Highway Administration, 2001 National Household Transportation Survey.

[a] A long-distance trip is defined as a trip of 50 miles or more, one-way.
[b] Includes other types of buses.
[c] Not applicable.

Chapter 9
Nonhighway Modes

Summary Statistics from Tables in this Chapter

Source		
	Passenger-miles	(millions)
Table 9.2	*Domestic and international air carrier, 2007*	*842,002*
Table 9.10	*Amtrak, 2007*	*5,784*
Table 9.11	*Commuter rail, 2007*	*11,153*
Table 9.12	*Transit rail, 2007*	*18,070*
	Freight ton-miles	(millions)
Table 9.5	*Domestic waterborne commerce, 2006*	*562,000*
Table 9.8	*Class I railroad, 2007*	*1,770,545*
	Passenger energy use	(trillion Btus)
Table 9.2	*Domestic and international air carrier, 2007*	*2,684.6*
Table 9.3	*General aviation, 2007*	*242.5*
Table 9.6	*Recreational boats, 2007*	*247.3*
Table 9.10	*Amtrak, 2007*	*14.5*
Table 9.11	*Commuter rail, 2007*	*29.4*
Table 9.12	*Transit rail, 2007*	*46.6*
	Freight energy use	(trillion Btus)
Table 9.5	*Domestic waterborne commerce, 2006*	*288.1*
Table 9.8	*Class I railroad, 2007*	*566.9*

Nonhighway transportation modes accounted for 20% of total transportation energy use in 2007.

Table 9.1
Nonhighway Energy Use Shares, 1970–2007

	Share of transportation energy use					
Year	Air	Water	Pipeline	Rail	Nonhighway total	Transportation total (trillion Btu)
1970	8.5%	5.5%	6.4%	3.6%	24.0%	15,399
1971	8.1%	4.9%	6.3%	3.5%	22.8%	16,019
1972	7.7%	4.7%	6.1%	3.4%	21.9%	17,040
1973	7.7%	5.0%	5.6%	3.4%	21.7%	17,878
1974	7.3%	5.1%	5.4%	3.6%	21.5%	17,178
1975	7.3%	5.3%	4.8%	3.2%	20.7%	17,427
1976	7.2%	5.9%	4.3%	3.1%	20.6%	18,495
1977	7.1%	6.2%	4.1%	3.1%	20.4%	19,130
1978	7.1%	6.9%	3.9%	2.9%	20.8%	20,101
1979	7.6%	5.9%	4.4%	3.1%	20.9%	19,654
1980	7.6%	7.4%	4.7%	3.1%	22.8%	18,944
1981	7.8%	6.8%	4.8%	3.0%	22.4%	18,744
1982	7.9%	5.8%	4.7%	2.6%	22.1%	18,241
1983	7.8%	5.3%	4.0%	2.6%	19.8%	18,371
1984	8.5%	5.1%	4.1%	2.8%	20.5%	19,966
1985	8.7%	4.6%	3.9%	2.6%	19.8%	19,208
1986	9.0%	6.5%	3.6%	2.4%	21.6%	20,280
1987	9.1%	6.7%	3.7%	2.4%	21.9%	20,775
1988	9.3%	6.7%	4.1%	2.4%	22.4%	21,330
1989	9.1%	7.0%	4.1%	2.4%	22.6%	21,688
1990	9.6%	6.7%	4.3%	2.3%	22.9%	21,616
1991	9.1%	7.2%	4.1%	2.3%	22.6%	21,208
1992	9.0%	7.3%	3.9%	2.2%	22.4%	21,869
1993	8.9%	6.4%	4.0%	2.3%	21.6%	22,324
1994	9.0%	6.1%	4.1%	2.3%	21.6%	22,928
1995	9.1%	6.3%	4.1%	2.4%	21.9%	23,467
1996	9.2%	5.9%	4.1%	2.4%	21.6%	23,975
1997	9.5%	5.1%	4.2%	2.4%	21.2%	24,329
1998	9.6%	5.0%	3.6%	2.3%	20.5%	24,758
1999	9.5%	5.3%	3.5%	2.3%	20.6%	25,948
2000	9.7%	5.5%	3.4%	2.3%	21.0%	26,269
2001	9.3%	4.6%	3.4%	2.3%	19.6%	25,960
2002	8.3%	4.7%	3.5%	2.3%	18.8%	26,520
2003	8.3%	4.0%	3.2%	2.3%	17.8%	26,673
2004	8.7%	4.8%	3.0%	2.4%	18.9%	27,066
2005	9.0%	5.0%	3.1%	2.4%	19.4%	27,526
2006	9.0%	5.2%	3.0%	2.4%	19.7%	27,759
2007	9.0%	5.6%	3.2%	2.3%	20.0%	28,002

Source:
See Appendix A for Nonhighway Energy Use.

These data include ALL international and domestic certificated route air carrier statistics; therefore, the data are different than those in Chapter 2. Revenue aircraft-miles, passenger-miles, and seat-miles continued to rise in 2007. Passenger load factor rose to 79.4% in 2007 –the highest in the series.

Table 9.2
Summary Statistics for U.S. Domestic and International Certificated Route Air Carriers (Combined Totals), 1970–2007[a]

Year	Revenue aircraft-miles (millions)	Revenue passenger-miles (millions)	Available seat-miles (millions)	Available seats per aircraft[b]	Passenger load factor (percentage)[c]	Revenue freight ton-miles (millions)	Energy use (trillion Btu)[d]
1970	2,542	148,137	264,904	104	55.9%	3,755	1,363.4
1975	2,241	173,324	315,823	141	54.9%	5,062	1,283.4
1980	2,924	267,722	448,479	153	59.7%	7,885	1,386.0
1985	3,462	351,073	565,677	163	62.1%	9,048	1,701.4
1986	3,873	378,923	623,075	161	60.8%	10,987	1,847.1
1987	4,182	417,808	670,825	160	62.3%	13,137	1,945.9
1988	4,354	437,649	696,337	160	62.9%	14,632	2,049.4
1989	4,442	447,480	703,888	158	63.6%	16,347	2,087.4
1990	4,724	472,236	753,211	159	62.7%	16,403	2,213.0
1991	4,661	463,296	738,030	158	62.8%	16,149	2,085.2
1992	4,899	493,715	772,869	158	63.9%	17,306	2,144.2
1993	5,118	505,996	793,959	155	63.7%	19,083	2,169.7
1994	5,360	537,518	809,259	151	66.4%	21,773	2,266.2
1995	5,627	558,794	832,081	148	67.2%	23,375	2,338.6
1996	5,855	596,164	859,721	147	69.3%	24,892	2,409.1
1997	6,025	620,029	880,715	146	70.4%	27,610	2,514.2
1998	6,220	634,933	899,029	145	70.6%	28,015	2,573.4
1999	6,558	668,626	942,311	144	71.0%	25,147	2,653.1
2000	6,946	708,926	981,080	141	72.3%	30,221	2,743.1
2001	6,814	664,849	950,519	139	69.9%	27,882	2,599.4
2002	6,834	655,215	913,898	134	71.7%	30,507	2,408.3
2003	7,367	674,160	922,440	125	73.1%	32,446	2,402.3
2004	7,479	752,341	1,000,193	134	75.2%	37,958	2,504.8
2005	7,716	795,117	1,029,316	133	77.2%	39,286	2,606.8
2006	8,220	810,086	1,027,526	125	78.8%	38,251	2,666.1
2007	8,417	842,002	1,060,082	126	79.4%	38,463	2,684.6
			Average annual percentage change				
1970–2007	3.3%	4.8%	3.8%	0.5%		6.5%	1.8%
1997–2007	3.4%	3.1%	1.9%	-1.5%		3.4%	0.7%

Sources:

U.S. Department of Transportation, Bureau of Transportation Statistics, *Air Carrier Traffic Statistics, 1981-2007*. (Additional resources: www.bts.gov/programs/airline_information/air_carrier_traffic_statistics)

1970–76 Energy Use - Department of Transportation, Civil Aeronautics Board, *Fuel Cost and Consumption*, Washington, DC, 1981, and annual.

1977–2003 Energy Use - Department of Transportation, Bureau of Transportation Statistics, "Fuel Cost and Consumption Table," Washington, DC. (Additional resources: www.bts.gov, www.faa.gov)

[a] Data are for all U.S. air carriers reporting on Form 41.

[b] Available seats per aircraft is calculated as the ratio of available seat-miles to revenue aircraft-miles.

[c] Passenger load factor is calculated as the ratio of revenue passenger-miles to available seat-miles for scheduled and nonscheduled services.

[d] Energy use includes fuel purchased abroad for international flights.

General aviation includes: (1) aircraft operating under general operating and flight rules; (2) not-for-hire airplanes with a seating capacity of 20 or more or a maximum payload capacity of 6,000 lbs. or more; (3) rotocraft external load operations; (4) on-demand and commuter operations not covered under Federal Aviation Regulations Part 121; and (5) agricultural aircraft operations.

Table 9.3
Summary Statistics for General Aviation, 1970–2007

Calendar year	Total number of aircraft	Aircraft hours flown (thousands)	Energy use (trillion btu)
1970	131,700[a]	26,030[b]	94.4
1975	168,475	30,298	121.5
1976	177,964	31,950	130.3
1977	184,294	33,679	149.7
1978	199,178	36,844	159.4
1979	210,339	40,432	167.2
1980	211,045	41,016	169.0
1981	213,226	40,704	162.4
1982	209,779	36,457	170.5
1983	213,293	35,249	143.9
1984	220,943	36,119	148.9
1985	196,500	31,456	144.0
1986	205,300	31,782	148.0
1987	202,700	30,883	139.1
1988	196,200	31,114	148.6
1989	205,000	32,332	134.0
1990	198,000	32,096	131.9
1991	196,874	29,862	120.4
1992	185,650	26,747	104.7
1993	177,120	24,455	97.5
1994	172,935	24,092	95.3
1995	188,089	26,612	106.6
1996	191,129	26,909	111.1
1997	192,414	27,713	121.1
1998	204,710	28,100	147.4
1999	219,464	31,756	172.1
2000	217,533	30,975	175.2
2001	211,446	29,133	165.1
2002	211,244	27,040	141.5
2003	209,708	27,329	141.4
2004	219,426	28,126	175.9
2005	224,352	26,982	242.4
2006	221,943	27,705	256.3
2007	231,607	27,852	242.5
	Average annual percentage change		
1970–2007	1.5%	0.2%	2.6%
1997–2007	1.9%	0.1%	7.2%

Sources:

U.S. Department of Transportation, Federal Aviation Administration, *General Aviation Activity and Avionics Survey: Calendar Year 2007*, Tables 1.2, 1.5, 5.1, and annual. (Additional resources: www.faa.gov/data_statistics/aviation_data_statistics/general_aviation/CY2007/)

[a] Active fixed-wing general aviation aircraft only.
[b] Includes rotocraft.
[c] Data are not available.

In the early seventies, domestic waterborne commerce accounted for over 60% of total tonnage, but by 1994 foreign tonnage grew to more than half of all waterborne tonnage. Total foreign and domestic tons shipped was over 2.5 billion tons in 2007.

Table 9.4
Tonnage Statistics for Domestic and International Waterborne Commerce, 1970–2007
(million tons shipped)

Year	Foreign and domestic total	Foreign total[a]	Domestic total[b]	Percent domestic of total
1970	1,532	581	951	62.1%
1975	1,695	749	946	55.8%
1976	1,835	856	979	53.4%
1977	1,908	935	973	51.0%
1978	2,021	946	1,075	53.2%
1979	2,073	993	1,080	52.1%
1980	1,999	921	1,077	53.9%
1981	1,942	887	1,054	54.3%
1982	1,777	820	957	53.9%
1983	1,708	751	957	56.0%
1984	1,836	803	1,033	56.3%
1985	1,788	774	1,014	56.7%
1986	1,874	837	1,037	55.3%
1987	1,967	891	1,076	54.7%
1988	2,088	976	1,112	53.3%
1989	2,140	1,038	1,103	51.5%
1990	2,164	1,042	1,122	51.8%
1991	2,092	1,014	1,079	51.6%
1992	2,132	1,037	1,095	51.4%
1993	2,128	1,060	1,068	50.2%
1994	2,215	1,116	1,099	49.6%
1995	2,240	1,147	1,093	48.8%
1996	2,284	1,183	1,101	48.2%
1997	2,333	1,221	1,113	47.7%
1998	2,340	1,245	1,094	46.8%
1999	2,323	1,261	1,062	45.7%
2000	2,425	1,355	1,070	44.1%
2001	2,393	1,351	1,042	43.5%
2002	2,340	1,319	1,021	43.6%
2003	2,394	1,378	1,016	42.4%
2004	2,552	1,505	1,047	41.0%
2005	2,528	1,499	1,029	40.7%
2006	2,589	1,565	1,024	39.6%
2007	2,565	1,543	1,022	39.8%
		Average annual percentage change		
1970–2007	1.4%	2.7%	0.2%	
1997–2007	1.0%	2.4%	-0.8%	

Source:
U.S. Department of the Army, Corps of Engineers, *Waterborne Commerce National Totals and Selected Inland Waterways for Multiple Years*, New Orleans, Louisiana, 2008, page 1. (Additional resources: www.ndc.iwr.usace.army.mil)

[a] All movements between the United States and foreign countries and between Puerto Rico and the Virgin Islands and foreign countries are classified as foreign trade.

[b] All movements between U.S. ports, continental and noncontiguous, and on the inland rivers, canals, and connecting channels of the United States, Puerto Rico, and the Virgin Islands, excluding the Panama Canal. Beginning in 1996, fish was excluded for internal and intra port domestic traffic.

Table 9.5
Summary Statistics for Domestic Waterborne Commerce, 1970–2006

Year	Number of vessels[a]	Ton-miles (billions)	Tons shipped[b] (millions)	Average length of haul (miles)	Energy intensity (Btu/ton-mile)	Energy use (trillion Btu)
1970	25,832	596	949	628.2	545	324.8
1975	31,666	566	944	599.9	549	311.0
1976	33,204	592	976	606.3	468	277.3
1977	35,333	599	969	618.0	458	274.3
1978	35,723	827	1,072	771.6	383	316.6
1979	36,264	829	1,076	770.0	436	361.8
1980	38,792	922	1,074	856.4	358	329.8
1981	42,079	929	1,051	884.0	360	334.5
1982	42,079	886	954	929.0	310	274.9
1983	41,784	920	953	964.6	286	262.7
1984	41,784	888	1,029	862.5	346	307.3
1985	41,672	893	1,011	883.5	446	398.6
1986	40,308	873	1,033	845.3	463	404.0
1987	40,000	895	1,072	835.0	414	370.7
1988	39,192	890	1,106	804.3	335	298.0
1989	39,209	816	1,097	743.2	410	334.9
1990	39,233	834	1,118	745.7	370	308.9
1991	39,233	848	1,074	789.9	371	314.4
1992	39,210	857	1,090	785.7	395	338.7
1993	39,064	790	1,063	742.7	404	318.9
1994	39,064	815	1,093	745.5	390	318.1
1995	39,641	808	1,086	743.6	422	341.0
1996	41,104	765	1,093	699.4	456	348.6
1997	41,419	707	1,106	639.5	486	343.3
1998	42,032	673	1,087	619.0	510	343.6
1999	41,766	656	1,056	621.1	515	338.0
2000	41,354	646	1,064	606.8	510	329.3
2001	41,588	622	1,037	599.7	451	280.2
2002	41,002	612	1,016	602.5	474	290.1
2003	39,983	606	1,010	600.3	481	291.2
2004	40,290	621	1,042	596.4	480	298.0
2005	41,028	591	1,024	577.4	495	292.6
2006	41,109	562	1,024	548.7	513	288.1
			Average annual percentage change			
1970–2006	1.3%	1.0%	0.2%	-0.4%	-0.2%	-0.3%
1996–2006	0.0%	-3.0%	-0.6%	-2.4%	1.2%	-1.9%

Sources:

Number of vessels -1970–92, 1995–2006 - U.S. Department of the Army, Corps of Engineers, *Waterborne Transportation Lines of the United States, 2006,* New Orleans, LA, 2007, and annual. 1993–94 - U.S. Department of the Army, Corps of Engineers, *The U.S. Waterway System-Facts*, Navigation Data Center, New Orleans, Louisiana, January 1996.

Ton-miles, tons shipped, average length of haul - U.S. Department of the Army, Corps of Engineers, *Waterborne Commerce of the United States, Calendar Year 2006* Part 5: National Summaries, New Orleans, LA, 2007, Table 1-4, pp. 1-6, 1-7, and annual.

Energy use - See Appendix A for Water Energy Use. (Additional resources: www.iwr.usace.army.mil/ndc)

[a] Grand total for self-propelled and non-self-propelled.

[b] These figures are not consistent with the figures on Table 9.3 because intra-territory tons are not included in this table. Intra-territory traffic is traffic between ports in Puerto Rico and the Virgin Islands.

Before Edition 24, the recreational boat energy use was based on data from a 1980's off-highway study. The data displayed in this table come from the Environmental Protection Agency's NONROAD2005 model.

Table 9.6
Recreational Boat Energy Use, 1970–2007

Year	Number of boats (thousands)	Diesel fuel	Gasoline	Total energy use
			(trillion Btu)	
1970	10,080	5.5	155.6	161.1
1971	10,130	6.5	156.5	163.1
1972	10,180	7.6	157.5	165.0
1973	10,230	8.6	158.4	167.0
1974	10,280	9.7	159.3	169.0
1975	10,330	10.7	160.2	171.0
1976	10,380	11.8	161.2	172.9
1977	10,430	12.8	162.1	174.9
1978	10,450	13.9	163.0	176.9
1979	10,530	14.9	164.0	178.9
1980	10,580	16.0	164.9	180.8
1981	10,630	17.0	165.8	182.8
1982	10,680	18.0	166.7	184.8
1983	10,730	19.1	167.7	186.7
1984	10,780	20.1	168.6	188.7
1985	10,830	21.2	169.5	190.7
1986	10,880	22.2	170.4	192.7
1987	10,930	23.3	171.4	194.6
1988	11,022	24.3	173.8	198.1
1989	11,115	25.4	176.2	201.6
1990	11,207	26.4	178.6	205.0
1991	11,320	27.5	181.8	209.2
1992	11,433	28.5	184.9	213.4
1993	11,545	29.5	188.0	217.5
1994	11,763	30.6	194.8	225.4
1995	11,981	31.6	201.6	233.2
1996	12,198	32.7	208.3	241.0
1997	12,237	33.7	208.8	242.5
1998	12,275	34.8	208.9	243.7
1999	12,313	35.8	208.7	244.5
2000	12,352	36.8	208.1	244.9
2001	12,456	37.9	208.4	246.3
2002	12,561	39.0	208.1	247.2
2003	12,665	40.2	207.5	247.6
2004	12,770	41.3	206.4	247.7
2005	12,874	42.4	205.2	247.6
2006	12,976	43.5	204.0	247.5
2007	13,078	44.6	202.7	247.3
		Average annual percentage change		
1970–2007	0.7%	5.8%	0.7%	1.2%
1997–2007	0.7%	2.8%	-0.3%	0.2%

Source:
U.S. Environmental Protection Agency, NONROAD2005 model, downloadable file from http://www.epa.gov/otaq/nonrdmdl.htm.

The Interstate Commerce Commission designates Class I railroads on the basis of annual gross revenues. In 2007, seven railroads were given this designation. The number of railroads designated as Class I has changed considerably in the last 30 years; in 1976 there were 52 railroads given Class I designation.

Table 9.7
Class I Railroad Freight Systems in the United States
Ranked by Revenue Ton-Miles, 2007

Railroad	Revenue ton-miles (billions)	Percent
Burlington Northern and Sante Fe Railway Company	655	37.0%
Union Pacific Railroad Company	562	31.8%
CSX Transportation	247	14.0%
Norfolk Southern Railway	196	11.1%
Canadian National, Grand Trunk Corporation	55	3.1%
Kansas City Southern Railway Company	30	1.7%
Soo Line Railroad Company	25	1.4%
Total	**1,770**	**100.0%**

Source:
Association of American Railroads, *Railroad Facts*, *2008 Edition*, Washington, DC, October 2008, p. 66. (Additional resources: www.aar.org)

Revenue ton-miles for Class I freight railroads was over 1.7 trillion in 2007. Though there are many regional and local freight railroads, the Class I freight railroads accounted for 93% of the railroad industry's freight revenue in 2007 and 67% of the industry's mileage operated. The energy intensity of Class I railroads hit an all-time low of 320 btu/ton-mile in 2007.

Table 9.8
Summary Statistics for Class I Freight Railroads, 1970–2007

Year	Number of locomotives in service[a]	Number of freight cars (thousands)[b]	Train-miles (millions)	Car-miles (millions)	Tons originated[c] (millions)	Average length of haul (miles)	Revenue ton-miles (millions)	Energy intensity (Btu/ton-mile)	Energy use (trillion Btu)
1970	27,077[d]	1,424	427	29,890	1,485	515	764,809	691	528.1
1975	27,846	1,359	403	27,656	1,395	541	754,252	687	518.3
1980	28,094	1,168	428	29,277	1,492	616	918,958	597	548.7
1981	27,421	1,111	408	27,968	1,453	626	910,169	572	521.0
1982	26,795	1,039	345	23,952	1,269	629	797,759	553	440.8
1983	25,448	1,007	346	24,358	1,293	641	828,275	525	435.1
1984	24,117	948	369	26,409	1,429	645	921,542	510	469.9
1985	22,548	867	347	24,920	1,320	665	876,984	497	436.1
1986	20,790	799	347	24,414	1,306	664	867,722	486	421.5
1987	19,647	749	361	25,627	1,372	688	943,747	456	430.3
1988	19,364	725	379	26,339	1,430	697	996,182	443	441.4
1989	19,015	682	383	26,196	1,403	723	1,013,841	437	442.6
1990	18,835	659	380	26,159	1,425	726	1,033,969	420	434.7
1991	18,344	633	375	25,628	1,383	751	1,038,875	391	405.8
1992	18,004	605	390	26,128	1,399	763	1,066,781	393	419.2
1993	18,161	587	405	26,883	1,397	794	1,109,309	389	431.6
1994	18,505	591	441	28,485	1,470	817	1,200,701	388	465.4
1995	18,812	583	458	30,383	1,550	843	1,305,688	372	485.9
1996	19,269	571	469	31,715	1,611	842	1,355,975	368	499.4
1997	19,684	568	475	31,660	1,585	851	1,348,926	370	499.7
1998	20,261	576	475	32,657	1,649	835	1,376,802	365	502.0
1999	20,256	579	490	33,851	1,717	835	1,433,461	363	520.0
2000	20,028	560	504	34,590	1,738	843	1,465,960	352	516.0
2001	19,745	500	500	34,243	1,742	859	1,495,472	346	517.3
2002	20,506	478	500	34,680	1,767	853	1,507,011	345	520.3
2003	20,774	467	516	35,555	1,799	862	1,551,438	344	533.9
2004	22,015	474	535	37,071	1,844	902	1,662,598	341	566.2
2005	22,779	475	548	37,712	1,899	894	1,696,425	337	571.4
2006	23,732	475	563	38,995	1,957	906	1,771,897	330	584.5
2007	24,143	460	543	38,186	1,940	913	1,770,545	320	566.9
				Average annual percentage change					
1970–2007	-0.3%	-3.0%	0.7%	0.7%	0.7%	1.6%	2.3%	-2.1%	0.2%
1997–2007	2.1%	-2.1%	1.3%	1.9%	2.0%	0.7%	2.8%	-1.4%	1.3%

Source:
Association of American Railroads, *Railroad Facts*, *2007 Edition*, Washington, DC, October 2008, pp. 27, 28, 33, 34, 36, 49, 52, 61. (Additional resources: www.aar.org)

[a] Does not include self-powered units.
[b] Does not include private or shipper-owned cars. Beginning in 2001, Canadian-owned U.S. railroads are excluded.
[c] Tons originated is a more accurate representation of total tonnage than revenue tons. Revenue tons often produces double-counting of loads switched between rail companies.
[d] Data represent total locomotives used in freight and passenger service. Separate estimates are not available.

According to the 2002 Commodity Flow Survey, 5% of all freight ton-miles are rail intermodal shipments (truck/rail or rail/water). ***See Table 5.12 for details.*** *The number of trailers and containers moved by railroads has increased more than seven-fold from 1965 to 2007. Containerization has increased in recent years, evidenced by the 310% increase in the number of containers from 1988 to 2007.*

Table 9.9
Intermodal Rail Traffic, 1965–2007

Year	Trailers & containers	Trailers	Containers
1965	1,664,929	[a]	[a]
1970	2,363,200	[a]	[a]
1975	2,238,117	[a]	[a]
1980	3,059,402	[a]	[a]
1985	4,590,952	[a]	[a]
1986	4,997,229	[a]	[a]
1987	5,503,819	[a]	[a]
1988	5,779,547	3,481,020	2,298,527
1989	5,987,355	3,496,262	2,491,093
1990	6,206,782	3,451,953	2,754,829
1991	6,246,134	3,201,560	3,044,574
1992	6,627,841	3,264,597	3,363,244
1993	7,156,628	3,464,126	3,692,502
1994	8,128,228	3,752,502	4,375,726
1995[b]	7,936,172	3,492,463	4,443,709
1996[b]	8,143,258	3,302,128	4,841,130
1997[b]	8,698,308	3,453,907	5,244,401
1998[b]	8,772,663	3,353,032	5,419,631
1999[c]	8,907,626	3,207,407	5,700,219
2000[c]	9,176,890	2,888,630	6,288,260
2001	8,935,444	2,603,423	6,332,021
2002	9,312,360	2,531,338	6,781,022
2003	9,955,605	2,625,837	7,329,768
2004	10,993,662	2,928,123	8,065,539
2005	11,693,512	2,979,906	8,713,606
2006	12,282,221	2,882,699	9,399,522
2007	12,026,660	2,600,651	9,426,009
	Average annual percentage change		
1965–2007	4.8%	[a]	[a]
1997–2007	3.3%	-2.8%	6.0%

Source:
Association of American Railroads, *Railroad Facts*, *2007 Edition*, Washington, DC, October 2008, p. 26. (Additional resources: www.aar.org)

[a] Data are not available.
[b] The Grand Trunk Western Railroad and the Soo Line Railroad Company data are excluded.
[c] The Illinois Central, Grand Trunk Western Railroad and the Soo Line Railroad Company data are excluded.

The National Railroad Passenger Corporation, known as Amtrak, began operation in 1971. Amtrak revenue passenger-miles have grown at an average annual rate of 3% from 1971 to 2007.

Table 9.10
Summary Statistics for the National Railroad Passenger Corporation (Amtrak), 1971–2007

Year	Number of locomotives in service	Number of passenger cars	Train-miles (thousands)	Car-miles (thousands)	Revenue passenger-miles (millions)	Average trip length (miles)	Energy intensity (Btu per revenue passenger-mile)	Energy use (trillion Btu)
1971	[a]	1,165	16,537	140,147	1,993	188	[a]	[a]
1975	355	1,913	30,166	253,898	3,753	224	3,548	13.3
1980	448	2,128	29,487	235,235	4,503	217	3,065	13.8
1981	398	1,830	30,380	222,753	4,397	226	2,883	12.7
1982	396	1,929	28,833	217,385	3,993	220	3,052	12.2
1983	388	1,880	28,805	223,509	4,227	223	2,875	12.2
1984	387	1,844	29,133	234,557	4,427	227	2,923	12.9
1985	382	1,818	30,038	250,642	4,785	238	2,703	12.9
1986	369	1,793	28,604	249,665	5,011	249	2,481	12.4
1987	381	1,850	29,515	261,054	5,361	259	2,450	13.1
1988	391	1,845	30,221	277,774	5,686	265	2,379	13.5
1989	312	1,742	31,000	285,255	5,859	274	2,614	15.3
1990	318	1,863	33,000	300,996	6,057	273	2,505	15.2
1991	316	1,786	34,000	312,484	6,273	285	2,417	15.2
1992	336	1,796	34,000	307,282	6,091	286	2,534	15.4
1993	360	1,853	34,936	302,739	6,199	280	2,565	15.9
1994	411	1,874	34,940	305,600	5,869	276	2,282	13.4[b]
1995	422	1,907	31,579	282,579	5,401	266	2,501	13.5
1996	348	1,501	30,542	277,750	5,066	257	2,690	13.6
1997	292	1,572	32,000	287,760	5,166	255	2,811	14.5
1998	362	1,347	32,926	315,823	5,325	251	2,788	14.8
1999	385	1,285	34,080	349,337	5,289	245	2,943	15.6
2000	385	1,891	35,404	371,215	5,574	243	3,235	18.0
2001	401	2,084	36,512	377,705	5,571	238	3,257	18.1
2002	372	2,896	37,624	378,542	5,314	228	3,212	17.1
2003	442	1,623	37,459	331,864	5,680	231	2,800	15.9
2004	276	1,211	37,159	308,437	5,511	219	2,760	15.2
2005	258	1,186	36,199	264,796	5,381	215	2,709	14.6
2006	319	1,191	36,083	263,908	5,410	220	2,650	14.3
2007	270	1,164	36,484	266,545	5,784	218	2,516	14.5
				Average annual percentage change				
1971–2007	[a]	0.0%	2.2%	1.8%	3.0%	0.4%	[a]	[a]
1997–2007	-0.8%	-3.0%	1.3%	-0.8%	1.1%	-1.6%	-1.1%	0.5%

Sources:
1971–83- Association of American Railroads, Economics and Finance Department, *Statistics of Class I Railroads*, Washington, DC, and annual.
1984–88- Association of American Railroads, *Railroad Facts*, 1988 Edition, Washington, DC, December 1989, p. 61, and annual.
1989–93- Personal communication with the Corporate Accounting Office of Amtrak, Washington, D.C.
1994–2007 - Number of locomotives in service, number of passenger cars, train-miles, car-miles, revenue passenger-miles, and average trip length - Association of American Railroads, *Railroad Facts*, *2008 Edition*, Washington, DC, 2008, p. 77.
Energy use - Personal communication with the Amtrak, Washington, DC. (Additional resources: www.amtrak.com, www.aar.org)

[a] Data are not available.
[b] Energy use for 1994 on is not directly comparable to earlier years. Some commuter rail energy use may have been inadvertently included in earlier years.

Commuter rail, which is also known as regional rail or suburban rail, is long-haul rail passenger service operating between metropolitan and suburban areas, whether within or across state lines. Commuter rail lines usually have reduced fares for multiple rides and commutation tickets for regular, recurring riders.

Table 9.11
Summary Statistics for Commuter Rail Operations, 1984–2007

Year	Number of passenger vehicles	Vehicle-miles (millions)	Passenger trips (millions)	Passenger-miles (millions)	Average trip length (miles)	Energy intensity (Btu/ passenger-mile)	Energy use (trillion Btu)
1984	4,075	167.9	267	6,207	23.2	2,804	17.4
1985	4,035	182.7	275	6,534	23.8	2,826	18.5
1986	4,440	188.6	306	6,723	22.0	2,926	19.7
1987	4,686	188.9	311	6,818	21.9	2,801	19.1
1988	4,649	202.2	325	6,964	21.4	2,872	19.7
1989	4,472	209.6	330	7,211	21.9	2,864	20.7
1990	4,982	212.7	328	7,082	21.6	2,822	20.0
1991	5,126	214.9	318	7,344	23.1	2,770	20.3
1992	5,164	218.8	314	7,320	23.3	2,629	19.2
1993	4,982	223.9	322	6,940	21.6	2,976	20.7
1994	5,126	230.8	339	7,996	23.6	2,682	21.4
1995	5,164	237.7	344	8,244	24.0	2,632	21.7
1996	5,240	241.9	352	8,351	23.7	2,582	21.6
1997	5,426	250.7	357	8,038	22.5	2,724	21.9
1998	5,536	259.5	381	8,704	22.8	2,646	23.0
1999	5,550	265.9	396	8,766	22.1	2,714	23.8
2000	5,498	270.9	413	9,402	22.8	2,551	24.0
2001	5,572	277.3	419	9,548	22.8	2,515	24.0
2002	5,724	283.7	414	9,504	22.9	2,514	23.9
2003	5,959	286.0	410	9,559	23.3	2,545	24.3
2004	6,228	294.7	414	9,719	23.5	2,569	25.0
2005	6,392	303.4	423	9,473	22.4	2,743	26.0
2006	6,403	314.7	441	10,361	23.5	2,527	26.2
2007	6,391	325.7	459	11,153	24.3	2,638	29.4
			Average annual percentage change				
1984–2007	2.0%	2.9%	2.4%	2.6%	0.2%		
1997–2007	1.7%	2.7%	2.5%	3.3%	0.8%		

Source:
American Public Transportation Association, *2009 Public Transportation Fact Book*, Washington, DC, April 2009, Table 47. (Additional resources: www.apta.com)

This table on transit rail operations includes data on light rail and heavy rail systems. Light rail vehicles are usually single vehicles driven electrically with power drawn from overhead wires. Heavy rail is characterized by high speed and rapid acceleration of rail cars operating on a separate right-of-way.

Table 9.12
Summary Statistics for Rail Transit Operations, 1970–2007[a]

Year	Number of passenger vehicles	Vehicle-miles (millions)	Passenger trips (millions)[b]	Passenger-miles (millions)[c]	Average trip length (miles)[d]	Energy intensity (Btu/ passenger-mile)[e]	Energy use (trillion Btu)
1970	10,548	440.8	2,116	12,273	[f]	2,157	26.5
1975	10,617	446.9	1,797	10,423	[f]	2,625	27.4
1980	10,654	402.2	2,241	10,939	4.9	2,312	25.3
1981	10,824	436.6	2,217	10,590	4.8	2,592	27.5
1982	10,831	445.2	2,201	10,428	4.7	2,699	28.1
1983	10,904	423.5	2,304	10,741	4.7	2,820	30.3
1984	10,848	452.7	2,388	10,531	4.4	3,037	32.0
1985	11,109	467.8	2,422	10,777	4.4	2,809	30.3
1986	11,083	492.8	2,467	11,018	4.5	3,042	33.5
1987	10,934	508.6	2,535	11,603	4.6	3,039	35.3
1988	11,370	538.3	2,462	11,836	4.8	3,072	36.2
1989	11,261	553.4	2,704	12,539	4.6	2,909	36.5
1990	11,332	560.9	2,521	12,046	4.8	3,024	36.4
1991	11,426	554.8	2,356	11,190	4.7	3,254	36.4
1992	11,303	554.0	2,395	11,438	4.8	3,155	36.1
1993	11,286	549.8	2,234	10,936	4.9	3,373	36.9
1994	11,192	565.8	2,453	11,501	4.7	3,338	38.4
1995	11,156	571.8	2,284	11,419	5.0	3,340	38.1
1996	11,341	580.7	2,418	12,487	5.2	3,017	37.7
1997	11,471	598.9	2,692	13,091	4.9	2,856	37.4
1998	11,521	609.5	2,669	13,412	5.0	2,823	37.9
1999	11,603	626.4	2,813	14,108	5.0	2,785	39.3
2000	12,168	648.0	2,952	15,200	5.1	2,797	42.5
2001	12,084	662.4	3,064	15,615	5.1	2,803	43.8
2002	12,479	681.9	3,025	15,095	5.0	2,872	43.3
2003	12,236	694.2	3,005	15,082	5.0	2,837	42.8
2004	12,480	709.7	3,098	15,930	5.1	2,750	43.8
2005	12,755	715.4	3,189	16,118	5.1	2,783	44.9
2006	12,853	726.4	3,334	16,587	5.0	2,707	44.9
2007	13,032	741.2	3,879	18,070	4.7	2,577	46.6
				Average annual percentage change			
1970–2007	0.6%	1.4%	1.7%	1.1%	-0.2%[g]	0.5%	1.5%
1997–2007	1.3%	2.2%	3.7%	3.3%	-0.4%	-1.0%	2.2%

Sources:
American Public Transportation Association, *2009 Public Transportation Fact Book*, Washington, DC, April 2009, Tables 48 and 49. (Additional resources: www.apta.com)
Energy use - See Appendix A for Rail Transit Energy Use.

[a] Heavy rail and light rail. Series not continuous between 1983 and 1984 because of a change in data source by the American Public Transit Association (APTA). Beginning in 1984, data provided by APTA are taken from mandatory reports filed with the Urban Mass Transit Administration (UMTA). Data for prior years were provided on a voluntary basis by APTA members and expanded statistically.
[b] 1970–79 data represents total passenger rides; after 1979, data represents unlinked passenger trips.
[c] Estimated for years 1970–76 based on an average trip length of 5.8 miles.
[d] Calculated as the ratio of passenger-miles to passenger trips.
[e] Large system-to-system variations exist within this category.
[f] Data are not available.
[g] Average annual percentage change is calculated for years 1980–2007.

Chapter 10
Transportation and the Economy

Summary Statistics from Tables/Figures in this Chapter

Source		
Figure 10.2	Share of gasoline cost attributed to taxes, 2007	
	Canada	*31%*
	France	*63%*
	Germany	*64%*
	Japan	*42%*
	United Kingdom	*66%*
	United States	*14%*
Table 10.12	Average price of a new car, 2007 (current dollars)	23,482
	Domestic	*20,595*
	Import	*29,862*
Table 10.13	Car operating costs, 2008	
	Variable costs (constant 2008 dollars per 10,000 miles)	*1,696*
	Fixed costs (constant 2008 dollars per 10,000 miles)	*5,399*
Table 10.17	Transportation sector share of total employment	
	1998	*8.4%*
	2008	*7.5%*

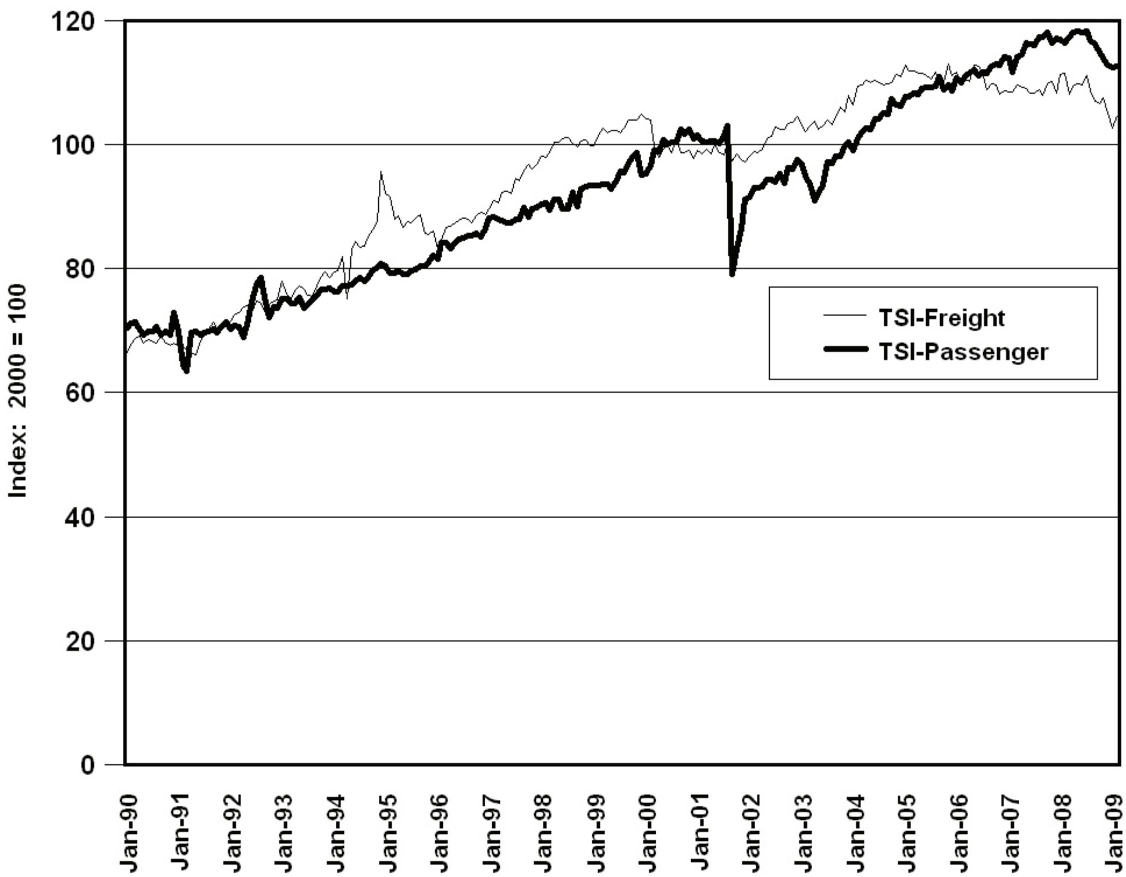
The Transportation Services Index (TSI) was created by the U.S. Department of Transportation Bureau of Transportation Statistics (BTS). It is an index that measures the movement of freight and passengers. The Freight TSI consists of:

- *for-hire trucking (parcel services are not included);*
- *freight railroad services (including rail-based intermodal shipments such as containers on flat cars);*
- *inland waterway traffic;*
- *pipeline movements (including principally petroleum and petroleum products and natural gas); and*
- *air freight.*

The index does not include international or coastal steamship movements, private trucking, courier services, or the United States Postal Services.

The index does not include intercity bus, sight seeing services, taxi service, private automobile usage, or bicycling and other nonmotorized means of transportation.

Figure 10.1. Transportation Services Index, January 1990–February 2009



Source:
U.S. Department of Transportation, Bureau of Transportation Statistics, Transportation Services Index Web site, www.bts.gov/xml/tsi/src. (Additional resources: www.bts.gov.)

The average price for a gallon of gasoline in China was 74 cents cheaper than in the United States in 2007. Those in France, the United Kingdom, and Germany paid, on average, more than six dollars per gallon.

Table 10.1
Gasoline Prices[a] for Selected Countries, 1990–2007

	Current dollars per gallon							Average annual percent change
	1990	1995	2000	2004	2005	2006	2007	1990–2007
China	[c]	1.03	[c]	1.48	1.70	2.11	2.29	[c]
Japan	3.16	4.43	3.65	3.93	4.28	4.47	4.49	2.1%
France[b]	3.63	4.26	3.80	4.99	5.46	5.88	6.60	3.6%
United Kingdom[b]	2.82	3.21	4.58	5.56	5.97	6.36	7.13	5.6%
Germany	2.65	3.96	3.45	5.24	5.66	6.03	6.88	5.8%
Canada	1.87	1.53	1.86	2.37	2.89	3.26	3.59	3.9%
United States[d]	1.35	1.34	1.69	1.88	2.49	2.81	3.03	4.9%

	Constant 2007 dollars[e] per gallon							Average annual percent change
	1990	1995	2000	2004	2005	2006	2007	1990–2007
China	[c]	1.40	[c]	1.62	1.80	2.17	2.29	[c]
Japan	5.01	6.03	4.39	4.31	4.54	4.60	4.49	-0.6%
France[b]	5.76	5.80	4.58	5.48	5.80	6.05	6.60	0.8%
United Kingdom[b]	4.47	4.37	5.51	6.10	6.34	6.54	7.13	2.8%
Germany	4.20	5.39	4.15	5.75	6.01	6.20	6.88	2.9%
Canada	2.97	2.08	2.24	2.60	3.07	3.35	3.59	1.1%
United States[d]	2.14	1.82	2.03	2.27	2.64	2.89	3.03	2.1%

Source:
U.S. Department of Energy, Energy Information Administration, *Annual Energy Review 2007*, Washington, DC, June 2008. (Additional resources: www.eia.doe.gov)

Note: Comparisons between prices and price trends in different countries require care. They are of limited validity because of fluctuations in exchange rates; differences in product quality, marketing practices, and market structures; and the extent to which the standard categories of sales are representative of total national sales for a given period.

[a] Prices represent the retail prices (including taxes) for regular unleaded gasoline, except for France and the United Kingdom which are premium unleaded gasoline.
[b] Premium gasoline.
[c] Data are not available.
[d] These estimates are international comparisons only and do not necessarily correspond to gasoline price estimates in other sections of the book.
[e] Adjusted by the U.S. Consumer Price Inflation Index.

Of these selected countries, the United Kingdom had the highest diesel fuel price average in 2007, while China had the lowest.

Table 10.2
Diesel Fuel Prices[a] for Selected Countries, 1998–2007

	Current dollars per gallon								Average annual percentage change
	1998	2000	2002	2003	2004	2005	2006	2007	1998–2007
China	[b]	[b]	1.20	1.32	1.47	1.69	2.10	2.42	[b]
Japan	2.25	2.85	2.50	2.76	3.09	3.45	3.68	3.82	6.1%
France	2.71	2.95	2.75	3.39	4.16	4.81	5.13	5.64	8.5%
United Kingdom	4.10	4.66	4.29	4.82	5.68	6.26	6.64	7.33	6.7%
Germany	2.45	2.79	3.00	3.79	4.41	5.01	5.30	6.06	10.6%
United States[c]	1.04	1.50	1.32	1.51	1.81	2.42	2.70	2.88	12.0%
	Constant 2007 dollars[d] per gallon								Average annual percentage change
	1998	2000	2002	2003	2004	2005	2006	2007	1998–2007
China	[b]	[b]	1.38	1.49	1.62	1.79	2.16	2.42	[b]
Japan	2.87	3.44	2.88	3.11	3.39	3.66	3.78	3.82	3.2%
France	3.44	3.55	3.17	3.82	4.57	5.11	5.27	5.64	5.6%
United Kingdom	5.22	5.61	4.94	5.43	6.23	6.64	6.82	7.33	3.8%
Germany	3.12	3.36	3.46	4.27	4.84	5.32	5.45	6.06	7.7%
United States[c]	1.33	1.80	1.52	1.70	1.99	2.58	2.78	2.88	9.0%

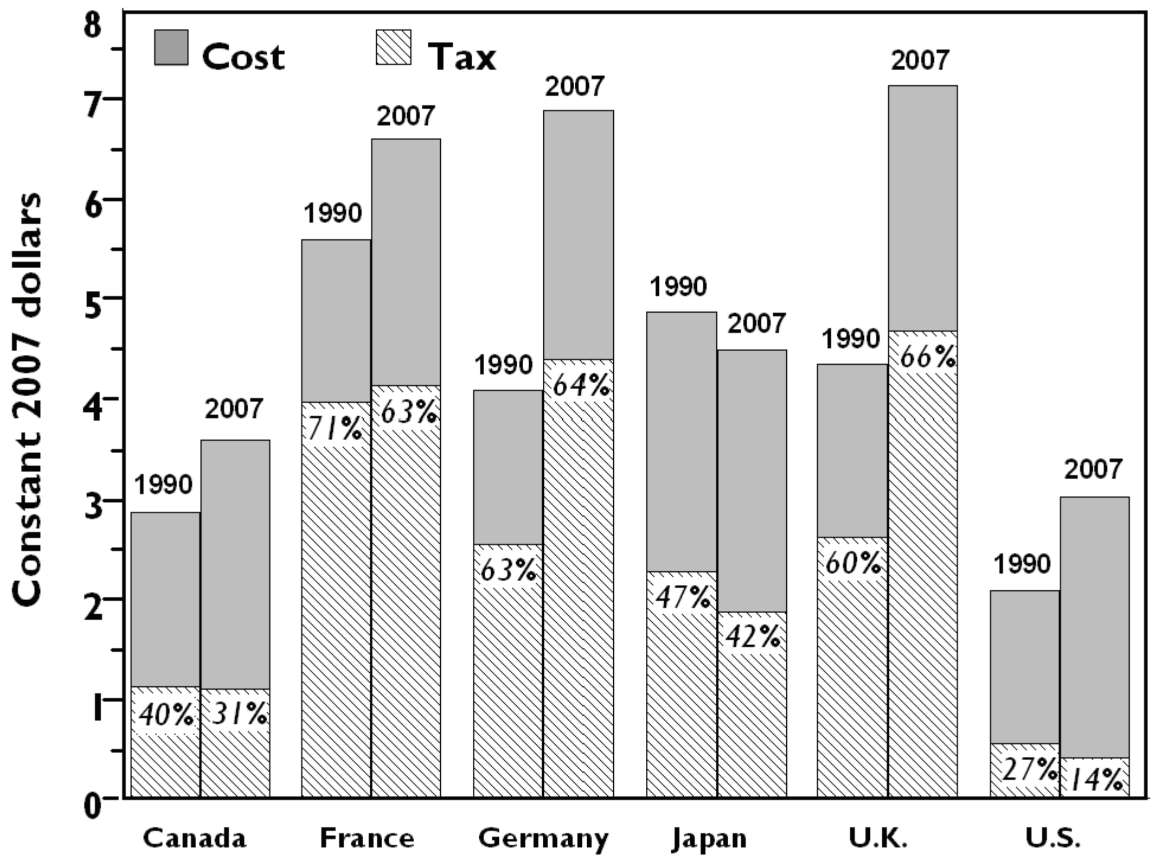
Source:
U.S. Department of Energy, Energy Information Administration, *International and United States Petroleum (Oil) Price and Crude Oil Import Cost Tables*, Washington, DC, August 2008. (Additional resources: www.eia.doe.gov)

Note: Comparisons between prices and price trends in different countries require care. They are of limited validity because of fluctuations in exchange rates; differences in product quality, marketing practices, and market structures; and the extent to which the standard categories of sales are representative of total national sales for a given period.

[a] Prices represent the retail prices (including taxes) for automotive diesel fuel for non-commercial (household) use.
[b] Data are not available.
[c] These estimates are for international comparisons only and do not necessarily correspond to gasoline price estimates in other sections of the book.
[d] Adjusted by the U.S. Consumer Price Inflation Index.

In 2007 more than sixty percent of the cost of gasoline in France, Germany, and the United Kingdom went for taxes. Of the listed countries, the United States has the lowest percentage of taxes.

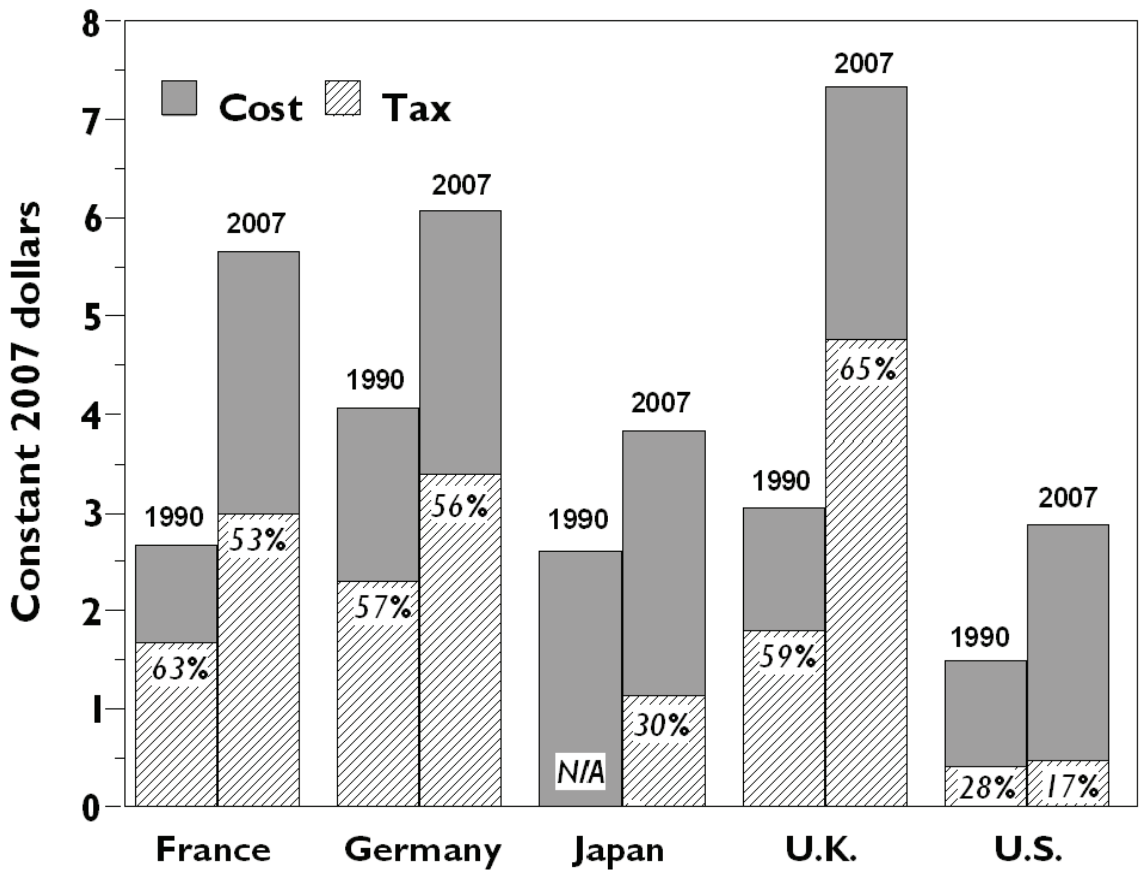
Figure 10.2. Gasoline Prices for Selected Countries, 1990 and 2007



Source:
Table 10.1 and International Energy Agency, *Energy Prices & Taxes, Fourth Quarter, 2007,* Paris, France, 2008. (Additional resources: www.iea.org.)

Diesel fuel is taxed heavily in the European countries shown here. The U.S. diesel fuel tax share is the lowest of the listed countries.

Figure 10.3. Diesel Prices for Selected Countries, 1990 and 2007



Source:
Table 10.2 and International Energy Agency, *Energy Prices & Taxes, Fourth Quarter, 2007,* Paris, France, 2008. (Additional resources: www.iea.org.)

Though the cost of crude oil certainly influences the price of gasoline, it is not the only factor which determines the price at the pump. Processing cost, transportation cost, and taxes also play a major part of the cost of a gallon of gasoline. The average price of a barrel of crude oil (in constant 2008 dollars) more than doubled from 2000 to 2008, while the average price of a gallon of gasoline increased 70% in this same time period.

Table 10.3
Prices for a Barrel of Crude Oil and a Gallon of Gasoline, 1978–2008

	Crude oil[a] (dollars per barrel)		Gasoline[b] (cents per gallon)		Ratio of gasoline to crude oil
Year	Current	Constant 2008[c]	Current	Constant 2008[c]	
1978	12.5	41.4	65.2	215.3	219.8
1979	17.7	52.6	88.2	261.6	209.1
1980	28.1	73.3	122.1	319.0	182.7
1981	35.2	83.5	135.3	320.5	161.3
1982	31.9	71.1	128.1	285.8	168.8
1983	29.0	62.7	122.5	264.8	177.5
1984	28.6	59.3	119.8	248.3	175.7
1985	26.8	53.5	119.6	239.3	187.8
1986	14.6	28.6	93.1	182.9	268.7
1987	17.9	33.3	95.7	181.4	224.5
1988	14.7	26.7	96.3	175.3	275.7
1989	18.0	31.2	106.0	184.0	247.7
1990	22.2	36.6	121.7	200.5	230.0
1991	19.1	30.1	119.6	189.1	263.5
1992	18.4	28.3	119.0	182.6	271.2
1993	16.4	24.5	117.3	174.8	300.2
1994	15.6	22.6	117.4	170.6	316.3
1995	17.2	24.3	120.5	170.2	293.7
1996	20.7	28.4	128.8	176.7	261.2
1997	19.0	25.5	129.1	173.2	284.8
1998	12.5	16.5	111.5	147.3	374.0
1999	17.5	22.6	122.1	157.8	292.9
2000	28.3	35.3	156.3	195.4	232.3
2001	23.0	27.9	153.1	186.1	280.2
2002	24.1	28.8	144.1	172.5	251.1
2003	28.5	33.4	163.8	191.7	241.1
2004	37.0	42.1	192.3	219.2	218.4
2005	50.2	55.4	233.8	257.7	195.5
2006	60.2	64.3	263.5	281.4	183.7
2007	68.0	70.6	284.9	229.8	176.1
2008	94.7	94.7	331.7	331.7	147.1
		Average annual percentage change			
1978–2008	7.0%	2.8%	5.6%	1.5%	
1998–2008	22.4%	19.1%	11.5%	8.5%	

Sources:
Crude oil - U.S. Department of Energy, Energy Information Administration, *Monthly Energy Review,* March 2009, Washington, DC, Table 9.1.
Gasoline - U.S. Department of Energy, Energy Information Administration, *Monthly Energy Review,* March 2009, Washington, DC, Table 9.4. (Additional resources: www.eia.doe.gov)

[a] Refiner acquisition cost of composite (domestic and imported) crude oil.
[b] Average for all types. These prices were collected from a sample of service stations in 85 urban areas selected to represent all urban consumers. Urban consumers make up about 80% of the total U.S. population.
[c] Adjusted by the Consumer Price Inflation Index.

Diesel fuel price has generally been lower than gasoline; however, from 2005 through 2008 the price of diesel fuel was higher than that of gasoline.

Table 10.4
Retail Prices for Motor Fuel, 1978–2008
(cents per gallon, including tax)

	Diesel fuel[a]		Average for all gasoline types[b]	
Year	Current	Constant 2008[c]	Current	Constant 2008[c]
1978	[d]	[d]	65	215
1979	[d]	[d]	88	262
1980	101	264	122	319
1981	118	279	135	320
1982	116	259	128	286
1983	120	259	123	265
1984	122	253	120	248
1985	122	244	120	239
1986	94	185	93	183
1987	96	182	96	181
1988	95	173	96	175
1989	102	177	106	184
1990	107	176	122	200
1991	91	144	120	189
1992	106	163	119	183
1993	98	146	117	175
1994	111	162	117	171
1995	111	157	121	170
1996	124	169	129	177
1997	120	161	129	173
1998	104	138	112	147
1999	112	145	122	158
2000	149	186	156	195
2001	140	170	153	186
2002	132	158	144	172
2003	151	177	164	192
2004	181	206	192	219
2005	240	265	234	258
2006	271	289	264	281
2007	289	300	285	296
2008	380	380	332	332
	Average annual percentage change			
1978–2008	4.8%[e]	1.3%[e]	5.6%	1.5%
1998–2008	13.8%	10.7%	11.5%	8.5%

Sources:
Gasoline - U.S. Department of Energy, Energy Information Administration, *Monthly Energy Review*, February 2009, Washington, DC, Table 9.4.
Diesel - U.S. Department of Energy, Energy Information Administration, *International Energy Annual 2004*, Washington, DC, June 2004, Table 7.2. 2005–2008 data from EIA Petroleum Navigator Web site. (Additional resources: www.eia.doe.gov)

[a] 1980-1993: Collected from a survey of prices on January 1 of the current year. 1994-on: Annual average.
[b] These prices were collected from a sample of service stations in 85 urban areas selected to represent all urban consumers. Urban consumers make up about 80 percent of the total U.S. population.
[c] Adjusted by the Consumer Price Inflation Index.
[d] Data are not available.
[e] Average annual percentage change is from the earliest year possible to 2007.

*The fuel prices shown here are **refiner sales prices** of transportation fuels to end users, excluding tax. Sales to end users are those made directly to the ultimate consumer, including bulk consumers. Bulk sales to utility, industrial, and commercial accounts previously included in the wholesale category are now counted as sales to end users.*

Table 10.5
Refiner Sales Prices for Propane and No. 2 Diesel, 1978–2008
(cents per gallon, excluding tax)

	Propane[a]		No. 2 diesel fuel	
Year	Current	Constant 2008[b]	Current	Constant 2008[b]
1978	33.5	110.6	37.7	124.5
1979	35.7	105.9	58.5	173.5
1980	48.2	125.9	81.8	213.7
1981	56.5	133.8	99.5	235.7
1982	59.2	132.1	94.2	210.2
1983	70.9	153.3	82.6	178.6
1984	73.7	152.7	82.3	170.5
1985	71.7	143.5	78.9	157.9
1986	74.5	146.4	47.8	93.9
1987	70.1	132.9	55.1	104.4
1988	71.4	129.9	50.0	91.0
1989	61.5	106.8	58.5	101.6
1990	74.5	122.7	72.5	119.4
1991	73.0	115.4	64.8	102.4
1992	64.3	98.7	61.9	95.0
1993	67.3	100.3	60.2	89.7
1994	53.0	77.0	55.4	80.5
1995	49.2	69.5	56.0	79.1
1996	60.5	83.0	68.1	93.4
1997	55.2	74.0	64.2	86.1
1998	40.5	53.5	49.4	65.3
1999	45.8	59.2	58.4	75.5
2000	60.3	75.4	93.5	116.9
2001	50.6	61.5	84.2	102.4
2002	41.9	50.1	76.2	91.2
2003	57.7	67.5	94.4	110.5
2004	83.9	95.6	124.3	141.7
2005	108.9	120.1	178.6	196.9
2006	135.8	145.0	209.6	223.8
2007	148.8	154.2	227.3	235.4
2008	184.2	184.2	315.1	315.1
		Average annual percentage change		
1978–2008	5.8%	1.7%	7.3%	3.1%
1998–2008	16.4%	13.2%	20.4%	17.0%

Source:
U.S. Department of Energy, Energy Information Administration, *Monthly Energy Review*, March 2009, Washington, DC, Table 9.7. (Additional resources: www.eia.doe.gov)

[a] Consumer grade.
[b] Adjusted by the Consumer Price Inflation Index.

The average price of finished aviation gasoline jumped $1.08 from 2005 to 2008; jet fuel rose by $1.32 in that same time period.

Table 10.6
Refiner Sales Prices for Aviation Gasoline and Jet Fuel, 1978–2008
(cents per gallon, excluding tax)

Year	Finished aviation gasoline		Kerosene-type jet fuel	
	Current	Constant 2008[a]	Current	Constant 2008[a]
1978	51.6	170.4	38.7	127.8
1979	68.9	204.3	54.7	162.2
1980	108.4	283.2	86.6	226.3
1981	130.3	308.6	102.4	242.5
1982	131.2	292.7	96.3	214.9
1983	125.5	271.3	87.8	189.8
1984	123.4	255.7	84.2	174.5
1985	120.1	240.3	79.6	159.3
1986	101.1	198.6	52.9	103.9
1987	90.7	171.9	54.3	102.9
1988	89.1	162.2	51.3	93.4
1989	99.5	178.8	59.2	102.8
1990	112.0	184.5	76.6	126.2
1991	104.7	165.5	65.2	103.1
1992	102.7	157.6	61.0	93.6
1993	99.0	147.5	58.0	86.4
1994	95.7	139.0	53.4	77.6
1995	100.5	142.0	54.0	76.3
1996	111.6	153.1	65.1	89.3
1997	112.8	151.3	61.3	82.2
1998	97.5	128.8	45.2	59.7
1999	105.9	136.9	54.3	70.2
2000	130.6	163.3	89.9	112.4
2001	132.3	160.8	77.5	94.2
2002	128.8	154.1	72.1	86.3
2003	149.3	174.7	87.2	102.0
2004	181.9	207.3	120.7	137.6
2005	223.1	246.0	173.5	191.3
2006	268.2	286.4	199.8	213.4
2007	284.9	295.8	216.5	224.8
2008	331.1	331.1	305.3	305.3
	Average annual percentage change			
1978–2008	6.1%	1.9%	6.1%	2.0%
1998–2008	9.7%	6.9%	13.5%	10.6%

Source:
U.S. Department of Energy, Energy Information Administration, *Monthly Energy Review*, March 2009, Washington, DC, Table 9.7. (Additional resources: www.eia.doe.gov)

[a] Adjusted by the Consumer Price Inflation Index.

At the end of 2007, only four states offered tax exemptions to encourage the use of gasohol for transportation purposes. This list is quite short compared to the 30 states which offered gasohol tax exemptions twenty years ago. Still, the Federal Government encourages gasohol use via a difference in the Federal tax rates of gasoline and gasohol.

Table 10.7
State Tax Exemptions for Gasohol, 2007

State	Exemption (Cents/gallon of gasohol)
Idaho	2.5
Indiana	2.0
Maine	3.8
South Dakota	2.0

Source:
U.S. Department of Transportation, Federal Highway Administration, *Highway Statistics 2007*, December 2008, Washington, DC, Table MF-121T. (Additional resources: www.fhwa.dot.gov)

Table 10.8
Federal Excise Taxes on Motor Fuels, 2007

Fuel	Cents per gallon
Gasoline[a]	18.40
Diesel	24.40
Gasohol[b]	18.40
Other special fuels[b]	18.30
Neat alcohol (85% Alcohol)	9.25
CNG	48.54/mcf [c]
LNG	11.90
LPG	13.60

Source:
U.S. Department of Transportation, Federal Highway Administration, *Highway Statistics 2007*, December 2008, Washington, DC, Table FE-21B. (Additional resources: www.fhwa.dot.gov)

[a] All gasohol blends are taxed at the same rate.
[b] Includes benzol, benzene, naphtha, and other liquid used a motor fuel.
[c] Thousand cubic feet.

These states have laws and incentives for alternative fuels production and/or use.

Table 10.9
Federal and State Alternative Fuel Incentives, 2009

State	Alternative fuel - all	Biodiesel	Ethanol	Natural gas	Liquefied petroleum gas (LPG)	Electric vehicles (EV and NEV)	Hydrogen fuel cells	Blends
Federal US	15	35	30	28	28	20	27	16
Alabama	1	2	2	2	2	1	1	0
Alaska	2	1	2	1	1	2	1	0
Arizona	5	6	6	9	10	10	7	0
Arkansas	2	4	3	4	4	2	2	2
California	9	14	11	29	18	32	26	1
Colorado	4	9	9	10	8	6	8	2
Connecticut	4	5	5	6	4	5	5	1
Delaware	1	1	1	2	2	1	1	0
Dist. of Columbia	3	3	3	4	3	3	3	0
Florida	2	11	13	2	2	4	7	5
Georgia	3	7	6	7	3	6	4	1
Hawaii	5	8	11	5	6	6	6	2
Idaho	0	5	4	2	2	1	1	4
Illinois	2	15	14	6	5	6	4	7
Indiana	3	12	17	6	4	4	4	18
Iowa	4	13	17	6	5	8	5	7
Kansas	2	7	10	4	4	2	1	1
Kentucky	3	7	7	6	4	2	1	4
Louisiana	0	3	7	6	4	4	2	3
Maine	3	6	8	5	5	5	4	3
Maryland	1	4	4	1	1	3	1	0
Massachusetts	3	7	7	5	3	3	3	2
Michigan	5	11	11	6	6	6	6	7
Minnesota	3	8	10	4	4	6	4	4
Mississippi	1	2	2	5	3	1	1	0
Missouri	3	7	6	5	4	4	4	5
Montana	2	8	8	4	4	3	2	2
Nebraska	0	3	4	3	3	2	2	1
Nevada	3	3	3	5	5	5	4	1
New Hampshire	2	5	2	2	2	3	2	1
New Jersey	2	3	3	6	5	6	3	0
New Mexico	5	11	9	6	5	6	8	6
New York	6	11	13	16	10	12	12	4
North Carolina	6	15	14	8	8	7	7	8
North Dakota	0	9	8	2	2	0	3	5
Ohio	3	7	6	3	3	2	3	2
Oklahoma	4	8	10	7	7	7	4	1
Oregon	5	12	11	7	6	9	7	4
Pennsylvania	4	8	7	5	4	4	4	0
Puerto Rico	0	0	0	0	0	0	0	0
Rhode Island	2	3	2	4	3	5	3	1
South Carolina	1	10	9	3	4	3	5	5
South Dakota	0	8	9	1	2	0	0	10
Tennessee	5	14	10	8	7	6	5	6
Texas	4	8	8	11	10	7	7	1
Utah	2	2	2	11	7	8	5	1
Vermont	3	5	4	4	3	4	3	2
Virginia	3	9	6	9	7	7	7	1
Washington	4	17	13	9	8	11	6	8
West Virginia	4	4	4	4	4	5	4	0
Wisconsin	6	13	10	7	7	6	6	4
Wyoming	0	0	2	1	0	0	0	1
Totals	**165**	**409**	**403**	**322**	**271**	**281**	**251**	**170**

Source:
U.S. Department of Energy, Energy Efficiency and Renewable Energy, Alternative Fuels Data Center. Data downloaded April 2009. (Additional resources: www.eere.energy.gov/afdc/progs/tech_matrx.php)

Table 10.10
Federal and State Advanced Technology Incentives, 2009

State	Hybrid Electric Vehicles (HEV)	Emissions Based	Fuel Efficiency	Idle Reduction
Federal US	8	21	16	8
Alabama	0	0	0	0
Alaska	0	1	1	0
Arizona	1	2	0	1
Arkansas	1	0	0	2
California	22	30	4	5
Colorado	4	3	0	2
Connecticut	2	5	1	1
Delaware	0	0	0	1
Dist. of Columbia	1	1	0	1
Florida	1	3	2	1
Georgia	2	2	1	0
Hawaii	2	0	1	1
Idaho	1	0	1	0
Illinois	3	4	1	1
Indiana	2	0	1	0
Iowa	0	0	1	0
Kansas	0	0	0	1
Kentucky	1	0	1	0
Louisiana	2	1	1	0
Maine	0	1	2	1
Maryland	2	2	0	1
Massachusetts	2	2	0	1
Michigan	5	0	1	0
Minnesota	3	1	2	3
Mississippi	1	0	1	0
Missouri	0	1	0	2
Montana	0	0	1	0
Nebraska	0	0	0	1
Nevada	2	2	0	1
New Hampshire	1	1	1	3
New Jersey	4	4	1	2
New Mexico	3	1	2	1
New York	4	2	2	5
North Carolina	4	3	0	4
North Dakota	0	0	0	0
Ohio	0	2	0	2
Oklahoma	1	0	0	0
Oregon	5	5	2	4
Pennsylvania	3	2	1	6
Puerto Rico	0	0	0	0
Rhode Island	1	4	2	1
South Carolina	2	0	0	2
South Dakota	0	0	0	0
Tennessee	4	1	3	0
Texas	1	1	1	4
Utah	1	0	0	3
Vermont	2	4	3	2
Virginia	1	2	2	2
Washington	6	6	2	2
West Virginia	0	0	1	0
Wisconsin	2	1	0	2
Wyoming	0	0	0	0
Totals	**113**	**121**	**62**	**80**

Source:
U.S. Department of Energy, Energy Efficiency and Renewable Energy, Alternative Fuels Data Center. Data downloaded April 2009. (Additional resources: www.eere.energy.gov/afdc/progs/tech_matrx.php)

The average price of a new car in 2007 ($23,482) was very close to the average price in 1915 ($25,786) when adjusted for inflation. Average new car prices were at their lowest in 1940 ($11,499). Since 1914 the highest average price was in the year 1998 ($25,904).

Table 10.11
Average Price of a New Car, 1906–2007

Year	2007 Constant Dollars	Year	2007 Constant Dollars	Year	2007 Constant Dollars	Year	2007 Constant Dollars
1906	$36,588	1934	$16,029	1959	$20,473	1984	$22,700
1908	$32,755	1935	$14,287	1960	$19,701	1985	$22,811
1910	$27,877	1936	$12,544	1961	$18,759	1986	$23,935
1912	$28,922	1937	$12,893	1962	$18,648	1987	$24,432
1913	$29,967	1938	$13,241	1963	$18,442	1988	$24,418
1914	$31,013	1939	$12,370	1964	$18,534	1989	$24,030
1915	$25,786	1940	$11,499	1965	$18,184	1990	$23,862
1916	$20,559	1941	$11,648	1966	$18,169	1991	$23,558
1917	$18,991	1942	$11,797	1967	$18,256	1992	$24,142
1918	$17,423	1943	$11,947	1968	$18,812	1993	$24,208
1919	$17,249	1944	$12,096	1969	$18,812	1994	$25,047
1920	$17,074	1945	$12,245	1970	$18,928	1995	$24,433
1921	$18,120	1946	$12,394	1971	$19,157	1996	$24,813
1922	$19,165	1947	$12,543	1972	$19,241	1997	$25,231
1923	$17,423	1948	$13,136	1973	$18,922	1998	$25,904
1924	$15,681	1949	$15,308	1974	$18,673	1999	$25,365
1925	$15,506	1950	$15,689	1975	$19,077	2000	$24,804
1926	$15,332	1951	$15,954	1976	$19,743	2001	$24,521
1927	$15,158	1952	$17,282	1977	$19,892	2002	$24,490
1928	$14,984	1953	$17,304	1978	$20,286	2003	$23,854
1929	$14,809	1954	$16,990	1979	$19,555	2004	$23,749
1930	$14,635	1955	$16,897	1980	$19,058	2005	$24,100
1931	$16,378	1956	$17,384	1981	$20,323	2006	$23,996
1932	$18,120	1957	$19,312	1982	$21,250	2007	$23,482
1933	$17,074	1958	$20,429	1983	$22,079		

Sources:
Compiled by Jacob Ward, Vehicle Technologies Program, U.S. Department of Energy, from the following sources. Raff, D.M.G. & Trajtenberg, M. (1995), "Quality-Adjusted Prices for the American Automobile Industry: 1906-1940," National Bureau of Economic Research, Inc.; Gordon, R.J. (1990), *The Measurement of Durable Goods Prices*, National Bureau of Economic Research, Inc.; and U.S. Department of Commerce, Bureau of Economic Analysis (2007), National Income and Product Accounts.

Note: Estimations were used for years 1941-1946.

In current dollars, import cars, on average, were less expensive than domestic cars until 1982. Since then, import prices have tripled, while domestic prices have doubled (current dollars).

Table 10.12
Average Price of a New Car (Domestic and Import), 1970–2007

	Domestic[a]		Import		Total	
Year	Current dollars	Constant 2007 dollars[b]	Current dollars	Constant 2007 dollars[b]	Current dollars	Constant 2007 dollars[b]
1970	3,708	19,815	2,648	14,150	3,542	18,928
1975	5,084	19,593	4,384	16,896	4,950	19,077
1980	7,609	19,146	7,482	18,827	7,574	19,058
1981	8,912	20,328	8,896	20,291	8,910	20,323
1982	9,865	21,196	9,957	21,394	9,890	21,250
1983	10,516	21,891	10,868	22,264	10,606	22,079
1984	11,079	22,109	12,336	24,617	11,375	22,700
1985	11,589	22,331	12,853	24,767	11,838	22,811
1986	12,319	23,305	13,670	25,861	12,652	23,935
1987	12,922	23,585	14,470	26,410	13,386	24,432
1988	13,418	23,517	15,221	26,677	13,932	24,418
1989	13,936	23,302	15,510	25,934	14,371	24,030
1990	14,489	22,985	16,640	26,397	15,042	23,862
1991	15,192	23,127	16,327	24,855	15,475	23,558
1992	15,644	23,119	18,593	27,477	16,336	24,142
1993	15,976	22,924	20,261	29,072	16,871	24,208
1994	16,930	23,686	21,989	30,764	17,903	25,047
1995	16,864	22,943	23,202	31,566	17,959	24,433
1996	17,468	23,084	26,205	33,629	18,777	24,813
1997	17,907	23,133	27,722	34,812	19,531	25,231
1998	18,479	23,506	29,614	33,670	20,364	25,904
1999	18,339	22,824	28,695	35,712	20,381	25,365
2000	18,577	22,368	27,447	33,048	20,600	24,804
2001	18,755	21,957	27,539	32,241	20,945	24,521
2002	18,897	21,779	27,440	31,625	21,249	24,490
2003	18,536	20,887	28,139	31,708	21,169	23,854
2004	18,909	20,755	28,409	31,182	21,637	23,749
2005	19,907	21,134	29,702	31,533	22,701	24,100
2006	20,621	21,208	29,620	30,463	23,332	23,996
2007	20,595	20,595	29,862	29,862	23,482	23,482
			Average annual percentage change			
1970–2007	4.7%	0.1%	6.8%	2.0%	5.2%	0.6%
1997–2007	1.4%	-1.2%	0.7%	-1.5%	1.9%	-0.7%

Source:
U.S. Department of Commerce, Bureau of Economic Analysis, *National Income and Product Accounts*, underlying detail estimates for Motor Vehicle Output, Washington, DC, 2008. (Additional resources: www.stat-usa.gov)

[a] Includes transplants.
[b] Adjusted by the Consumer Price Inflation Index.

The total cost of operating an car is the sum of the fixed cost (depreciation, insurance, finance charge, and license fee) and the variable cost (gas and oil, tires, and maintenance), which is related to the amount of travel. The gas and oil share of total cost in 2008 rose to 16.4%.

Table 10.13
Car Operating Cost per Mile, 1985–2008

Model year	Constant 2008 dollars per 10,000 miles[a]			Total cost per mile[b] (constant 2008 cents[a])	Percentage gas and oil of total cost
	Variable cost	Fixed cost	Total cost		
1985	1,485	4,124	5,609	56.09	19.9%
1986	1,281	4,532	5,813	58.13	15.1%
1987	1,270	4,412	5,682	56.82	14.7%
1988	1,438	5,515	6,952	69.52	13.6%
1989	1,389	5,070	6,459	64.59	14.2%
1990	1,384	5,364	6,747	67.47	13.2%
1991	1,533	5,637	7,170	71.70	14.6%
1992	1,381	5,807	7,188	71.88	12.6%
1993	1,371	5,546	6,917	69.17	12.7%
1994	1,322	5,573	6,895	68.95	11.8%
1995	1,356	5,658	7,014	70.14	11.7%
1996	1,317	5,754	7,071	70.71	10.9%
1997	1,449	5,833	7,295	72.95	12.1%
1998	1,413	5,981	7,381	73.81	11.1%
1999	1,370	6,022	7,392	73.92	9.8%
2000	1,525	5,906	7,432	74.32	11.6%
2001	1,653	5,618	7,271	72.71	13.2%
2002	1,412	5,833	7,245	72.45	9.7%
2003	1,533	5,715	7,248	72.48	11.6%
2004	1,436	6,420	7,856	78.56	9.4%
2005	1,554	5,966	7,521	75.21	12.0%
2006	1,613	5,005	6,617	66.17	15.3%
2007	1,506	4,948	6,454	64.54	14.3%
2008	1,696	5,399	7,095	70.95	16.4%
	Average annual percentage change				
1985–2008	0.6%	1.2%	1.0%	1.0%	

Source:
Ward's Communications, *Motor Vehicle Facts and Figures 2008*, Southfield, Michigan, 2008, p. 66, and annual. Original data from AAA "Your Driving Costs."

[a] Adjusted by the Consumer Price Inflation Index.
[b] Based on 10,000 miles per year.

*While the previous table shows costs per **mile**, this table presents costs per **year** for fixed costs associated with car operation. For 2007 model year autos, the fixed cost is over $16 per day.*

Table 10.14
Fixed Car Operating Costs per Year, 1975–2008
(constant 2008 dollars)[a]

Model year	Insurance[b]	License, registration & taxes	Depreciation	Finance charge	Total	Average fixed cost per day
1975	1,533	120	3,093	[e]	4,746	13.01
1980	1,280	214	2,712	[e]	5,312	14.55
1985	930	220	2,525	1,069	4,744	13.01
1986	1,000	255	2,593	1,251	5,100	13.97
1987	1,014	243	2,832	997	5,085	13.93
1988	1,043	253	3,247	1,028	5,571	15.27
1989	1,120	250	3,504	1,021	5,895	16.15
1990	1,109	272	3,883	1,120	6,383	17.49
1991	1,119	266	3,958	420	5,764	15.79
1992	1,208	267	4,169	1,222	6,866	18.81
1993	1,109	265	4,217	998	6,589	18.06
1994	1,117	282	4,271	941	6,612	18.12
1995	1,106	287	4,341	969	6,703	18.37
1996	1,160	295	4,350	985	6,790	18.61
1997	1,136	290	4,389	1,030	6,845	18.75
1998	1,189	299	4,443	1,074	7,005	19.19
1999	1,254	292	4,440	1,070	7,056	19.33
2000	1,213	279	4,366	1,062	6,919	18.95
2001	1,205	253	4,313	1,053	6,824	18.70
2002	1,214	241	4,453	991	6,898	18.90
2003	1,289	240	4,374	871	6,774	18.56
2004	1,827	473	4,311	845	7,455	20.42
2005	1,420	429	4,276	815	6,940	19.02
2006	989	571	3,623	765	5,948	16.30
2007	1,023	559	3,522	761	5,865	16.06
2008	943	554	3,321	758	5,576	15.28
			Average annual percentage change			
1975–2008	-1.5%	4.7%	0.2%	[e]	0.5%	0.5%
1998–2008	-2.3%	6.4%	-2.9%	-3.4%	-2.3%	-2.3%

Source:
Ward's Communications, *Motor Vehicle Facts and Figures 2008*, Southfield, Michigan, 2008, p. 66 and annual. Original data from AAA "Your Driving Costs."

[a] Adjusted by the Consumer Price Inflation Index.

[b] Fire & Theft: $50 deductible 1975 through 1977; $100 deductible 1978 through 1992; $250 deductible for 1993 – on. Collision: $100 deductible through 1977; $250 deductible 1978 through 1992; $500 deductible for 1993 – on. Property Damage & Liability: coverage = $100,000/$300,000.

[e] Data are not available.

Table 10.15
Personal Consumption Expenditures, 1970–2008
(billion dollars)

	Personal consumption expenditures		Transportation personal consumption expenditures		
Year	Current	Constant 2008[a]	Current	Constant 2008[a]	Transportation PCE as a percent of PCE
1970	648.5	3,598.6	81.4	435.0	12.6%
1980	1,757.1	4,591.1	238.9	601.1	13.6%
1990	3,839.9	6,325.5	471.7	748.3	12.3%
2000	6,739.4	8,426.3	853.5	1,067.1	12.7%
2001	7,055.0	8,576.9	872.3	1,060.5	12.4%
2002	7,350.7	8,797.3	882.2	1,055.8	12.0%
2003	7,703.6	9,014.2	921.7	1,078.5	12.0%
2004	8,195.9	9,341.5	976.4	1,112.9	11.9%
2005	8,694.1	9,584.6	1,051.0	1,158.6	12.1%
2006	9,207.2	9,833.0	1,089.0	1,163.0	11.8%
2007	9,710.2	10,083.0	1,138.0	1,181.7	11.7%
2008	10,056.8	10,056.8	1,135.2	1,135.2	11.3%

Source:
U.S. Department of Commerce, Bureau of Economic Analysis, National Income and Product Accounts, Table 2.3.5, http://www.bea.doc.gov/bea/dn/nipaweb.

Note: Transportation PCE includes the following categories: transportation, motor vehicles and parts, and gasoline and oil.

Table 10.16
Consumer Price Indices, 1970–2008
(1970 = 1.000)

Year	Consumer Price Index	Transportation Consumer Price Index[b]	New vehicle Consumer Price Index	Used vehicle Consumer Price Index	Gross National Product Index
1970	1.000	1.000	1.000	1.000	1.000
1980	2.124	2.216	1.667	1.997	2.702
1990	3.369	3.213	2.286	3.769	5.587
2000	4.438	4.088	2.689	4.994	9.432
2002	4.637	4.077	2.637	4.872	10.037
2004	4.869	4.349	2.582	4.272	11.257
2005	5.034	4.637	2.597	4.468	11.977
2006	5.196	4.824	2.591	4.487	12.687
2007	5.344	4.925	2.566	4.351	13.312
2008	5.549	5.215	2.527	4.293	13.779

Source:
Bureau of Labor Statistics, Consumer Price Index Table 1A for 2008, and annual. (Additional resources: www.bls.gov)
GNP – U.S. Department of Commerce, Bureau of Economic Analysis, National Income and Product Accounts, Table 1.7.5. (Additional resources: www.bea.doc.gov)

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[a] Adjusted by the GNP price deflator.
[b] Transportation Consumer Price Index includes new and used cars, gasoline, auto insurance rates, intracity mass transit, intracity bus fare, and airline fares.

The data below were summarized from the Bureau of Labor Statistics (BLS) Current Employment Statistics Survey data using the North American Industry Classification System (NAICS). Transportation-related employment was 7.5% of total employment in 2008.

Table 10.17
Transportation-related Employment, 1998 and 2008
(thousands)

	1998	2008
Truck transportation	1,354.4	1,391.1
Transit and ground transportation	362.7	418.1
Air transportation	562.7	492.6
Rail transportation	225.0	229.5
Water transportation	50.5	65.2
Pipeline transportation	48.1	42.0
Motor vehicle and parts - retail	1,740.9	1,844.5
Motor vehicles and parts - wholesale	353.6	338.8
Gasoline stations - retail	961.3	843.4
Automotive repair and maintenance	828.3	858.3
Automotive equipment rental and leasing	188.5	194.6
Manufacturing	2,165.5	1,666.2
Autos and light trucks	*235.1*	*162.0*
Heavy-duty trucks	*48.5*	*28.7*
Motor vehicle bodies and trailers	*169.7*	*141.9*
Motor vehicle parts	*818.2*	*544.4*
Aerospace products and parts	*578.6*	*503.9*
Railroad rolling stock	*34.9*	*28.4*
Ship & boat building	*153.8*	*156.7*
All other transportation equipment	*39.6*	*40.6*
Tires	*87.1*	*59.6*
Oil and gas pipeline construction	76.2	111.7
Highway street and bridge construction	308.0	328.9
Scenic & sightseeing	25.4	38.0
Support activities for transportation	496.8	589.9
Couriers and messengers	568.2	575.9
Travel arrangement and reservation services	304.3	227.7
Total transportation-related employment	**10,620.4**	**10,256.4**
Total nonfarm employment	125,930.0	137,066.0
Transportation-related to total employment	8.4%	7.5%

Source:

Bureau of Labor Statistics Web site query system: www.bls.gov/ces/cesnaics.htm, (Additional resources: www.bls.gov)

The total number of employees involved in the manufacture of motor vehicles decreased by about 30% from 1990 to 2008 and by about 16% for those involved in the manufacturer of motor vehicle parts. In 2008, the share of production workers fell below 80% for manufacturers of both vehicles and parts.

Table 10.18
U.S. Employment for Motor Vehicles and Motor Vehicle Parts Manufacturing, 1990–2008

Year	All Employees	Production Workers	Share of Production Workers to Total Employees
Motor Vehicles			
1990	271.4	243.4	89.68%
1991	258.4	234.8	90.87%
1992	259.9	234.0	90.03%
1993	263.7	234.8	89.04%
1994	281.5	250.9	89.13%
1995	294.7	273.7	92.87%
1996	285.3	271.2	95.06%
1997	286.8	273.6	95.40%
1998	283.6	254.8	89.84%
1999	291.3	254.3	87.30%
2000	291.4	251.0	86.14%
2001	278.7	236.4	84.82%
2002	265.4	220.8	83.20%
2003	264.6	217.1	82.05%
2004	255.9	208.0	81.28%
2005	247.6	198.6	80.21%
2006	236.5	191.8	81.10%
2007	220.0	177.3	80.59%
2008	190.7	150.3	78.81%
Motor Vehicle Parts			
1990	653.0	527.4	80.77%
1991	638.9	514.7	80.56%
1992	661.2	537.0	81.22%
1993	677.8	554.7	81.84%
1994	735.6	606.9	82.50%
1995	786.9	647.7	82.31%
1996	799.9	657.4	82.19%
1997	808.9	662.4	81.89%
1998	818.2	660.3	80.70%
1999	837.1	674.2	80.54%
2000	839.5	676.7	80.61%
2001	774.7	624.9	80.66%
2002	733.6	590.9	80.55%
2003	707.8	567.6	80.19%
2004	692.1	561.6	81.14%
2005	678.1	553.9	81.68%
2006	654.7	533.7	81.52%
2007	607.9	488.9	80.42%
2008	544.4	431.2	79.21%

Source:
Tabulated from the U.S. Department of Labor, Bureau of Labor Statistics, www.bls.gov, April 2009.

Chapter 11
Greenhouse Gas Emissions

Summary Statistics from Tables in this Chapter

Source			
Table 11.1	Carbon dioxide emissions (million metric tonnes)	1990	2005
	United States	*4,989*	*5,982*
	OECD Europe	*4,092*	*4,383*
	China	*2,241*	*5,323*
	Russia	*2,334*	*1,696*
	Japan	*1,015*	*1,230*
	Non-OECD Europe	*1,859*	*1,169*
	India	*578*	*1,164*
Table 11.5	Transportation share of U.S. carbon dioxide emissions from fossil fuel consumption		
	1990		*31.6%*
	1995		*31.7%*
	2000		*32.0%*
	2007		*33.6%*
Table 11.6	Motor gasoline share of transportation carbon dioxide emissions		58.6%
Table 11.10	Average annual carbon footprint (short tons of CO_2)		
	Cars		*6.2*
	Light trucks		*8.3*

The U. S. accounted for 23.5% of the World's carbon dioxide emissions in 1990 and 21.3% in 2005. Nearly half (44%) of the U.S. carbon emissions are from oil use.

Table 11.1
World Carbon Dioxide Emissions, 1990 and 2005

	1990		2005	
	Million metric short tonnes	Percent of emissions from oil use	Million metric short tonnes	Percent of emissions from oil use
United States	4,989	44%	5,982	44%
Canada	465	48%	628	46%
Mexico	300	77%	398	66%
OECD[a] Europe	4,101	46%	4,383	48%
OECD[a] Asia	241	60%	500	48%
Japan	1,009	66%	1,230	52%
Australia/New Zealand	291	38%	444	32%
Russia	2,376	33%	1,696	22%
Non-OECD[a] Europe	1,822	31%	1,169	25%
China	2,241	15%	5,323	17%
India	565	28%	1,164	26%
Non-OECD[a] Asia	807	57%	1,690	51%
Middle East	700	70%	1,400	59%
Africa	649	46%	966	43%
Central & South America	669	75%	1,078	69%
Total World	21,246	42%	28,051	39%

Source:
U.S. Department of Energy, Energy Information Administration, *International Energy Outlook 2008*, Washington, DC, September 2008, Tables A10 and A11. (Additional resources: www.eia.doe.gov)

[a] OECD is the Organization for Economic Cooperation and Development. See Glossary for included countries.

Global Warming Potentials (GWP) were developed to allow comparison of the ability of each greenhouse gas to trap heat in the atmosphere relative to carbon dioxide. Extensive research has been performed and it has been discovered that the effects of various gases on global warming are too complex to be precisely summarized by a single number. Further understanding of the subject also causes frequent changes to estimates. Despite that, the scientific community has developed approximations, the latest of which are shown below. Most analysts use the 100-year time horizon.

Table 11.2
Numerical Estimates of Global Warming Potentials Compared with Carbon Dioxide
(kilogram of gas per kilogram of carbon dioxide)

Gas	Lifetime (years)	Global warming potential direct effect for time horizons of 20 years	100 years	500 years
Carbon Dioxide (CO_2)	5-200[a]	1	1	1
Methane (CH_4)	12	72	25	8
Nitrous Oxide (N_2O)	114	289	298	153
HFCs[b], PFCs[c], and Sulfur Hexafluoride				
HFC-23	270	12,000	14,800	12,200
HFC-125	29	6,350	3,500	1,100
HFC-134a	14	3,830	1,430	435
HFC-152a	1	437	124	38
HFC-227ea	34	5,310	3,220	1,040
Perfluoromethane (CF_4)	50,000	5,210	7,390	11,200
Perfluoroethane (C_2F_6)	10,000	8,630	12,200	18,200
Sulfur hexafluoride (SF_6)	3,200	16,300	22,800	32,600

Source:
Solomon, S. et al.,"Technical Summary," in *Climate Change 2007: The Physical Science Basis*, Contribution of Working Group I to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change, Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA, 2007.

Note: The typical uncertainty for global warming potentials is estimated by the Intergovernmental Panel on Climate Change ± 35 percent.

[a] No single lifetime can be defined for carbon dioxide due to different rates of uptake by different removal processes.
[b] Hydrofluorocarbons
[c] Perfluorocarbons

Carbon dioxide emissions in 2007 were 20% higher than in 1990. Carbon dioxide accounts for the majority of greenhouse gases.

Table 11.3
U.S. Emissions of Greenhouse Gases, based on Global Warming Potential, 1990–2007
(million metric tonnes carbon dioxide equivalent[a])

	Carbon Dioxide	Methane	Nitrous Oxide	High GWP Gases[b]	Total
1990	5,021.4	782.1	336.0	102.4	6,241.8
1991	4,973.5	778.4	345.2	93.2	6,190.4
1992	5,084.1	781.0	352.4	98.1	6,315.6
1993	5,207.4	753.3	351.8	96.5	6,409.1
1994	5,293.6	754.7	377.5	97.2	6,522.9
1995	5,348.4	752.6	359.7	114.6	6,575.2
1996	5,534.2	729.1	360.2	124.8	6,748.2
1997	5,610.9	730.0	353.1	132.1	6,826.0
1998	5,637.9	696.5	351.0	150.6	6,836.0
1999	5,708.1	690.6	348.9	149.0	6,896.6
2000	5,892.6	685.7	344.6	152.1	7,075.0
2001	5,806.9	670.1	339.3	141.4	6,957.7
2002	5,880.5	674.2	335.4	153.6	7,043.7
2003	5,938.7	676.5	334.6	149.0	7,098.8
2004	6,023.9	679.7	361.5	165.0	7,230.1
2005	6,032.3	679.4	370.8	174.5	7,256.9
2006	5,945.8	686.9	375.7	171.3	7,179.7
2007	6,021.8	699.9	383.9	176.9	7,282.4

Source:
U.S. Department of Energy, Energy Information Administration, *Emissions of Greenhouse Gases in the United States, 2007*, Washington, DC, December 2008, Table 1. (Additional resources: www.eia.doe.gov)

Note: This greenhouse gas emissions inventory includes two "adjustments to energy consumption" which make the data different from Table 11.5. The adjustments are as follows:
1) Emissions from U.S. Territories are included.
2) International bunker fuels and military bunker fuels are excluded from the U.S. total.

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[a] Carbon dioxide equivalents are computed by multiplying the weight of the gas being measured by its estimated Global Warming Potential (See Table 11.2).

[b] GWP = Global warming potential. Includes HFC-hydrofluorocarbons; PFC-perfluorocarbons; and SF_6-sulfur hexaflouride.

Though the transportation sector accounts for the largest share of carbon dioxide emissions, the industrial sector accounts for the largest share of total greenhouse gas emissions.

Table 11.4
Total U.S. Greenhouse Emissions by End-Use Sector, 2007
(million metric tonnes carbon dioxide equivalent[a])

Greenhouse gas and source	Residential	Commercial	Industrial	Transportation	Total
Carbon dioxide	1,261.3	1,097.7	1,760.3	1,902.5	6,021.8
Methane	10.5	186.7	497.6	5.1	699.9
Nitrous oxide	4.5	9.8	313.5	56.2	383.9
Hydrofluorocarbons	0.0	50.2	22.0	72.7	144.9
Perfluorocarbons	0.0	0.0	10.1	0.0	10.1
Other hydrofluorocarbons, perfluorocarbons/perfluoropolyether	0.0	6.1	0.0	0.0	6.1
Sulfur hexafluoride	4.6	4.4	6.8	0.0	15.8
Total greenhouse gas emissions	1,280.8	1,354.7	2,610.4	2,036.4	7,282.4

Source:
U.S. Department of Energy, Energy Information Administration, *Emissions of Greenhouse Gases in the United States, 2007*, Washington, DC, December 2008, and annual. (Additional resources: www.eia.doe.gov)

Note: This greenhouse gas emissions inventory includes two "adjustments to energy consumption" which make the data different from Table 11.5. The adjustments are as follows:
(1) Emissions from U.S. Territories are included.
(2) International bunker fuels and military bunker fuels are excluded from the U.S. total.

[a] Carbon dioxide equivalents are computed by multiplying the weight of the gas being measured by its estimated Global Warming Potential (See Table 11.2).

Gases which contain carbon can be measured in terms of the full molecular weight of the gas or just in terms of their carbon content. This table presents carbon dioxide gas. The ratio of the weight of carbon to carbon dioxide is 0.2727. The transportation sector accounts for approximately one-third of carbon emissions.

Table 11.5
U.S. Carbon Emissions from Fossil Energy Consumption by End-Use Sector, 1990–2007[a]
(million metric tonnes of carbon dioxide)

	End Use Sector				Transportation Percentage	CO_2 From All Sectors
	Residential	Commercial	Industrial	Transportation		
1990	961.7	787.5	1,686.9	1,582.6	31.5%	5,018.7
1991	977.2	788.5	1,644.1	1,561.3	31.4%	4,971.0
1992	978.6	790.1	1,719.2	1,582.1	31.2%	5,070.1
1993	1,039.3	815.9	1,709.5	1,610.6	31.1%	5,175.3
1994	1,032.3	830.4	1,739.6	1,651.8	31.4%	5,254.0
1995	1,039.2	848.4	1,738.6	1,682.2	31.7%	5,308.5
1996	1,098.5	879.0	1,791.9	1,725.4	31.4%	5,494.9
1997	1,089.7	923.0	1,820.3	1,744.2	31.3%	5,577.2
1998	1,097.0	943.6	1,794.9	1,779.5	31.7%	5,615.0
1999	1,120.1	955.5	1,773.4	1,828.3	32.2%	5,677.3
2000	1,181.6	1,015.2	1,786.4	1,872.6	32.0%	5,855.8
2001	1,168.3	1,020.1	1,715.8	1,850.9	32.2%	5,755.1
2002	1,196.3	1,017.9	1,715.5	1,890.9	32.5%	5,820.6
2003	1,224.6	1,027.1	1,719.1	1,897.2	32.3%	5,868.1
2004	1,220.7	1,042.3	1,744.2	1,958.9	32.8%	5,966.2
2005	1,254.9	1,060.2	1,672.3	1,988.0	33.3%	5,975.3
2006	1,197.9	1,043.0	1,652.4	2,013.4	34.1%	5,906.7
2007	1,249.5	1,087.4	1,639.7	2,014.4	33.6%	5,990.9
			Average annual percentage change			
1990–2007	1.6%	1.9%	-0.2%	1.4%		1.0%
2000–2007	0.8%	1.0%	-1.2%	1.0%		0.3%

Source:
U.S. Department of Energy, Energy Information Administration, *Emissions of Greenhouse Gases in the United States, 2007*, Washington, DC, December 2008, Table 6. (Additional resources: www.eia.doe.gov)

Note: Emissions from U.S. Territories are not included. International bunker fuels and military bunker fuels are included in these data.

[a] Includes energy from petroleum, coal, and natural gas. Electric utility emissions are distributed across consumption sectors.

Most U.S. transportation sector carbon dioxide emissions come from petroleum fuels (98%). Motor gasoline has been responsible for about 60% of U.S. carbon dioxide emissions over the last twenty years.

Table 11.6
U.S. Carbon Emissions from Energy Use in the Transportation Sector, 1990–2007
(million metric tonnes of carbon dioxide)

	1990		2000		2007	
Fuel	Emissions	Percentage	Emissions	Percentage	Emissions	Percentage
			Petroleum			
Motor gasoline	961.7	60.8%	1,121.9	59.9%	1,180.5	58.6%
LPG[a]	1.3	0.1%	0.7	0.0%	1.1	0.1%
Jet fuel	222.6	14.1%	253.8	13.6%	238.0	11.8%
Distillate fuel	267.8	16.9%	377.8	20.2%	472.5	23.5%
Residual fuel	80.1	5.1%	69.9	3.7%	73.5	3.6%
Lubricants	6.5	0.4%	6.7	0.4%	5.6	0.3%
Aviation gas	3.1	0.2%	2.5	0.1%	2.2	0.1%
Subtotal	**1,544.2**	97.5%	**1,833.3**	97.9%	**1,974.0**	98.0%
			Other energy			
Natural gas	36.2	2.3%	35.6	1.9%	35.4	1.8%
Electricity[b]	3.2	0.2%	3.6	0.2%	5.0	0.2%
Total[c]	**1,582.6**	100.0%	**1,872.6**	100.0%	**2,014.4**	100.0%

Source:
U.S. Department of Energy, Energy Information Administration, *Emissions of Greenhouse Gases in the United States, 2007*, Washington, DC, December 2008, Table 10 and annual. (Additional resources: www.eia.doe.gov)

[a] Liquified petroleum gas.
[b] Share of total electric utility carbon dioxide emissions weighted by sales to the transportation sector.
[c] Totals may not equal sum of components due to independent rounding.

Highway vehicles are responsible for the majority of greenhouse gas emissions in the transportation sector.

Table 11.7
Transportation Greenhouse Gas Emissions by Mode, 1990 and 2007
(Million metric tonnes of carbon dioxide equivalent)

	Carbon Dioxide	Methane	Nitrous Oxide
	1990		
Highway Total	1,187.2	4.2	40.4
Cars, light trucks, motorcycles	951.2	4.0	39.6
Medium & heavy trucks and buses	236.0	0.2	0.8
Water	46.5	0.1	0.4
Air	179.4	0.2	1.7
Rail	38.1	0.1	0.3
Pipeline	36.2	0.0	0.0
Other	0.0	0.2	0.9
Total	1,487.5	4.7	43.7
	2007		
Highway Total	1,568.5	1.7	26.0
Cars, light trucks, motorcycles	1,149.0	1.6	25.0
Medium & heavy trucks and buses	419.5	0.1	1.0
Water	50.8	0.1	0.4
Air	187.4	0.1	1.8
Rail	50.8	0.1	0.4
Pipeline	34.6	0.0	0.0
Other	0.0	0.3	1.5
Total	1,892.2	2.3	30.1
	Percent change 1990–2007		
Highway Total	32.1%	-59.5%	-35.6%
Cars, light trucks, motorcycles	20.8%	-60.0%	-36.9%
Medium & heavy trucks and buses	77.8%	-50.0%	25.0%
Water	9.2%	0.0%	0.0%
Air	4.5%	-50.0%	5.9%
Rail	33.3%	0.0%	33.3%
Pipeline	-4.4%	0.0%	0.0%
Other	0.0%	0.0%	0.0%
Total	27.2%	-51.1%	-31.1%

Source:
U.S. Environmental Protection Agency, Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990–2007, Tables 3-12, 3-13, 3-14, April 2009. (Additional resources: www.epa.gov/climatechange/emissions)

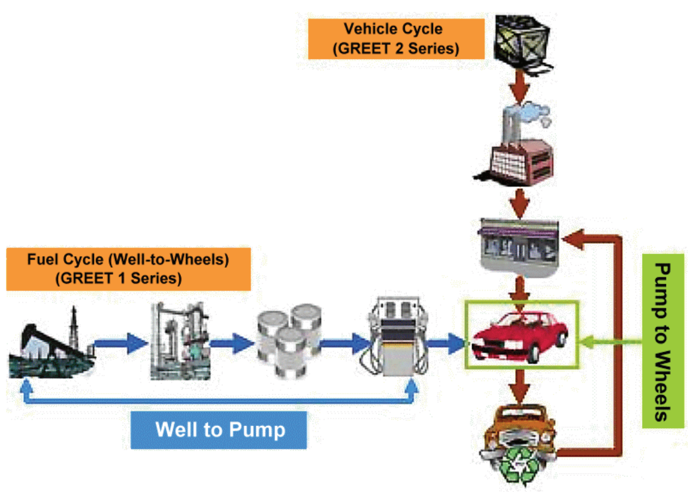
Note: Emissions from U.S. Territories, International bunker fuels, and military bunker fuels are not included.

The Greenhouse Gases, Regulated Emissions, and Energy Use in Transportation (GREET) Model

http://www.transportation.anl.gov/modeling_simulation/GREET/

Sponsored by the U.S. Department of Energy's Office of Energy Efficiency and Renewable Energy (EERE), Argonne has developed a full life-cycle model called GREET (Greenhouse gases, Regulated Emissions, and Energy use in Transportation). It allows researchers and analysts to evaluate energy and emission impacts of various vehicle and fuel combinations on a full fuel-cycle/vehicle-cycle basis. The first version of GREET was released in 1996. Since then, Argonne has continued to update and expand the model. The most recent GREET versions are GREET 1.8c.0 version for fuel-cycle analysis and GREET 2.7 version for vehicle-cycle analysis.

Figure 11.1. GREET Model



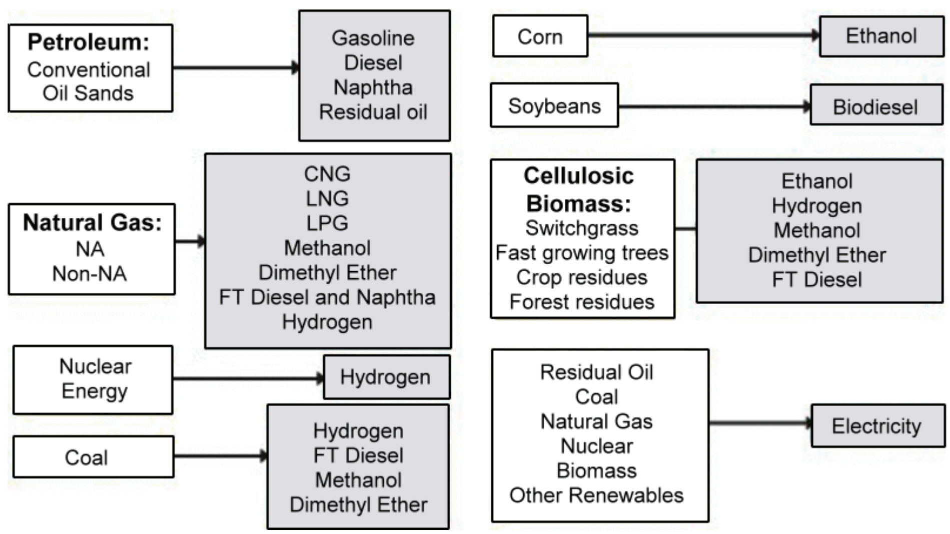
For a given vehicle and fuel system, GREET separately calculates the following:

- Consumption of total energy (energy in non-renewable and renewable sources), fossil fuels (petroleum, natural gas, and coal together), petroleum, coal and natural gas.
- Emissions of CO_2-equivalent greenhouse gases - primarily carbon dioxide (CO_2), methane (CH_4), and nitrous oxide (N_2O).
- Emissions of six criteria pollutants: volatile organic compounds (VOCs), carbon monoxide (CO), nitrogen oxide (NOx), particulate matter with size smaller than 10 micron (PM_{10}), particulate matter with size smaller than 2.5 micron ($PM_{2.5}$),and sulfur oxides (SOx).

GREET includes more than 100 fuel production pathways and more than 70 vehicle/fuel systems. These vehicle/fuel systems cover all major vehicle technologies in the market and R&D arena:

- Conventional spark-ignition engines
- Direct-injection, spark-ignition engines
- Direct injection, compression-ignition engines
- Grid-independent hybrid electric vehicles
- Grid-connected (or plug-in) hybrid electric vehicles
- Battery-powered electric vehicles
- Fuel-cell vehicles

Figure 11.2. GREET Model Feedstocks and Fuels



To address technology improvements over time, GREET simulates vehicle/fuel systems over the period from 1990 to 2020, in five-year intervals.

For additional information about the GREET model, see the GREET Web site, or contact:

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Carbon Footprint

The carbon footprint measures a vehicle's impact on climate change in tons of carbon dioxide (CO_2) emitted annually. The following three tables show the carbon footprint for various vehicle classes. The sales-weighted average fuel economy rating for each vehicle class, based on 45% highway and 55% city driving, is used to determine the average annual carbon footprint for vehicles in the class. An estimate of 15,000 annual miles is used for each vehicle class and for each year in the series. The equation to calculate carbon footprint uses results of the GREET model version 1.8.

$$CarbonFootprint = \left(CO_2 \times LHV \times \frac{AnnualMiles}{CombinedMPG} \right) + \left(CH_4 + N_2O \right) \times AnnualMiles$$

where:

CO_2 = (Tailpipe CO_2 = Upstream Greenhouse Gases) in grams per million Btu

LHV = Lower (or net) Heating Value in million Btu per gallon

CH_4 = Tailpipe CO_2 equivalent methane in grams per mile

N_2O = Tailpipe CO_2 equivalent nitrous oxide in grams per mile

The carbon footprint for all classifications of cars declined between 1975 and 2008. Midsize cars have experienced the greatest reduction in carbon footprint with a decrease of almost 57%.

Table 11.8
Sales-Weighted Annual Carbon Footprint of New Domestic and Import Cars by Size Class, Model Years 1975–2008[a]
(Short tons of CO_2)

	Cars			Wagons		
Model Year	Small	Midsize	Large	Small	Midsize	Large
1975	10.2	13.6	14.2	8.3	14.1	15.6
1976	9.3	11.8	13.1	7.8	11.6	13.7
1977	9.0	11.3	11.7	7.3	11.4	12.0
1978	8.0	10.0	11.1	7.7	10.0	11.7
1979	8.0	9.7	10.7	7.3	9.7	11.5
1980	7.1	8.6	9.7	6.5	8.8	9.7
1981	6.5	8.1	9.1	6.2	8.1	9.3
1982	6.4	7.8	9.0	6.1	7.9	9.7
1983	6.3	7.8	9.2	5.8	7.6	9.5
1984	6.3	7.7	9.1	5.9	7.5	9.3
1985	6.3	7.5	8.3	5.7	7.4	8.9
1986	6.2	7.2	7.8	6.0	7.2	8.5
1987	6.2	7.2	7.8	6.1	7.3	8.4
1988	6.1	7.0	7.7	6.0	7.1	8.2
1989	6.2	7.0	7.8	5.9	7.3	8.3
1990	6.3	7.1	7.9	6.3	7.4	8.2
1991	6.2	7.2	7.9	6.1	7.2	8.1
1992	6.2	7.2	7.8	6.2	7.1	8.2
1993	6.1	7.1	7.7	5.7	7.1	8.3
1994	6.1	7.2	7.7	5.7	7.2	8.1
1995	6.1	7.1	7.6	5.6	7.0	8.2
1996	6.1	7.0	7.7	5.9	7.1	8.0
1997	6.0	7.0	7.6	5.8	7.1	*b*
1998	6.0	6.9	7.6	5.8	7.1	*b*
1999	6.2	6.9	7.5	5.9	7.1	*b*
2000	6.2	6.9	7.3	6.4	6.8	*b*
2001	6.1	6.9	7.3	6.8	7.0	*b*
2002	6.1	6.7	7.2	7.1	6.8	*b*
2003	6.1	6.6	7.2	6.2	6.9	*b*
2004	6.1	6.5	7.2	5.9	7.1	8.5
2005	6.0	6.3	7.1	5.8	7.2	8.4
2006	6.0	6.3	7.2	5.9	7.1	8.5
2007	5.9	6.0	7.1	5.9	7.0	8.6
2008	5.9	5.9	7.0	5.8	7.0	8.5
			Average annual percentage change			
1975–2008	-1.6%	-2.5%	-2.1%	-1.1%	-2.1%	-1.8%
1998–2008	0.2%	-1.6%	-0.8%	0.0%	-0.1%	*c*

Source:
Calculated using fuel economy from the U.S. Environmental Protection Agency, *Light-Duty Automotive Technology and Fuel Economy Trends: 1975 Through 2008*, September 2008. See page 11-10 for details.

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[a] Annual carbon footprint is based on 15,000 miles of annual driving.
[b] No vehicles in this category were sold in this model year.
[c] Data are not available.

The annual carbon footprint of light trucks decreased for all classes of light trucks between 1975 and 2008. In the last ten years, midsize SUVs experienced the greatest decline with about 17% while small SUVs experienced a slight gain in carbon emissions.

Table 11.9
Sales-Weighted Annual Carbon Footprint of New Domestic and Import Light Trucks by Size Class, Model Years 1975–2008[a]
(Short tons of CO_2)

	Pickups			Vans			SUVs		
Model Year	Small	Midsize	Large	Small	Midsize	Large	Small	Midsize	Large
1975	8.3	8.8	14.2	9.0	14.0	14.7	11.5	15.3	15.2
1976	7.8	8.1	13.4	9.3	13.2	13.8	11.7	14.0	14.6
1977	7.3	6.3	12.5	8.4	13.0	12.0	10.9	12.7	13.6
1978	7.3	6.4	12.6	9.3	13.4	12.4	11.0	13.4	14.1
1979	8.2	7.2	13.0	9.9	13.0	15.3	11.1	15.6	16.7
1980	7.7	7.2	10.8	9.8	11.0	11.6	9.9	13.0	13.0
1981	6.6	7.1	10.0	10.0	10.4	11.1	9.1	11.9	12.1
1982	6.8	7.0	10.0	8.6	10.4	11.5	9.1	11.3	9.8
1983	6.9	7.0	10.3	9.4	9.9	11.5	8.7	9.9	10.6
1984	7.1	7.3	10.4	7.3	9.7	11.3	8.6	9.8	11.0
1985	7.0	7.3	10.5	7.3	9.4	11.5	8.4	9.4	11.0
1986	7.2	7.1	10.2	7.3	8.9	10.6	7.9	9.4	11.1
1987	7.2	7.3	10.5	7.7	8.8	10.9	7.7	9.4	10.9
1988	7.5	7.4	10.3	7.6	8.5	11.0	7.7	9.5	11.2
1989	7.8	7.5	10.3	7.5	8.5	11.1	8.2	9.5	11.1
1990	7.5	7.5	10.3	7.8	8.5	11.3	8.0	9.7	11.1
1991	7.5	7.6	10.2	7.8	8.5	11.1	7.9	9.2	11.5
1992	7.6	7.8	10.2	6.9	8.5	11.0	8.0	9.3	11.8
1993	7.1	7.9	9.9	6.6	8.3	10.9	8.0	9.3	11.4
1994	7.5	7.8	10.1	6.9	8.5	10.9	7.7	9.4	11.3
1995	7.6	7.5	10.3	7.0	8.4	10.9	7.7	9.5	11.2
1996	7.6	7.5	10.2	7.1	8.2	10.9	6.5	9.3	10.7
1997	7.5	7.7	9.8	*b*	8.2	10.0	8.2	9.1	10.6
1998	7.6	7.8	10.0	*b*	8.0	10.2	7.8	8.9	10.7
1999	8.0	8.3	10.0	*b*	8.1	10.4	7.7	8.9	10.8
2000	7.1	8.2	9.6	*b*	7.9	10.3	8.3	8.9	10.6
2001	7.0	8.5	9.8	*b*	7.8	10.5	7.5	8.6	10.0
2002	8.0	8.8	9.9	*b*	7.9	10.4	7.5	8.5	9.7
2003	8.0	8.2	9.8	*b*	7.7	9.9	7.4	8.3	9.9
2004	8.2	8.5	9.8	*b*	7.7	9.6	7.5	8.3	9.8
2005	7.2	7.9	9.6	*b*	7.7	9.6	7.7	8.1	9.3
2006	7.1	7.7	9.5	*b*	7.5	9.6	8.7	7.9	9.1
2007	*b*	8.0	9.4	*b*	7.6	9.4	8.3	7.5	8.9
2008	*b*	7.8	9.4	*b*	7.5	9.3	8.1	7.4	8.8
				Average annual percentage change					
1975-2008	*c*	-0.4%	-1.2%	*c*	-1.9%	-1.4%	-1.1%	-2.2%	-1.6%
1998-2008	*c*	0.0%	-0.6%	*c*	-0.6%	-0.9%	0.4%	-1.8%	-1.9%

Source:
Calculated using fuel economy from the U.S. Environmental Protection Agency, *Light-Duty Automotive Technology and Fuel Economy Trends: 1975 Through 2008*, September 2008. See page 11-10 for details.

Note: Includes light trucks of 8,500 lbs. or less.

[a] Annual carbon footprint is based on 15,000 miles of annual driving.
[b] No vehicles in this category were sold in this model year.
[c] Data are not available.

Between 1975 and 2008, the carbon footprint for light vehicles sold in the United States dropped dramatically. Cars experienced the greatest decrease at 47.6% while the carbon footprint for light trucks decreased by 38.9%.

Table 11.10
Average Annual Carbon Footprint by Vehicle Classification, 1975 and 2008[a]
(Short tons of CO_2)

	Market Share		Carbon Footprint		Percent Change
Fuel	1975	2008	1975	2008	1975 - 2008
Cars					
Small	40.0%	19.4%	10.2	5.9	-42.2%
Midsize	16.0%	17.7%	13.6	5.9	-56.6%
Large	15.2%	10.0%	14.2	7.0	-50.7%
Small Wagon	4.7%	3.4%	8.3	5.8	-30.1%
Midsize Wagon	2.8%	1.1%	14.1	7.0	-50.4%
Large Wagon	1.9%	0.5%	15.6	8.5	-45.5%
Total Cars	**80.6%**	**52.0%**	**11.8**	**6.2**	**-47.6%**
Light Trucks					
Small Van	0.0%	0.0%	9.0	0.0	b
Midsize Van	3.0%	5.3%	14.0	7.5	-46.4%
Large Van	1.5%	0.2%	14.7	9.3	-36.7%
Small SUV	0.5%	0.9%	11.5	8.1	-29.6%
Midsize SUV	1.2%	16.5%	15.3	7.4	-51.6%
Large SUV	0.1%	12.3%	15.2	8.8	-42.1%
Small Pickup	1.6%	0.0%	8.3	0.0	b
Midsize Pickup	0.5%	1.6%	8.8	7.8	-11.4%
Large Pickup	11.0%	11.3%	14.2	9.4	-33.8%
Total Light Trucks	**19.4%**	**48.0%**	**13.5**	**8.3**	**-38.9**

Source:
Calculated using fuel economy from the U.S. Environmental Protection Agency, *Light-Duty Automotive Technology and Fuel Economy Trends: 1975 Through 2008*, September 2008. See 11-10 for details.

[a] Annual carbon footprint is based on 15,000 miles of annual driving.
[b] Data are not available.

The amount of carbon dioxide released into the atmosphere by a vehicle is primarily determined by the carbon content of the fuel. However, there is a small portion of the fuel that is not oxidized into carbon dioxide when the fuel is burned. The Environmental Protection Agency (EPA) has published information on carbon dioxide emissions from gasoline and diesel which takes the oxidation factor into account and is based on the carbon content used in EPA's fuel economy analyses.

Table 11.11
Carbon Dioxide Emissions from a Gallon of Fuel

	Grams per gallon	Kilograms per gallon	Pounds per gallon
Gasoline	8,788	8.8	19.4
Diesel	10,084	10.1	22.2

Source:
U.S. Environmental Protection Agency, "Emission Facts: Average Carbon Dioxide Emissions Resulting from Gasoline and Diesel Fuel," February 2009. (Additional resources: www.epa.gov/OMS)

Chapter 12
Criteria Air Pollutants

Summary Statistics from Tables in this Chapter

Source		
Table 12.1	Transportation's share of U.S. emissions, 2007	
	CO	*68.4%*
	NO_X	*57.1%*
	VOC	*33.9%*
	SO_2	*8.9%*
	PM-2.5	*7.2%*
	NH_3	*5.7%*
	PM-10	*2.7%*

Transportation accounts for the majority of carbon monoxide and nitrogen oxide emissions. Highway vehicles are responsible for the largest share of transportation emissions.

Table 12.1
Total National Emissions of the Criteria Air Pollutants by Sector, 2007
(millions of short tons/percentage)

Sector	CO	NO_x	VOC	PM-10	PM-2.5	SO_2	NH_3
Highway vehicles	**41.61**	**5.56**	**3.60**	**0.17**	**0.11**	**0.09**	**0.31**
	47.2%	*32.7%*	*19.5%*	*1.0%*	*2.1%*	*1.7%*	*5.6%*
Other off-highway	**18.76**	**4.16**	**2.65**	**0.30**	**0.28**	**0.40**	**0.00**
	21.3%	*24.5%*	*14.4%*	*1.7%*	*5.1%*	*7.3%*	*0.1%*
Transportation total	**60.37**	**9.73**	**6.25**	**0.47**	**0.39**	**0.49**	**0.31**
	68.4%	*57.1%*	*33.9%*	*2.7%*	*7.2%*	*8.9%*	*5.7%*
Stationary source fuel combustion	**5.30**	**6.00**	**1.63**	**1.36**	**1.03**	**11.26**	**0.07**
	6.0%	*35.2%*	*8.8%*	*7.8%*	*19.0%*	*206.5%*	*1.2%*
Industrial processes	**2.24**	**0.92**	**6.88**	**1.17**	**0.48**	**1.03**	**0.19**
	2.5%	*5.4%*	*37.4%*	*6.7%*	*8.8%*	*18.9%*	*3.5%*
Waste disposal and recycling total	**1.59**	**0.11**	**0.38**	**0.29**	**0.27**	**0.03**	**0.03**
	1.8%	*0.6%*	*2.1%*	*1.7%*	*4.9%*	*0.5%*	*0.5%*
Miscellaneous	**18.75**	**0.26**	**3.28**	**14.09**	**3.28**	**0.13**	**3.54**
	21.2%	*1.6%*	*17.8%*	*81.1%*	*60.2%*	*2.3%*	*65.0%*
Total of all sources	**88.25**	**17.03**	**18.42**	**17.37**	**5.45**	**12.93**	**4.13**
	100.0%	*100.0%*	*100.0%*	*100.0%*	*100.0%*	*100.0%*	*100.0%*

Source:
U. S. Environmental Protection Agency, National Emission Inventory Air Pollutant Emission Trends Web site www.epa.gov/ttn/chief/trends. (Additional resources: www.epa.gov/ttn/chief)

Note: CO = Carbon monoxide. NO_x = Nitrogen oxides. PM-10 = Particulate matter less than 10 microns. PM-2.5 = Particulate matter less than 2.5 microns. SO_2 = Sulfur dioxide. VOC = Volatile organic compounds. NH_3 = Ammonia.

The transportation sector accounted for more than 68% of the nation's carbon monoxide (CO) emissions in 2007. Highway vehicles are by far the source of the greatest amount of CO. For details on the highway emissions of CO, see Table 12.3.

Table 12.2
Total National Emissions of Carbon Monoxide, 1970–2007[a]
(million short tons)

Source category	1970	1980	1990	2000	2005	2007	Percent of total, 2007
Highway vehicles	163.23	143.83	110.26	68.06	48.22	41.61	47.1%
Other off-highway	11.37	16.69	21.45	24.18	20.80	18.76	21.3%
Transportation total	174.60	160.52	131.71	92.24	69.03	60.37	68.4%
Stationary fuel combustion total	4.63	7.30	5.51	4.78	5.27	5.30	6.0%
Industrial processes total	9.84	6.95	4.77	2.63	2.24	2.24	2.5%
Waste disposal and recycling total	7.06	2.90	1.67	1.85	1.59	1.59	1.8%
Miscellaneous total	7.91	15.02	13.30	12.96	18.49	18.75	21.2%
Total of all sources	**204.04**	**192.69**	**156.96**	**114.47**	**96.62**	**88.25**	**100.0%**

Source:
U. S. Environmental Protection Agency, National Emission Inventory Air Pollutant Emission Trends Web site www.epa.gov/ttn/chief/trends (Additional resources: www.epa.gov/ttn/chief)

[a] The sums of subcategories may not equal total due to rounding.

Though gasoline-powered light vehicles continue to be responsible for the majority of carbon monoxide emissions from highway vehicles, the total pollution from light vehicles in 2005 is about a third of what it was in 1970. This is despite the fact that there were many more light vehicles on the road in 2005.

Table 12.3
Emissions of Carbon Monoxide from Highway Vehicles, 1970–2005[a]
(million short tons)

Source category	1970	1980	1990	1995	2000	2005	Percent of total, 2005
Gasoline powered							
Light vehicles & motorcycles	119.14	98.21	67.24	46.54	36.40	24.19	50.2%
Light trucks[b]	22.27	28.83	32.23	29.81	27.04	21.19	43.9%
Heavy vehicles	21.27	15.35	8.92	5.96	3.42	1.97	4.1%
Total	162.68	142.39	108.39	82.31	66.86	47.35	98.2%
Diesel powered							
Light vehicles	0.01	0.03	0.04	0.02	0.01	0.01	0.0%
Light trucks[b]	0.06	0.05	0.03	0.02	0.01	0.01	0.0%
Heavy vehicles	0.49	1.36	1.81	1.53	1.19	0.85	1.8%
Total	0.56	1.43	1.87	1.57	1.20	0.87	1.6%
Total							
Highway vehicle total	**163.23**	**143.83**	**110.26**	**83.88**	**68.06**	**48.22**	**100.0%**
Percent diesel	0.3%	1.0%	1.7%	1.9%	1.8%	1.8%	

Source:
U. S. Environmental Protection Agency, National Emission Inventory Air Pollutant Emission Trends Web site www.epa.gov/ttn/chief/trends (Additional resources: www.epa.gov/oar/oaqps)

Note: Data beyond 2005 are not available.

[a] The sums of subcategories may not equal total due to rounding.
[b] Less than 8,500 pounds.

The transportation sector accounted for over half of the nation's nitrogen oxide (NOx) emissions in 2007, with the majority coming from highway vehicles. For details on the highway emissions of NOx, see Table 12.5.

Table 12.4
Total National Emissions of Nitrogen Oxides, 1970–2007[a]
(million short tons)

Source category	1970	1980	1990	2000	2005	2007	Percent of total, 2007
Highway vehicles	12.62	11.49	9.59	8.39	6.41	5.56	32.7%
Other off-highway	2.65	3.35	3.78	4.17	4.40	4.16	24.5%
Transportation total	15.28	14.84	13.37	12.56	10.81	9.73	57.1%
Stationary fuel combustion total	10.06	11.32	10.89	8.82	6.63	6.00	35.2%
Industrial processes total	0.78	0.56	0.80	0.81	0.95	0.92	5.4%
Waste disposal and recycling total	0.44	0.11	0.09	0.13	0.11	0.11	0.6%
Miscellaneous total	0.33	0.25	0.37	0.28	0.21	0.26	1.6%
Total of all sources	**26.89**	**27.08**	**25.52**	**22.60**	**18.71**	**17.03**	**100.0%**

Source:
U. S. Environmental Protection Agency, National Emission Inventory Air Pollutant Emission Trends Web site www.epa.gov/ttn/chief/trends (Additional resources: www.epa.gov/ttn/chief)

[a] The sums of subcategories may not equal total due to rounding.

Heavy diesel-powered vehicles were responsible for nearly one-half (44.1%) of highway vehicle nitrogen oxide emissions in 2005, while light gasoline vehicles were responsible for the rest.

Table 12.5
Emissions of Nitrogen Oxides from Highway Vehicles, 1970–2005[a]
(million short tons)

Source category	1970	1980	1990	1995	2000	2005	Percent of total, 2005
Gasoline powered							
Light vehicles & motorcycles	8.54	6.63	4.26	3.05	2.31	1.63	25.5%
Light trucks[b]	1.54	1.58	1.50	1.46	1.44	1.56	24.4%
Heavy vehicles	0.72	0.62	0.57	0.52	0.45	0.38	5.9%
Total	10.81	8.83	6.33	5.03	4.20	3.57	55.9%
Diesel powered							
Light vehicles	0.00	0.03	0.04	0.02	0.01	0.00	0.0%
Light trucks[b]	0.07	0.05	0.02	0.01	0.01	0.01	0.2%
Heavy vehicles	1.76	2.59	3.19	3.82	4.18	2.81	44.0%
Total	1.83	2.66	3.26	3.85	4.19	2.82	44.1%
Total							
Highway vehicle total	**12.64**	**11.49**	**9.59**	**8.88**	**8.39**	**6.39**	**100.0%**
Percent diesel	14.5%	23.1%	34.0%	43.4%	49.9%	44.1%	

Source:
U. S. Environmental Protection Agency, National Emission Inventory Air Pollutant Emission Trends Web site www.epa.gov/ttn/chief/trends. (Additional resources: www.epa.gov/oar/oaqps)

Note: Data beyond 2005 are not available.

[a] The sums of subcategories may not equal total due to rounding.
[b] Less than 8,500 pounds.

The transportation sector accounted for almost 34% of the nation's volatile organic compound (VOC) emissions in 2007, with the majority coming from highway vehicles. For details on the highway emissions of VOC, see Table 12.7.

Table 12.6
Total National Emissions of Volatile Organic Compounds, 1970–2007[a]
(million short tons)

Source category	1970	1980	1990	2000	2005	2007	Percent of total, 2007
Highway vehicles	16.91	13.87	9.39	5.33	4.08	3.60	19.6%
Off-highway	1.62	2.19	2.66	2.64	2.86	2.65	14.4%
Transportation total	18.53	16.06	12.05	7.97	6.94	6.25	33.9%
Stationary fuel combustion total	0.72	1.05	1.01	1.18	1.58	1.63	8.8%
Industrial processes total	12.33	12.10	9.01	7.21	7.10	6.88	37.4%
Waste disposal and recycling total	1.98	0.76	0.99	0.42	0.40	0.38	2.1%
Miscellaneous total	1.10	1.13	1.06	0.73	3.97	3.28	17.8%
Total of all sources	**34.66**	**31.10**	**24.12**	**17.51**	**19.98**	**18.42**	**100.0%**

Source:
U. S. Environmental Protection Agency, National Emission Inventory Air Pollutant Emission Trends Web site www.epa.gov/ttn/chief/trends (Additional resources: www.epa.gov/ttn/chief)

[a] The sum of subcategories may not equal total due to rounding. The EPA's definition of volatile organic compounds excludes methane, ethane, and certain other nonphotochemically reactive organic compounds.

Gasoline-powered vehicles are responsible for over 95% of highway vehicle emissions of volatile organic compounds. VOC emissions from highway vehicles in 2005 were about one-quarter of the 1990 level.

Table 12.7
Emissions of Volatile Organic Compounds from Highway Vehicles, 1970–2005[a]
(thousand short tons)

Source category	1970	1980	1990	1995	2000	2005	Percent of total, 2005
Gasoline powered							
Light vehicles & motorcycles	11,996	9,304	5,690	3,768	2,903	2,111	51.8%
Light trucks[b]	2,776	2,864	2,617	2,225	1,929	1,629	39.9%
Heavy vehicles	1,679	1,198	633	421	256	171	4.2%
Total	16,451	13,366	8,940	6,414	5,088	3,911	95.9%
Diesel powered							
Light vehicles	8	16	18	9	3	2	0.0%
Light trucks[b]	41	28	15	10	4	6	0.1%
Heavy vehicles	411	459	415	315	230	159	3.9%
Total	460	503	448	335	238	167	4.1%
Total							
Highway vehicle total	**16,911**	**13,869**	**9,388**	**6,749**	**5,326**	**4,078**	**100.0%**
Percent diesel	2.7%	3.6%	4.8%	5.0%	4.5%	4.1%	

Source:
U. S. Environmental Protection Agency, National Emission Inventory Air Pollutant Emission Trends Web site www.epa.gov/ttn/chief/trends (Additional resources: www.epa.gov/oar/oaqps)

Note: Data beyond 2005 are not available.

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[a] The sums of subcategories may not equal total due to rounding.
[b] Less than 8,500 pounds.

The transportation sector accounted for just under 3% of the nation's particulate matter (PM-10) emissions in 2007. For details on the highway emissions of PM-10, see Table 12.9.

Table 12.8
Total National Emissions of Particulate Matter (PM-10), 1970–2007[a]
(million short tons)

Source category	1970	1980	1990	2000	2005	2007	Percent of total, 2007
Highway vehicles	0.48	0.43	0.39	0.23	0.18	0.17	1.0%
Off-highway	0.16	0.26	0.33	0.32	0.31	0.30	1.7%
Transportation total	0.64	0.69	0.72	0.55	0.50	0.47	2.7%
Stationary fuel combustion total	2.87	2.45	1.20	1.47	1.43	1.36	7.8%
Industrial processes total	7.67	2.75	1.04	0.71	1.19	1.17	6.7%
Waste disposal and recycling total	1.00	0.27	0.27	0.36	0.29	0.29	1.7%
Miscellaneous total	0.84	0.85	24.54	20.70	17.9	14.1	81.1%
Total of all sources	**13.02**	**7.01**	**27.77**	**23.75**	**21.29**	**17.37**	**100.0%**

Source:
U. S. Environmental Protection Agency, National Emission Inventory Air Pollutant Emission Trends Web site www.epa.gov/ttn/chief/trends (Additional resources: www.epa.gov/ttn/chief)

Note: Because PM-10 is fine particle matter less than 10 microns, it also includes PM-2.5. Specific data for PM-2.5 are shown on Tables 12.10 and 12.11.

[a] Fine particle matter less than 10 microns. The sums of subcategories may not equal total due to rounding.
[b] Data are not available.

Since the mid-1980's, diesel-powered vehicles have been responsible for more than half of highway vehicle emissions of particulate matter (PM-10). Heavy vehicles are clearly the main source.

Table 12.9
Emissions of Particulate Matter (PM-10) from Highway Vehicles, 1970–2005[a]
(thousand short tons)

Source category	1970	1980	1990	1995	2000	2005	Percent of total, 2005
Gasoline powered							
Light vehicles & motorcycles	249	141	57	53	51	46	25.1%
Light trucks[b]	74	49	31	32	32	35	19.1%
Heavy vehicles	44	30	17	13	10	8	4.4%
Total	367	220	104	98	93	89	48.6%
Diesel powered							
Light vehicles	2	9	11	4	1	1	0.5%
Light trucks[b]	19	12	5	3	1	1	0.5%
Heavy vehicles	92	191	268	199	135	92	50.3%
Total	113	212	284	206	137	94	51.4%
Total							
Highway vehicle total	**480**	**432**	**389**	**304**	**230**	**183**	**100.0%**
Percent diesel	23.5%	49.1%	73.0%	67.7%	59.5%	51.4%	

Source:
U. S. Environmental Protection Agency, National Emission Inventory Air Pollutant Emission Trends Web site www.epa.gov/ttn/chief/trends (Additional resources: www.epa.gov/oar/oaqps)

Note: Because PM-10 is fine particle matter less than 10 microns, it also includes PM-2.5. Specific data for PM-2.5 are shown on Tables 12.10 and 12.11. Data beyond 2005 are not available.

[a] The sums of subcategories may not equal total due to rounding.
[b] Less than 8,500 pounds.

The transportation sector accounted for only 4% of the nation's particulate matter (PM-2.5) emissions in 2007. For details on the highway emissions of PM-2.5, see Table 12.11.

Table 12.10
Total National Emissions of Particulate Matter (PM-2.5), 1990–2007
(million short tons)

Source category	1990	1995	2000	2005	2006	2007	Percent of total, 2007
Highway vehicles	0.32	0.25	0.17	0.13	0.12	0.11	2.1%
Off-highway	0.30	0.31	0.30	0.29	0.28	0.28	5.1%
Transportation total	0.62	0.56	0.47	0.42	0.40	0.39	7.2%
Stationary fuel combustion total	0.91	0.90	1.29	1.11	1.07	1.03	19.0%
Industrial processes total	0.56	0.50	0.50	0.49	0.48	0.48	8.8%
Waste disposal and recycling total	0.23	0.25	0.33	0.27	0.27	0.27	4.9%
Miscellaneous total	5.23	4.73	4.69	3.26	3.27	3.28	60.2%
Total of all sources	**7.55**	**6.94**	**7.28**	**5.54**	**5.49**	**5.45**	**100.0%**

Source:
U. S. Environmental Protection Agency, National Emission Inventory Air Pollutant Emission Trends Web site www.epa.gov/ttn/chief/trends (Additional resources: www.epa.gov/ttn/chief)

Diesel vehicles are responsible for the majority of highway vehicle PM-2.5 emissions. Nearly two-thirds of the highway vehicles' PM-2.5 emissions are from heavy diesel trucks.

Table 12.11
Emissions of Particulate Matter (PM-2.5) from Highway Vehicles, 1990–2005[a]
(thousand short tons)

Source category	1990	1995	2000	2005	Percent of total, 2005
Gasoline powered					
Light vehicles & motorcycles	35	30	27	23	18.0%
Light trucks[b]	21	20	18	18	14.1%
Heavy vehicles	11	9	7	6	4.7%
Total	67	59	52	47	36.7%
Diesel powered					
Light vehicles	9	4	1	1	0.8%
Light trucks[b]	4	2	1	1	0.8%
Heavy vehicles	243	179	119	79	61.7%
Total	256	185	121	81	63.3%
Total					
Highway vehicle total	**323**	**245**	**173**	**128**	**100.0%**
Percent diesel	79.3%	75.5%	69.9%	63.3%	

Source:
U. S. Environmental Protection Agency, National Emission Inventory Air Pollutant Emission Trends Web site www.epa.gov/ttn/chief/trends (Additional resources: www.epa.gov/oar/oaqps)

Note: Data beyond 2005 are not available.

[a] The sums of subcategories may not equal total due to rounding.
[b] Less than 8,500 pounds.

Table 12.12
U.S. Tier 2 Emission Standards for Cars and Light Trucks
(grams/mile)

Bin	NMOG	CO	NOx	PM	HCHO
			50,000 miles		
10[a]	0.125	3.4	0.4	[b]	0.015
9[a]	0.075	3.4	0.2	[b]	0.015
8	0.100	3.4	0.14	[b]	0.015
7	0.075	3.4	0.11	[b]	0.015
6	0.075	3.4	0.08	[b]	0.015
5	0.075	3.4	0.05	[b]	0.015
			120,000 miles		
MDPV[a]	0.280	7.3	0.9	0.12	0.032
10[a]	0.156	4.2	0.6	0.08	0.018
9[a]	0.090	4.2	0.3	0.06	0.018
8	0.125	4.2	0.2	0.02	0.018
7	0.090	4.2	0.15	0.02	0.018
6	0.090	4.2	0.10	0.01	0.018
5	0.090	4.2	0.07	0.01	0.018
4	0.070	2.1	0.04	0.01	0.011
3	0.055	2.1	0.03	0.01	0.011
2	0.010	2.1	0.02	0.01	0.004
1	0.000	0.0	0.00	0.00	0.000

Source:
Federal Register, Vol. 65, No. 28, Thursday, February 10, 2000, pp. 6822–6870.

Acronyms Used on Tables 12.12 and 12.13

CO	Carbon monoxide
GVW	Gross vehicle weight
HC	Hydrocarbons
HCHO	Formaldehyde
LDT	Light-duty truck
LEV	Low-emission vehicle
LVW	Loaded vehicle weight
MDPV	Medium-duty passenger vehicle (8,500–10,000 lbs. GVWR)
NMOG	Non-methane organic gases
NOx	Nitrogen oxides
PM	Particulate matter
SULEV	Super-ultra-low-emission vehicle
ULEV	Ultra-low-emission vehicle
ZEV	Zero-emission vehicle

[a] Bin expired after 2008.
[b] No Standard.

Table 12.13
Light Vehicle Exhaust Emission Standards in Effect in 2009
when U.S. Tier 2 Standards are Final
(grams/mile)

Vehicle fuels: Gasoline AND diesel unless noted otherwise

Vehicle size: Up to 8,500 lbs. GVW unless noted otherwise

Useful life:		120,000 miles				
	Bins, category, size	NMOG	CO	NOx	PM	HCHO
U.S.	Bins					
emission	8	0.125	4.2	0.20	0.02	0.018
standards	7	0.090	4.2	0.15	0.02	0.018
	6	0.090	4.2	0.10	0.01	0.018
	5	0.090	4.2	0.07	0.01	0.018
	4	0.070	2.1	0.04	0.01	0.011
	3	0.055	2.1	0.03	0.01	0.011
	2	0.010	2.1	0.02	0.01	0.004
	1	0.000	0.0	0.00	0.00	0.000
	Average[a]	–	–	0.07	–	–
California	Category			(Diesel only)		
LEV II	LEV[b]	0.090	4.2	0.07	0.01	0.018
emission	ULEV	0.055	2.1	0.07	0.01	0.011
standards	SULEV	0.010	1.0	0.02	0.01	0.004
	ZEV[c]	0.000	0.0	0.00	0.00	0.000

Source:
U.S.: *Federal Register*, Vol. 65, No. 28, Thursday, February 10, 2000, pp. 6822–6870.
California Exhaust Emission Standards and Test Procedures for 2001 and Subsequent Model Passenger Cars, Light-Duty Trucks and Medium-Duty Vehicles, as of December 1, 1999 (adopted August 5, 1999), incorporated by reference in section 1961(d), title 13, CCR.

Note: See acronym list on previous page.

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[a] Includes medium-duty passenger vehicles which are also required to meet bin standards.
[b] A LEV Option 1 with higher NOx levels also exists for up to 4% of LDTs above 3,750 lbs.
[c] Only apply to cars and LDTs 0-3750 lbs LVW.

Table 12.14
California Cars and Light Trucks Emission Certification Standards
(grams/mile)

		Vehicle Useful Life						
		10 Years / 100,000 Miles						
Vehicle Type	Emission Category	THC[a]	NMHC[b]	NMOG[c]	CO	NO_X	PM	HCHO
Car	Tier 1	–	0.31	–	4.2	0.6	–	–
	TLEV	–	–	0.156	4.2	0.6	0.08[d]	0.018
	LEV	–	–	0.090	4.2	0.3	0.08[d]	0.018
	ULEV	–	–	0.055	2.1	0.3	0.04[d]	0.011
	ZEV	0.00	0.00	0.000	0.0	0.0	0.00	0.000
LDT1	Tier 1	–	0.31	–	4.2	0.6	–	–
	TLEV	–	–	0.156	4.2	0.6	0.08[d]	0.018
	LEV	–	–	0.090	4.2	0.3	0.08[d]	0.018
	ULEV	–	–	0.055	2.1	0.3	0.04[d]	0.011
	ZEV	0.00	0.00	0.000	0.0	0.0	0.00	0.000
LDT2	Tier 1	–	0.40	–	5.5	0.97	–	–
	TLEV	–	–	0.200	5.5	0.9	0.10[d]	0.023
	LEV	–	–	0.130	5.5	0.5	0.10[d]	0.023
	ULEV	–	–	0.070	2.8	0.5	0.05[d]	0.013

Source:
U.S. Environmental Protection Agency, Office of Transportation and Air Quality, EPA 420-B-00-001. (Additional resources: www.epa.gov/otag)

Note: After 2003, Tier 1 and TLEV standards were eliminated. LDT1 = light truck (6,000 lbs. or less GVWR) up through 3,750 lbs. loaded vehicle weight; LDT2 = light truck (6,000 lbs. or less GVWR) greater than 3,750 lbs. loaded vehicle weight.

[a] THCE for methanol vehicles. Does not apply to CNG vehicles.
[b] THCE for Tier 0 methanol vehicles. NMHCE for other alcohol vehicles.
[c] NMHC for diesel-fueled vehicles.
[d] Diesel-fueled vehicles only.

APPENDIX A

SOURCES & METHODOLOGIES

SOURCES & METHODOLOGIES

This appendix contains documentation of the estimation procedures used by ORNL. The reader can examine the methodology behind the estimates and form an opinion as to their utility. The appendix is arranged by subject heading. Only tables which contain ORNL estimations are documented in Appendix A; all other tables have sources listed at the bottom of the table. Since abbreviations are used throughout the appendix, a list of abbreviations is also included.

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List of Abbreviations Used in Appendix A

AAMA	American Automobile Manufacturers Association
AAR	Association of American Railroads
APTA	American Public Transportation Association
Amtrak	National Railroad Passenger Corporation
Btu	British thermal unit
DOC	Department of Commerce
DOE	Department of Energy
DOT	Department of Transportation
EIA	Energy Information Administration
EPA	Environmental Protection Agency
FAA	Federal Aviation Administration
FHWA	Federal Highway Administration
GSA	General Services Administration
gvw	gross vehicle weight
lpg	liquefied petroleum gas
mpg	miles per gallon
NHTS	National Household Travel Survey
NHTSA	National Highway Traffic Safety Administration
NPTS	Nationwide Personal Transportation Survey
NVPP	National Vehicle Population Profile
ORNL	Oak Ridge National Laboratory
pmt	passenger-miles traveled
RECS	Residential Energy Consumption Survey
RTECS	Residential Transportation Energy Consumption Survey
TIUS	Truck Inventory and Use Survey
TSC	Transportation Systems Center
VIUS	Vehicle Inventory and Use Survey
vmt	vehicle-miles traveled

Energy Use Sources

Highway energy use

Automobiles

Fuel use in gallons from: DOT, FHWA, *Highway Statistics 2007*, Table VM-1 and annual editions back to 1996; DOT, FHWA, *Highway Statistics Summary to 1995.* Fuel use was distributed among fuel types using the percentages shown in Table A.1. The Federal Highway Administration discontinued publication of gasohol data in 2005. Therefore, a new methodology was developed using data from EIA, *Alternatives to Traditional Transportation Fuels*, 2006, Table C1.

Table A.1
Automobile Fuel Use and Fuel Type Shares for Calculation of Energy Use

Year	Fuel use (million gallons)	Source for gasohol shares	Source for gasoline/diesel shares	Shares by fuel type: Gasoline	Gasohol	Diesel
1970	67,820		1984 NVPP	99.8%	0.0%	0.2%
1975	74,140		interpolated	97.0%	0.0%	3.0%
1980	69,981	FHWA, MF-33e	interpolated	93.9%	0.5%	5.6%
1981	69,112	FHWA, MF-33e	1981 RTECS	93.4%	0.7%	5.9%
1982	69,116	FHWA, MF-33e	interpolated	93.5%	2.3%	4.2%
1983	70,322	FHWA, MF-33e	1983 RTECS	93.2%	4.3%	2.5%
1984	70,663	FHWA, MF-33e	interpolated	92.7%	5.3%	2.0%
1985	71,518	FHWA, MF-33e	1985 RTECS	90.8%	7.7%	1.5%
1986	73,174	FHWA, MF-33e	interpolated	91.0%	7.6%	1.4%
1987	73,308	FHWA, MF-33e	interpolated	92.4%	6.3%	1.3%
1988	73,345	FHWA, MF-33e	1988 RTECS	91.4%	7.4%	1.2%
1989	73,913	FHWA, MF-33e	interpolated	92.6%	6.2%	1.2%
1990	69,568	FHWA, MF-33e	interpolated	92.0%	6.8%	1.2%
1991	64,318	FHWA, MF-33e	1991 RTECS	90.8%	8.0%	1.2%
1992	65,436	FHWA, MF-33e	interpolated	90.8%	7.9%	1.2%
1993	67,047	FHWA, MF-33e	interpolated	89.7%	9.1%	1.3%
1994	67,874	FHWA, MF-33e	1994 RTECS	89.1%	9.6%	1.3%
1995	68,072	FHWA, MF-33e	interpolated	87.6%	11.2%	1.2%
1996	69,221	FHWA, MF-33e	interpolated	88.8%	10.1%	1.0%
1997	69,892	FHWA, MF-33e	interpolated	86.9%	12.2%	0.9%
1998	71,695	FHWA, MF-33e	interpolated	88.0%	11.2%	0.8%
1999	73,283	FHWA, MF-33e	interpolated	88.3%	11.0%	0.6%
2000	73,065	FHWA, MF-33e	2000 NVPP	86.9%	12.6%	0.5%
2001	73,559	FHWA, MF-33e	2001 NVPP	86.5%	13.0%	0.5%
2002	75,471	FHWA, MF-33e	2001 NVPP	83.9%	15.6%	0.5%
2003	74,590	FHWA, MF-33e	2001 NVPP	75.3%	24.2%	0.5%
2004	75,402	FHWA, MF-33e	2001 NVPP	67.2%	32.3%	0.5%
2005	77,418	FHWA, MF-33e	2001 NVPP	66.9%	32.6%	0.5%
2006	75,009	EIA, C1	2001 NVPP	78.2%	21.3%	0.5%
2007	74,355	EIA, C1	2001 NVPP	72.8%	26.7%	0.5%
Heat content used for conversion to btu:				125,000 btu/gallon	120,900 btu/gallon	138,700 btu/gallon

Motorcycles

DOT, FHWA, *Highway Statistics 2007,* Table VM-1, and annual editions.

Table A.2
Motorcycle Fuel Use

Year	Fuel use (thousand gallons)	Year	Fuel use (thousand gallons)
1970	59,580	1989	207,420
1971	72,140	1990	191,140
1972	86,620	1991	183,560
1973	103,880	1992	191,140
1974	108,900	1993	198,120
1975	112,580	1994	204,800
1976	120,060	1995	198,262
1977	126,980	1996	195,940
1978	143,160	1997	201,620
1979	172,740	1998	205,660
1980	204,280	1999	211,680
1981	213,800	2000	209,380
1982	198,200	2001	192,780
1983	175,200	2002	191,040
1984	175,680	2003	190,780
1985	181,720	2004	202,447
1986	187,940	2005	189,495
1987	190,120	2006	221,030
1988	200,480	2007	242,170
Heat content used for conversion to btu:			125,000 btu/gallon

Buses

Transit:

APTA, *Public Transportation Fact Book,* 2008, Washington, DC. Includes motorbus and trolley bus data.

Table A.3
Transit Bus Fuel Use

Year	LNG (million gallons)	LPG (million gallons)	CNG (million gallons)	Gasoline (million gallons)	Diesel fuel (million gallons)	Electricity (million kilowatt hours)	Biodiesel (million gallons)	Methanol (million gallons)
1994	1.1	0.2	3.1	2.1	565.1	102.9		12.5
1995	1.7	0.3	10.0	2.3	563.8	100.0		12.0
1996	2.3	0.6	11.5	1.8	577.7	69.0		11.6
1997	3.3	1.0	20.0	2.7	597.6	78.0		8.7
1998	3.1	0.9	32.6	2.0	606.6	74.0		5.0
1999	5.3	0.8	39.9	1.4	618.0	75.0		2.7
2000	10.5	0.7	50.4	1.3	635.2	77.0		0.8
2001	11.7	1.2	60.9	1.5	587.2	74.0		0.8
2002	16.8	1.8	77.8	1.3	559.0	73.0		1.8
2003	14.2	1.8	94.9	1.1	536.0	69.0		1.9
2004	16.5	1.7	106.7	1.8	550.5	68.0		4.7
2005	18.3	2.0	117.2	1.0	533.8	67.0		8.1
2006	19.6	1.6	138.8	2.3	536.7	62.0	20.5*	0.9*
2007	18.3	[a]	129.1	2.5	494.1	61.0	25.8	1.3
Heat content used for conversion to btu:	90,800 btu/gallon	91,300 btu/gallon	129,400 btu/gallon	125,000 btu/gallon	138,700 btu/gallon	64,600 btu/gallon		10,339 btu/kWhr

[*] Estimates.

Intercity and School:

Eno Transportation Foundation, *Transportation in America*, 2001, Nineteenth Edition, 2003, Washington, DC, pp. 20–23. School bus fuel was assumed to be 90% diesel fuel and 10% gasoline based on estimates from the National Association of State Directors of Pupil Transportation Services. Intercity bus fuel was assumed to be 100% diesel.

Table A.4
Intercity and School Bus Fuel Use

Year	Intercity (million gallons)	School (million gallons)
1970	305.34	299.88
1971	296.73	309.75
1972	288.12	319.62
1973	252.42	327.04
1974	216.72	334.46
1975	181.02	341.88
1976	182.28	389.76
1977	181.86	401.52
1978	180.18	406.98
1979	205.38	404.88
1980	213.78	379.68
1981	205.38	386.82
1982	227.22	398.58
1983	237.30	400.68
1984	169.26	375.06
1985	165.48	425.04
1986	148.68	462.42
1987	155.82	487.20
1988	160.44	511.14
1989	166.74	498.12
1990	159.60	472.08
1991	160.44	533.40
1992	157.08	546.00
1993	171.36	533.40
1994	195.30	546.00
1995	195.30	545.16
1996	199.92	545.16
1997	212.52	544.74
1998	220.08	550.20
1999	241.08	555.66
2000	233.10	577.08
2001	217.35*	538.08*
2002	210.22*	520.44*
2003	208.32*	515.72*
2004	208.87*	517.09*
2005	214.37*	530.70*
2006	208.32*	515.72*
2007	214.24*	530.40*
Fuel type shares	100% diesel	90% diesel 10% gasoline
Heat content used for conversion to btu:	138,700 btu/gallon	138,700 btu/gallon 125,000 btu/gallon

* Estimated using the rate of change of bus vehicle-miles traveled from FHWA *Highway Statistics* Table VM-1.

Trucks

Light Trucks:

DOT, FHWA, *Highway Statistics 2007*, Table VM-1 and annual editions back to 1996; DOT, FHWA, *Highway Statistics Summary to 1995.* The Federal Highway Administration discontinued publication of gasohol data in 2005. Therefore, a new methodology was developed using data from EIA, *Alternatives to Traditional Transportation Fuels*, 2006, Table C1.

Table A.5
Light Truck Fuel Use and Fuel Type Shares for Calculation of Energy Use

Year	Fuel use (million gallons)	Source for gasohol shares	Source for gasoline/diesel /lpg shares	Shares by fuel type			
				Gasoline	Gasohol	Diesel	Lpg
1970	12,313		1977 TIUS	97.6%	0.0%	1.6%	0.8%
1975	19,081		1977 TIUS	97.6%	0.0%	1.6%	0.8%
1976	20,828		1977 TIUS	97.6%	0.0%	1.6%	0.8%
1977	22,383		1977 TIUS	97.6%	0.0%	1.6%	0.8%
1978	24,162		Interpolated	97.1%	0.0%	2.0%	0.9%
1979	24,445		Interpolated	96.7%	0.0%	2.4%	1.0%
1980	23,796	FHWA, MF-33e	Interpolated	95.7%	0.5%	2.7%	1.0%
1981	23,697	FHWA, MF-33e	Interpolated	95.1%	0.7%	3.1%	1.1%
1982	22,702	FHWA, MF-33e	1982 TIUS	93.0%	2.3%	3.5%	1.2%
1983	23,945	FHWA, MF-33e	Interpolated	91.0%	4.3%	3.5%	1.2%
1984	25,604	FHWA, MF-33e	Interpolated	90.0%	5.3%	3.5%	1.2%
1985	27,363	FHWA, MF-33e	Interpolated	87.6%	7.7%	3.5%	1.2%
1986	29,074	FHWA, MF-33e	Interpolated	87.7%	7.6%	3.5%	1.2%
1987	30,598	FHWA, MF-33e	1987 TIUS	89.0%	6.3%	3.5%	1.2%
1988	32,653	FHWA, MF-33e	Interpolated	88.2%	7.4%	3.5%	1.0%
1989	33,271	FHWA, MF-33e	Interpolated	89.5%	6.2%	3.4%	0.8%
1990	35,611	FHWA, MF-33e	Interpolated	89.2%	6.8%	3.4%	0.7%
1991	38,217	FHWA, MF-33e	Interpolated	88.1%	8.0%	3.3%	0.5%
1992	40,929	FHWA, MF-33e	1992 TIUS	88.5%	7.9%	3.3%	0.3%
1993	42,851	FHWA, MF-33e	Interpolated	87.3%	9.1%	3.3%	0.3%
1994	44,112	FHWA, MF-33e	Interpolated	86.8%	9.6%	3.3%	0.3%
1995	45,605	FHWA, MF-33e	Interpolated	85.1%	11.2%	3.4%	0.3%
1996	47,354	FHWA, MF-33e	Interpolated	86.2%	10.1%	3.4%	0.3%
1997	49,388	FHWA, MF-33e	1997 VIUS	84.2%	12.2%	3.4%	0.2%
1998	50,462	FHWA, MF-33e	Interpolated	85.0%	11.2%	3.5%	0.3%
1999	52,859	FHWA, MF-33e	Interpolated	84.9%	11.0%	3.6%	0.4%
2000	52,939	FHWA, MF-33e	Interpolated	83.1%	12.6%	3.8%	0.6%
2001	53,522	FHWA, MF-33e	Interpolated	82.4%	13.0%	3.9%	0.7%
2002	55,220	FHWA, MF-33e	2002 VIUS	79.6%	15.6%	4.0%	0.8%
2003	60,758	FHWA, MF-33e	2002 VIUS	71.0%	24.2%	4.0%	0.8%
2004	63,417	FHWA, MF-33e	2002 VIUS	62.9%	32.3%	4.0%	0.8%
2005	58,869	FHWA, MF-33e	2002 VIUS	62.6%	32.6%	4.0%	0.8%
2006	60,685	EIA, C1	2002 VIUS	73.9%	21.3%	4.0%	0.8%
2007	61,816	EIA, C1	2002 VIUS	68.5%	26.7%	4.0%	0.8%
Heat content used for conversion to btu:				125,000 btu/gallon	120,900 btu/gallon	138,700 btu/gallon	90,800 btu/gallon

Medium/Heavy Trucks:

DOT, FHWA, *Highway Statistics 2007*, Table VM-1 and annual editions back to 1996; DOT, FHWA, *Highway Statistics Summary to 1995*. Total gallons for other trucks was the difference between total trucks and 2-axle, 4-tire trucks.

Table A.6
Medium/Heavy Truck Fuel Use and Fuel Type Shares for Calculation of Energy Use

Year	Fuel use (million gallons)	Source for gasoline/diesel /lpg shares	Shares by fuel type		
			Gasoline	Diesel	Lpg
1970	11,316	1977 TIUS	10.4%	89.5%	0.1%
1971	11,812	1977 TIUS	10.4%	89.5%	0.1%
1972	12,964	1977 TIUS	10.4%	89.5%	0.1%
1973	14,320	1977 TIUS	10.4%	89.5%	0.1%
1974	14,341	1977 TIUS	10.4%	89.5%	0.1%
1975	14,598	1977 TIUS	10.4%	89.5%	0.1%
1976	15,408	1977 TIUS	10.4%	89.5%	0.1%
1977	17,082	1977 TIUS	10.4%	89.5%	0.1%
1978	19,121	Interpolated	16.2%	83.5%	0.3%
1979	19,913	Interpolated	22.1%	77.5%	0.5%
1980	19,960	Interpolated	27.9%	71.4%	0.6%
1981	20,376	Interpolated	33.8%	65.4%	0.8%
1982	20,386	1982 TIUS	39.6%	59.4%	1.0%
1983	20,761	Interpolated	35.6%	63.6%	0.8%
1984	21,428	Interpolated	31.5%	67.8%	0.7%
1985	21,405	Interpolated	27.5%	72.0%	0.5%
1986	21,861	Interpolated	23.4%	76.2%	0.4%
1987	22,513	1987 TIUS	19.4%	80.4%	0.2%
1988	22,925	Interpolated	18.8%	81.0%	0.3%
1989	23,512	Interpolated	18.1%	81.6%	0.3%
1990	24,490	Interpolated	17.5%	82.1%	0.4%
1991	24,981	Interpolated	16.8%	82.7%	0.4%
1992	25,453	1992 TIUS	16.2%	83.3%	0.5%
1993	26,236	Interpolated	15.4%	84.1%	0.5%
1994	27,685	Interpolated	14.7%	84.8%	0.5%
1995	28,828	Interpolated	13.9%	85.6%	0.5%
1996	29,601	Interpolated	13.2%	86.3%	0.5%
1997	29,878	1997 VIUS	12.4%	87.1%	0.5%
1998	30,841	Interpolated	12.1%	87.4%	0.5%
1999	33,909	Interpolated	11.8%	87.6%	0.5%
2000	35,229	Interpolated	11.6%	87.9%	0.5%
2001	35,179	Interpolated	11.3%	88.1%	0.5%
2002	36,800	2002 VIUS	11.0%	88.4%	0.5%
2003	35,775	2002 VIUS	11.0%	88.4%	0.5%
2004	33,150	2002 VIUS	11.0%	88.4%	0.5%
2005	37,190	2002 VIUS	11.0%	88.4%	0.5%
2006	37,959	2002 VIUS	11.0%	88.4%	0.5%
2007	38,550	2002 VIUS	11.0%	88.4%	0.5%
Heat content used for conversion to btu:			125,000 btu/gallon	138,700 btu/gallon	90,800 btu/gallon

Off-highway energy use

The off-highway energy use estimates are for the year 2001. The estimates are a combination of data from EPA's NONROAD2002 model and VIUS 1997. First, the NONROAD model was queried on a national basis for energy use by nonroad engines. The resulting database included sector, fuel type, number of gallons used annually, and a description of the off-highway equipment called the source category code (SCC). ORNL sorted the data by SCC and only the SCC's which pertained to off-highway transportation were kept in the database. Examples of exclusions include chainsaws and stationary generators. The EPA model does not include off-highway use of trucks; therefore, the 1997 VIUS was queried to derive the amount of fuel (by sector and fuel type) used by trucks off-road. The rate of change in off-highway transportation-related fuel use from NONROAD2002 between 1997 and 2001 was applied to the 1997 VIUS data to provide an estimate for 2001. The transportation-related fuel use from NONROAD and the VIUS estimates were added together for a total off-highway transportation-related fuel use by sector and fuel type. These totals are found on Table 2.8. Gallons were converted to btu using the gross heat content for each fuel. (Heat content values shown on Table B.4.)

Additional detail on this methodology can be found in the report *Off-Highway Transportation-related Fuel Use*, ORNL/TM-2004/92, April 2004,
http://cta.ornl.gov/cta/Publications/pdf/ORNL_TM-2004_92.pdf .

Nonhighway energy use

Air

General Aviation:

DOT, FAA, *General Aviation Activity and Avionics Survey: Annual Summary Report Calendar Year 2007,* Table 5.1, and annual.

Table A.7
General Aviation Fuel Use

Year	Jet fuel (million gallons)	Aviation gasoline (million gallons)
1970	208.0	551.0
1971	226.0	508.0
1972	245.0	584.0
1973	304.0	411.0
1974	357.0	443.0
1975	453.0	412.0
1976	495.0	432.0
1977	536.0	456.0
1978	763.0	518.0
1979	736.0	570.0
1980	766.0	520.0
1981	759.0	489.0
1982	887.0	448.0
1983	613.0	428.0
1984	738.9	462.4
1985	691.0	421.0
1986	732.1	408.6
1987	672.7	401.8
1988	746.0	398.0
1989	688.0	342.8
1990	662.0	353.0
1991	579.0	348.0
1992	496.0	306.0
1993	454.1	268.4
1994	470.8	264.1
1995	544.0	276.0
1996	567.5	286.5
1997	639.4	289.7
1998	814.6	311.4
1999	967.2	345.4
2000	998.1	336.3
2001	938.7	319.3
2002	815.5	261.4
2003	820.0	255.5
2004	1,075.2	256.1
2005	1,507.4	323.6
2006	1,636.3	294.7
2007	1,516.3	314.8
Heat content used for conversion to btu:	135,000 btu/gallon	120,200 btu/gallon

Domestic and International Air Carrier:

DOT, Bureau of Transportation Statistics, "Fuel Cost and Consumption Tables," www.bts.gov/xml/fuel/report/src/index.xml. The table below shows all international fuel use. Because the data for international include fuel purchased abroad, for the tables in Chapter 2, the international total was divided in half to estimate domestic fuel use for international flights.

Table A.8
Air Carrier Fuel Use

Year	Domestic (thousand gallons)	All international (thousand gallons)	Total (thousand gallons)
1970	Separate estimates for domestic and international are not available from 1970-1976.		10,085,000
1971			10,140,000
1972			10,302,000
1973			10,671,000
1974			10,417,260
1975			10,412,640
1976			10,400,040
1977	8,202,051	1,708,376	9,910,427
1978	8,446,117	1,741,918	10,188,035
1979	8,865,885	1,828,435	10,694,320
1980	8,519,233	1,747,306	10,266,539
1981	8,555,249	2,032,520	10,587,769
1982	8,432,465	1,967,733	10,400,198
1983	8,672,574	1,998,289	10,670,863
1984	9,625,958	2,286,407	11,912,365
1985	10,115,007	2,487,929	12,602,936
1986	11,137,331	2,544,996	13,682,327
1987	11,586,838	2,893,617	14,480,455
1988	11,917,904	3,262,824	15,180,728
1989	11,905,144	3,557,294	15,462,438
1990	12,429,305	3,963,081	16,392,386
1991	11,506,477	3,939,666	15,446,144
1992	11,762,852	4,120,132	15,882,983
1993	11,958,663	4,113,321	16,071,984
1994	12,475,549	4,310,879	16,786,428
1995	12,811,717	4,511,418	17,323,135
1996	13,187,305	4,658,093	17,845,398
1997	13,659,581	4,964,181	18,623,762
1998	13,876,971	5,185,562	19,062,533
1999	14,402,127	5,250,492	19,652,619
2000	14,844,592	5,474,685	20,319,277
2001	14,017,461	5,237,487	19,254,948
2002	12,848,329	4,990,798	17,839,127
2003	12,958,581	4,836,356	17,794,936
2004	13,622,603	4,931,546	18,554,149
2005	13,778,869	5,520,889	19,309,758
2006	13,694,437	6,017,638	19,712,075
2007	13,681,664	6,204,502	19,886,165
Heat content used for conversion to btu:	135,000 btu/gallon	135,000 btu/gallon	135,000 btu/gallon

Water

Freight:

Total – DOE, EIA, *Fuel Oil and Kerosene Sales 2006*, Table 23. Adjusted sales of distillate and residual fuel oil for vessel bunkering. (This may include some amounts of bunker fuels used for recreational purposes.)

Table A.9
Diesel and Residual Fuel Oil for Vessel Bunkering

Year	Distillate fuel oil (thousand gallons)	Residual fuel oil (thousand gallons)
1970	819,000	3,774,120
1971	880,000	3,307,000
1972	1,013,000	3,273,000
1973	1,125,000	3,859,000
1974	1,018,920	3,827,040
1975	1,097,880	4,060,140
1976	1,220,100	4,977,000
1977	1,407,420	5,416,740
1978	1,578,822	6,614,790
1979	1,630,858	8,002,672
1980	717,376	7,454,242
1981	1,723,143	7,922,512
1982	1,423,216	6,408,818
1983	1,418,890	5,724,115
1984	1,692,141	5,687,375
1985	1,894,016	5,473,614
1986	2,034,215	5,287,347
1987	2,223,258	5,259,272
1988	2,310,367	5,248,981
1989	2,356,444	5,410,263
1990	2,197,004	6,248,095
1991	2,167,640	6,786,055
1992	2,240,170	7,199,078
1993	2,043,745	6,269,882
1994	2,026,899	5,944,383
1995	1,978,105	6,431,238
1996	2,177,608	5,804,977
1997	2,107,561	4,789,861
1998	2,125,568	4,640,153
1999	2,064,590	5,598,630
2000	2,041,433	6,192,294
2001	2,099,011	4,345,284
2002	2,056,465	4,783,956
2003	1,863,150	3,801,425
2004	2,313,448	4,886,978
2005	2,115,381	5,533,552
2006	2,203,876	6,012,838
Heat content used for conversion to btu:	138,700 btu/gallon	149,700 btu/gallon
Domestic share of total fuel use	77.5%	9.3%

Recreational Boating:

Fuel use by recreational boating comes from the EPA's NONROAD2005 model.

Table A.10
Recreational Boating Fuel Use

Year	Diesel use (gallons)	Gasoline use (gallons)
1970	39,589,953	1,244,804,236
1971	47,130,906	1,252,226,262
1972	54,671,856	1,259,648,217
1973	62,212,803	1,267,070,191
1974	69,753,735	1,274,492,200
1975	77,294,680	1,281,914,303
1976	84,835,632	1,289,336,252
1977	92,376,573	1,296,758,199
1978	99,917,523	1,304,180,198
1979	107,458,470	1,311,602,248
1980	114,999,421	1,319,024,363
1981	122,540,357	1,326,446,317
1982	130,081,302	1,333,686,303
1983	137,622,248	1,341,290,185
1984	145,163,202	1,348,712,302
1985	152,704,140	1,356,134,278
1986	160,245,074	1,363,556,343
1987	167,786,030	1,370,978,262
1988	175,326,970	1,390,334,510
1989	182,867,916	1,409,690,693
1990	190,408,869	1,429,046,923
1991	197,949,808	1,454,007,592
1992	205,490,749	1,478,968,217
1993	213,031,707	1,503,928,793
1994	220,572,649	1,558,368,924
1995	228,113,596	1,612,684,936
1996	235,654,521	1,666,705,087
1997	243,195,481	1,670,031,772
1998	250,736,414	1,671,290,139
1999	258,159,525	1,669,234,443
2000	265,582,657	1,664,722,577
2001	273,547,835	1,666,868,187
2002	281,512,965	1,665,099,320
2003	289,478,093	1,659,719,994
2004	297,443,197	1,651,597,210
2005	305,408,463	1,641,941,981
2006	313,420,594	1,631,847,790
2007	321,432,801	1,621,977,436
Heat content used for conversion to btu:	138,700 btu/gallon	125,000 btu/gallon

Pipeline

The sum of natural gas, crude petroleum and petroleum product, and coal slurry and water.

Natural Gas:

The amount of natural gas used to transport natural gas was defined as "pipeline fuel" as reported in DOE, EIA, *Natural Gas Annual 2007*, Table 1. Cubic feet were converted to Btu using 1,031 Btu/ft^3. Electricity use was estimated using the following procedure as reported on p. 5-110 of J. N. Hooker et al., *End Use Energy Consumption DataBase: Transportation Sector*. The energy consumption of a natural gas pipeline was taken to be the energy content of the fuel used to drive the pumps. Some 94% of the installed pumping horsepower was supplied by natural gas. The remaining 6% of the horse power was generated more efficiently, mostly by electric motors. The energy consumed by natural gas pipeline pumps that were electrically powered was not known. In order to estimate the electricity consumed, the Btu of natural gas pipeline fuel consumed was multiplied by a factor of 0.015. From this computed value, electricity efficiency and generation loss must be taken into account. The electricity energy use in Btu must be converted to kWhr, using the conversion factor 29.305 x 10^{-5} kWhr/Btu. Electricity generation and distribution efficiency was 29%. When generation and distribution efficiency are taken into account, 1 kWhr equals 10,339 Btu.

Crude petroleum and petroleum product:

J. N. Hooker, *Oil Pipeline Energy Consumption and Efficiency*, ORNL-5697, ORNL, Oak Ridge, TN, 1981. (Data held constant; Latest available data.)

Coal slurry and water:

W. F. Banks, Systems, Science and Software, *Energy Consumption in the Pipeline Industry*, LaJolla, CA, October 1977. (Data held constant; Latest available data.)

Table A.11
Pipeline Fuel Use

Year	Natural gas (million cubic feet)	Estimated natural gas pipeline electricity use (million kWhr)	Electricity constant (trillion btu)
1970	722,166	3,272.9	212.1
1971	742,592	3,365.4	212.1
1972	766,156	3,472.2	212.1
1973	728,177	3,300.1	212.1
1974	668,792	3,031.0	212.1
1975	582,963	2,642.0	212.1
1976	548,323	2,485.0	212.1
1977	532,669	2,414.1	212.1
1978	530,451	2,404.0	212.1
1979	600,964	2,723.6	212.1
1980	634,622	2,876.1	212.1
1981	642,325	2,911.0	212.1
1982	596,411	2,703.0	212.1
1983	490,042	2,220.9	212.1
1984	528,754	2,396.3	212.1
1985	503,766	2,283.1	212.1
1986	485,041	2,198.2	212.1
1987	519,170	2,352.9	212.1
1988	613,912	2,782.3	212.1
1989	629,308	2,852.0	212.1
1990	659,816	2,990.3	212.1
1991	601,305	2,725.1	212.1
1992	587,710	2,663.5	212.1
1993	624,308	2,829.4	212.1
1994	685,362	3,106.1	212.1
1995	700,335	3,173.9	212.1
1996	711,446	3,224.3	212.1
1997	751,470	3,405.7	212.1
1998	635,477	2,880.0	212.1
1999	645,319	2,924.6	212.1
2000	642,210	2,910.5	212.1
2001	624,964	2,832.3	212.1
2002	666,920	3,022.5	212.1
2003	591,492	2,680.7	212.1
2004	566,187	2,566.0	212.1
2005	584,026	2,646.8	212.1
2006	584,213	2,647.7	212.1
2007	622,893	2,823.0	212.1
Heat content used for conversion to btu:	1,031 btu/cubic foot	10,339 Btu/kWhr	

Note: Formula for estimating electricity use for natural gas pipelines is:
Natural gas use (in million cubic ft) × 1,031 btu/cubic ft × 0.015 × 29.305 ×10^{-5} kWhr/btu

Rail

Freight:

AAR, *Railroad Facts*, 2008 Edition, Washington, DC, 2008.

Table A.12
Class I Freight Railroad
Fuel Use

Year	Diesel fuel (thousand gallons)
1970	3,807,663
1971	3,822,907
1972	3,996,985
1973	4,160,730
1974	4,175,375
1975	3,736,484
1976	3,895,542
1977	3,985,069
1978	3,968,007
1979	4,072,187
1980	3,955,996
1981	3,756,439
1982	3,178,116
1983	3,137,295
1984	3,388,173
1985	3,144,190
1986	3,039,069
1987	3,102,227
1988	3,182,267
1989	3,190,815
1990	3,134,446
1991	2,925,970
1992	3,022,108
1993	3,111,981
1994	3,355,802
1995	3,503,096
1996	3,600,649
1997	3,602,793
1998	3,619,341
1999	3,749,428
2000	3,720,107
2001	3,729,985
2002	3,751,413
2003	3,849,229
2004	4,082,236
2005	4,119,879
2006	4,214,459
2007	4,087,405
Heat content used for conversion to btu:	138,700 Btu/gallon

Passenger:

Commuter - APTA, *Public Transportation Fact Book*, 2008, Washington, DC, 2008.

Table A.13
Commuter Rail Fuel Use

Year	Diesel (thousand gallons)	Electricity (million kWhr)
1984	58,320	901
1985	55,372	1,043
1986	54,608	1,170
1987	51,594	1,155
1988	53,054	1,195
1989	52,516	1,293
1990	52,681	1,226
1991	54,315	1,239
1992	54,951	1,124
1993	59,766	1,196
1994	61,900	1,244
1995	63,064	1,253
1996	61,888	1,255
1997	63,195	1,270
1998	69,200	1,299
1999	73,005	1,322
2000	70,818	1,370
2001	72,204	1,354
2002	72,847	1,334
2003	72,264	1,383
2004	71,999	1,449
2005	76,714	1,484
2006	78,600	1,478
2007	80,700	1,763
Heat content used for conversion to btu:	138,700 Btu/gallon	10,339 Btu/kWhr

Transit – APTA, *Public Transportation Fact Book*, 2008, Washington, DC, 2008. Includes light rail and heavy rail.

Table A.14
Transit Rail Fuel Use

	Electricity (million kWhr)		
Year	Light rail	Heavy rail	Total
1970			2,561
1971			2,556
1972			2,428
1973			2,331
1974			2,630
1975			2,646
1976	Light rail and heavy rail data are not available separately from 1970 to 1985.		2,576
1977			2,303
1978			2,223
1979			2,473
1980			2,446
1981			2,655
1982			2,722
1983			2,930
1984			3,092
1985			2,928
1986	173	3,066	3,239
1987	191	3,219	3,410
1988	243	3,256	3,499
1989	242	3,286	3,528
1990	239	3,284	3,523
1991	274	3,248	3,522
1992	297	3,193	3,490
1993	281	3,287	3,568
1994	282	3,431	3,713
1995	288	3,401	3,689
1996	321	3,322	3,643
1997	361	3,253	3,614
1998	381	3,280	3,661
1999	416	3,385	3,801
2000	463	3,549	4,012
2001	487	3,646	4,133
2002	510	3,683	4,193
2003	507	3,632	4,138
2004	553	3,684	4,237
2005	571	3,769	4,430
2006	634	3,709	4,343
2007	687	3,817	4,505
Heat content used for conversion to btu:	10,339 Btu/kWhr	10,339 Btu/kWhr	10,339 Btu/kWhr

Intercity – Personal communication with Amtrak, Washington, DC, 2009.

Table A.15
Intercity Rail Fuel Use

Year	Diesel fuel (thousand gallons)	Electricity (thousand kWhr)
1994	73,516	308,948
1995	72,371	335,818
1996	71,226	362,689
1997	75,656	389,559
1998	75,999	416,429
1999	79,173	443,300
2000	94,968	470,170
2001	96,846	455,703
2002	84,432	518,306
2003	74,621	536,950
2004	68,605	550,695
2005	65,477	531,377
2006	62,463	548,856
2007	61,824	577,864
Heat content used for conversion to btu:	138,700 Btu/gallon	10,339 Btu/kWhr

Calculation of Million Barrels per Day Crude Oil Equivalent

One gallon of gasoline, diesel fuel, or lpg is estimated to be the equivalent of one gallon of crude oil. Petroleum used for electricity was calculated using the following formula:

({[(BTU*S)/G]/P }/365)/1000

BTU = Btus of electricity from Table 2.4
S = Share of petroleum used in making primary electricity (Calculated from Table 2.6 from the EIA, *Monthly Energy Review*)
G = Electricity generation and distribution (assumed 29%)
P = Btus per barrel of petroleum product (Table A3 from the EIA, *Monthly Energy Review*).

Passenger Travel and Energy Use

Automobiles

Number of vehicles, vehicle-miles – DOT, FHWA, *Highway Statistics, 2007*, Table VM-1. Data series shown in Table 4.1.
Passenger-miles – Vehicle-miles multiplied by an average load factor.
Load factor – 2001 NHTS shows automobile load factor as 1.1 persons per vehicle.
Energy intensities –
***Btu per vehicle-mile* –** Automobile energy use divided by vehicle-miles.
***Btu per passenger-mile* –** Automobile energy use divided by passenger-miles.
Energy use – See Energy Use Sources, p. A-4. Data series shown in Table 2.7.

Light trucks

Number of vehicles, vehicle-miles – DOT, FHWA, *Highway Statistics 2007*, Table VM-1. Data by truck type were multiplied by the shares of trucks/truck travel which are for personal use (Table A.16).
Passenger-miles – Vehicle-miles multiplied by an average load factor.
Load factor – 2001 NHTS shows personal light truck load factor as 1.72 persons per vehicle.
Energy intensities -
***Btu per vehicle-mile* –** Personal light truck energy use divided by personal light truck vehicle-miles.
***Btu per passenger-mile* –** Personal light truck energy use divided by personal light truck passenger-miles.
Energy use – See Energy Use Sources, p. A-7, A-8 (light trucks, medium/heavy trucks). Data by truck type were multiplied by the shares of truck fuel use which are for personal use (Table A.16) which were derived by ORNL from the 2002 VIUS Micro Data File on CD.

Table A.16
Share of Trucks, Truck Travel,
and Fuel Use for Personal Travel

Personal trucks	
85.6%	2-axle, 4-tire trucks
26.9%	Other single-unit and combination trucks
Personal truck travel	
80.9%	2-axle, 4-tire trucks
13.1%	Other single-unit and combination trucks
Personal truck fuel use	
78.0%	2-axle, 4-tire trucks
6.0%	Other single-unit and combination trucks

Note:
Since these shares come from the 2002 VIUS, they may underestimate the amount of personal trucks, truck travel, and energy use for 2007.

Motorcycles

Number of vehicles, vehicle-miles – DOT, FHWA, *Highway Statistics 2007* Table VM-1.
Passenger-miles – Vehicle-miles multiplied by an average load factor.
Load factor - 2001 NHTS shows motorcycle load factor as 1.22 persons per vehicle.
Energy intensities –
Btu per vehicle-mile **–** Motorcycle energy use divided by vehicle-miles.
Btu per passenger-mile **–** Motorcycle energy use divided by passenger-miles.
Energy use – See Energy Use Sources, p. A-5. Data series shown in Table 2.7.

Demand Response

Number of vehicles, vehicle-miles, passenger-miles – APTA, *2009 Public Transportation Fact Book*, Washington, DC, 2009.
Load factor – Passenger-miles divided by vehicle-miles.
Energy intensities –
Btu per vehicle-mile **–** Energy use divided by vehicle-miles.
Btu per passenger-mile **–** Energy use divided by passenger-miles.
Energy use – APTA, *2009 Public Transportation Fact Book*, Washington, DC, 2009.

Vanpool

Number of vehicles, vehicle-miles, passenger-miles – APTA, *2009 Public Transportation Fact Book*, Washington, DC, 2009.
Load factor – Passenger-miles divided by vehicle-miles.
Energy intensities –
Btu per vehicle-mile **–** Energy use divided by vehicle-miles.
Btu per passenger-mile **–** Energy use divided by passenger-miles.
Energy use – APTA, *2009 Public Transportation Fact Book*, Washington, DC, 2009.

Buses

Transit

Number of vehicles, vehicle-miles, passenger-miles – APTA, *2009 Public Transportation Fact Book*, Washington, DC, 2009. Data series shown on Table 5.14.
Load factor – Passenger-miles divided by vehicle-miles.
Energy intensities –
Btu per vehicle-mile **–** Transit bus energy use divided by transit bus vehicle-miles.
Btu per passenger-mile **–** Transit bus energy use divided by transit bus passenger-miles.
Energy use - See Energy Use Sources, p. A-5. Data series shown in Table 5.14.

Intercity

Energy use – See Energy Use Sources, p. A-6. Because the 2001and 2002 data are not available, the rate of change in bus VMT from FHWA, *Highway Statistics 2007,* was used to estimate the change in energy use.

School

Number of vehicles – DOT, FHWA, *Highway Statistics 2007*, Table MV-10.

Energy use – See Energy Use Sources, p. A-5. Because the data past 2000 are not available, the rate of change in bus VMT from FHWA, *Highway Statistics 2007,*was used to estimate the change in energy use.

Air

Certificated air carriers

Aircraft-miles, passenger-miles – DOT, BTS, *Air Carrier Traffic Statistics*, www.bts.gov/programs/airline_information/air_carrier_traffic_statistics, Washington, DC.

Load factor – Passenger-miles divided by aircraft-miles.

Energy intensities -

***Btu per passenger-mile* –** Certificated air carrier energy use divided by passenger-miles.

Energy use – See Energy Use Sources, p. A-11. All of domestic fuel use and half of international fuel use was considered to be domestic use.

Note: These data differ from the data in Table 9.2 because that table contains data on ALL domestic AND international air carrier energy use and passenger-miles.

General aviation

Number of vehicles – DOT, FAA, *General Aviation Activity and Avionics Survey: Calendar Year 2007* Data series shown in Table 9.3.

Energy intensities –

***Btu per passenger-mile* –** General aviation energy use divided by passenger-miles.

Energy use – See Energy Use Sources, p. A-10. Data series shown in Table 9.3.

Recreational boating

Number of vehicles and energy use – U.S. EPA, NONROAD2005 model.

Rail

Intercity

Number of vehicles, vehicle-miles, passenger-miles – AAR, *Railroad Facts, 2008 Edition*, Washington, DC, 2008.
Load factor – Passenger-miles divided by vehicle-miles.
Energy Intensities -
***Btu per vehicle-mile* –** Intercity rail energy use divided by vehicle-miles.
***Btu per passenger-mile* –** Intercity rail energy use divided by passenger-miles.
Energy use - See Energy Use Sources, p. A-19. Data series shown in Table 9.10.

Transit

Number of vehicles, vehicle-miles, passenger-miles – APTA, *2009 Public Transportation Fact Book*, Washington, DC, 2009. Sum of light and heavy rail transit. Data series shown on Table 9.12.
Load factor – Passenger-miles divided by vehicle-miles.
Energy intensities –
***Btu per vehicle-mile* –** Light and heavy transit rail energy use divided by vehicle-miles.
***Btu per passenger-mile* –** Light and heavy transit rail energy use divided by passenger-miles.
Energy use – See Energy Use Sources, p. A-18. Data series shown in Table 9.12.

Commuter

Number of vehicles, vehicle-miles, passenger-miles – APTA, *2009 Public Transportation Fact Book*, Washington, DC, 2009. Data series shown on Table 9.11.
Load factor – Passenger-miles divided by vehicle-miles.
Energy intensities –
***Btu per vehicle-mile* –** Commuter rail energy use divided by vehicle-miles.
***Btu per passenger-mile* –** Commuter rail energy use divided by passenger-miles.
Energy use – See Energy Use Sources, p. A-17. Data series shown in Table 9.11.

Highway Passenger Mode Energy Intensities

Automobiles

Btu per vehicle-mile – Automobile energy use divided by automobile vehicle miles of travel.
***Energy use* –** See Energy Use Sources, p. A-4. Data series shown in Table 2.7.
***Vehicle-miles* –** DOT, FHWA, *Highway Statistics 2007*, Table VM-1 and annual editions back to 1996; DOT, FHWA, *Highway Statistics Summary to 1995.* Data series shown in Table 4.1.

Btu per passenger-mile – Automobile energy use divided by automobile passenger-miles.
***Energy use* –** See Energy Use Sources, p. A-4. Data series shown in Table 2.7.
***Passenger miles* –** Vehicle miles multiplied by an average load factor.
***Vehicle-miles* –** DOT, FHWA, *Highway Statistics 2007*, Table VM-1 and annual editions back to 1996; DOT, FHWA, *Highway Statistics Summary to 1995.* Data series shown in Table 4.1.
***Load factor* –** NPTS 1969, 1977, 1983/84, 1990, and 1995, and NHTS 2001.

Table A.17
Automobile Load Factor used to calculate Passenger-Miles

Year	Source	Load Factor
1970	1969 NPTS	1.90
1971	Interpolated	1.90
1972	Interpolated	1.90
1973	Interpolated	1.90
1974	Interpolated	1.90
1975	Interpolated	1.90
1976	Interpolated	1.90
1977	1977 NPTS	1.90
1978	Interpolated	1.88
1979	Interpolated	1.87
1980	Interpolated	1.85
1981	Interpolated	1.83
1982	Interpolated	1.82
1983	1983/84 NPTS	1.80
1984	Interpolated	1.77
1985	Interpolated	1.74
1986	Interpolated	1.71
1987	Interpolated	1.69
1988	Interpolated	1.66
1989	Interpolated	1.63
1990	1990 NPTS	1.60
1991	Interpolated	1.60
1992	Interpolated	1.60
1993	Interpolated	1.60
1994	Interpolated	1.60
1995	1995 NPTS	1.60
1996	Interpolated	1.60
1997	Interpolated	1.59
1998	Interpolated	1.59
1999	Interpolated	1.58
2000	Interpolated	1.58
2001	2001 NHTS	1.57
2002	2001 NHTS	1.57
2003	2001 NHTS	1.57
2004	2001 NHTS	1.57
2005	2001 NHTS	1.57
2006	2001 NHTS	1.57
2007	2001 NHTS	1.57

Light trucks

Btu per vehicle-mile – Light truck energy use divided by light truck vehicle miles of travel.
Energy use – See Energy Use Sources, p. A-7. Data series shown in Table 2.7.
Vehicle-miles – DOT, FHWA, *Highway Statistics 2007*, Table VM-1 and annual editions back to 1996; DOT, FHWA, *Highway Statistics Summary to 1995.* Data series shown in Table 4.2.

Buses

Transit

Btu per vehicle-mile – Transit bus energy use divided by transit bus vehicle-miles.
Energy use – See Energy Use Sources, p. A-5. Data series shown in Table 5.14.
Vehicle-miles – APTA, *2009 Public Transportation Fact Book*, Washington, DC, 2009. Data series shown on Table 5.14.

Btu per passenger-mile – Transit bus energy use divided by transit bus passenger-miles.
Energy use – See Energy Use Sources, p. A-5. Data series shown in Table 5.14.
Passenger-miles – APTA, *2009 Public Transportation Fact Book*, Washington, DC, 2009. Data series shown on Table 5.14.

Intercity

Btu per passenger-mile – Intercity bus energy use divided by intercity bus passenger-miles.
Energy use – See Energy Use Sources, p. A-6 . Because the data past 2000 are not available, the rate of change in bus VMT from FHWA, *Highway Statistics 2007,* was used to estimate the change in energy use.
Passenger-miles – (Data past 2000 are not available.) Eno Foundation for Transportation, *Transportation in America 2001*, Nineteenth edition, Washington, DC.

Nonhighway Mode Energy Intensities

Air

Certificated air carriers

Btu per passenger-mile – Certificated air carrier energy use divided by passenger-miles.

Energy use – See Energy Use Sources, p. A-11. All of domestic fuel use and half of international fuel use was considered to be domestic use.

Passenger-miles – DOT, BTS, *Air Carrier Traffic Statistics*, www.bts.gov/programs/airline_information/air_carrier_traffic_statistics, Washington, DC. Pre-1994 data are from various editions of the *FAA Statistical Handbook of Aviation* (no longer published). Scheduled service passenger-miles of domestic air carriers and half of international air carriers were used to coincide with fuel use.

Note: These data differ from the data in Table 9.2 because that table contains data on ALL domestic AND international air carrier energy use and passenger-miles.

General aviation

Btu per passenger-mile – General aviation energy use divided by passenger-miles.

Energy use – See Energy Use Sources, p. A-10. Data series shown in Table 9.3.

Passenger-miles – (Data past 2000 not available.) Eno Foundation for Transportation, *Transportation in America 2001*, Nineteenth edition, Washington, DC.

Rail

Intercity

Btu per passenger-mile – Intercity rail energy use divided by passenger-miles.

Energy use – See Energy Use Sources, p. A-19. Data series shown in Table 9.10.

Passenger-miles – AAR, *Railroad Facts, 2008 Edition*, and previous annual editions.

Transit

Btu per passenger-mile – Transit rail energy use divided by passenger-miles.

Energy use – See Energy Use Sources, p. A-18. Data series shown in Table 9.12.

Passenger-miles – APTA, *2009 Public Transportation Fact Book*, Washington, DC, 2009. Data series shown on Table 9.12.

Commuter

Btu per passenger-mile – Commuter rail energy use divided by passenger-miles.

Energy use – See Energy Use Sources, p. A-17. Data series shown in Table 9.11.

Passenger-miles – APTA, *2009 Public Transportation Fact Book*, Washington, DC, 2009. Data series shown on Table 9.11.

Freight Movement and Energy Use

Rail

Number of locomotives, ton-miles, tons shipped, average length of haul – AAR, *Railroad Facts, 2008 Edition*, Washington, DC, 2008. Data series shown in Table 9.8.
Energy intensity – Class I rail energy use divided by freight car-miles.
Energy use – See Energy Use Sources, p. A-16. Data series shown in Table 9.8.

Water

Number of vehicles – U.S. Department of the Army, Army Corps of Engineers, "Summary of U.S. Flag Passenger and Cargo Vessels, 2006," New Orleans, LA, 2003.
Ton-miles, tons shipped, average length of haul – U.S. Department of the Army, Army Corps of Engineers, *Waterborne Commerce of the United States, Calendar Year 2006*, Part 5: National Summaries, New Orleans, LA, 2006. Data series shown in Table 9.5.
Btu per ton-mile – Domestic waterborne commerce energy use divided by ton-miles.
Energy use – See Energy Use Sources, p. A-12. Data series shown in Table 9.5.

Freight Mode Energy Intensities

Truck

Btu per vehicle-mile – Heavy single-unit and combination truck energy use divided by vehicle miles

Energy use – See Energy Use Sources (medium/heavy trucks), p. A-8.

Vehicle-miles – DOT, FHWA, *Highway Statistics 2007*, Table VM-1 and annual editions back to 1996; DOT, FHWA, *Highway Statistics Summary to 1995.* Data series is the total of vehicle travel data on Tables 5.1 and 5.2.

Rail

Btu per freight car-mile – Class I rail energy use divided by freight car-miles.

Energy use – See Energy Use Sources, p. A-16. Data series shown in Table 9.8.

Freight car miles – AAR, *Railroad Facts, 2008 Edition*, Washington, DC, 2008. Data series shown in Table 9.8.

Btu per ton-mile – Class I rail energy use divided by ton-miles.

Energy use – See Energy Use Sources, p. A-16. Data series shown in Table 9.8.

Ton-miles – AAR, *Railroad Facts, 2008 Edition*, Washington, DC, 2008. Data series shown in Table 9.8.

Water

Btu per ton-mile – Domestic waterborne commerce energy use divided by ton-miles.

Energy use – See Energy Use Sources, p. A-12. Data series shown in Table 9.5.

Ton-miles – U.S. Department of the Army, Army Corps of Engineers, *Waterborne Commerce of the United States, Calendar Year 2006*, Part 5: National Summaries, New Orleans, LA, 2006. Data series shown in Table 9.5. Ton miles for 2006 were used since data were unavailable for 2007.

APPENDIX B

CONVERSIONS

CONVERSIONS

A Note About Heating Values

The heat content of a fuel is the quantity of energy released by burning a unit amount of that fuel. However, this value is not absolute and can vary according to several factors. For example, empirical formulae for determining the heating value of liquid fuels depend on the fuels' American Petroleum Institute (API) gravity. The API gravity varies depending on the percent by weight of the chemical constituents and impurities in the fuel, both of which are affected by the combination of raw materials used to produce the fuel and by the type of manufacturing process. Temperature and climatic conditions are also factors.

Because of these variations, the heating values in Table B.4 may differ from values in other publications. The figures in this report are representative or average values, not absolute ones. The gross (higher) heating values used here agree with those used by the Energy Information Administration (EIA).

Heating values fall into two categories, usually referred to as "higher" (or gross) and "lower" (or net). If the products of fuel combustion are cooled back to the initial fuel-air or fuel-oxidizer mixture temperature and the water formed during combustion is condensed, the energy released by the process is the higher (gross) heating value. If the products of combustion are cooled to the initial fuel-air temperature, but the water is considered to remain as a vapor, the energy released by the process is lower (net) heating value. Usually the difference between the gross and net heating values for fuels used in transportation is around 5 to 8 percent; however, it is important to be consistent in their use.

Table B.1
Hydrogen Heat Content

1 kilogram hydrogen =	
Higher heating value	Lower heating value
134,200 Btu	113,400 Btu
39.3 kWhr	33.2 kWhr
141,600 kJ	119,600 kJ
33,800 kCal	28,560 kCal

Table B.2
Hydrogen Conversions

	Weight		Gas		Liquid	
	Pounds (lb)	Kilograms (kg)	Standard cubic feet (SCF)	Normal cubic meter (Nm^3)	Gallons (gal)	Liters (L)
1 lb	1.0	0.4536	192.00	5.047	1.6928	6.408
1 kg	2.205	1.0	423.3	11.126	3.733	14.128
1 SCF gas	0.005209	0.002363	1.0	0.02628	0.008820	0.0339
1 Nm^3 gas	0.19815	0.08988	38.04	1.0	0.3355	1.2699
1 gal liquid	0.5906	0.2679	113.41	2.981	1.0	3.785
1 L liquid	0.15604	0.07078	29.99	0.77881	0.2642	1.0

Table B.3
Pressure Conversions

	Bar	Atmosphere	lb/in^2 (or psi)
Bar	1.0	0.987	14.5
Atmoshpere	1.013	1.0	14.696
lb/in^2 (or psi)	0.0689	0.0680	1.0

Table B.4
Heat Content for Various Fuels

Conventional gasoline	125,000 Btu/gal(gross) = 115,400 Btu/gal(net)
Hydrogen	134,200 Btu/kg(gross) = 113,400 Btu/kg(net)
Diesel motor fuel	138,700 Btu/gal (gross) = 128,700 Btu/gal (net)
Biodiesel	126,206 Btu/gal (gross) = 117,093 Btu/gal (net)
Methanol	64,600 Btu/gal (gross) = 56,560 Btu/gal (net)
Ethanol	84,600 Btu/gal (gross) = 75,670 Btu/gal (net)
Gasohol	120,900 Btu/gal (gross) = 112,417 Btu/gal (net)
E85	90,660 Btu/gal (gross) = 81,630 Btu/gal (net
Aviation gasoline	120,200 Btu/gal (gross) = 112,000 Btu/gal (net)
Propane	91,300 Btu/gal (gross) = 83,500 Btu/gal (net)
Butane	103,000 Btu/gal (gross) = 93,000 Btu/gal (net)
Jet fuel (naphtha)	127,500 Btu/gal (gross) = 118,700 Btu/gal (net)
Jet fuel (kerosene)	135,000 Btu/gal (gross) = 128,100 Btu/gal (net)
Lubricants	144,400 Btu/gal (gross) = 130,900 Btu/gal (net)
Waxes	131,800 Btu/gal (gross) = 120,200 Btu/gal (net)
Asphalt and road oil	158,000 Btu/gal (gross) = 157,700 Btu/gal (net)
Natural gas	
Wet	1,109 Btu/ft^3
Dry	1,027 Btu/ft^3
Compressed	20,551 Btu/pound 960 Btu/cubic foot
Liquid	90,800 Btu/gal (gross) = 87,600 Btu/gal (net)
Crude petroleum	138,100 Btu/gal (gross) = 131,800 Btu/gal (net)
Fuel Oils	
Residual	149,700 Btu/gal (gross) = 138,400 Btu/gal (net)
Distillate	138,700 Btu/gal (gross) = 131,800 Btu/gal (net)
Coal	
Anthracite - Consumption	21.711 x 10^6 Btu/short ton
Bituminous and lignite - Consumption	21.012 x 10^6 Btu/short ton
Production average	21.352 x 10^6 Btu/short ton
Consumption average	21.015 x 10^6 Btu/short ton

Table B.5
Fuel Equivalents

1 million bbl crude oil/day	= 0.365 billion bbl crude oil/year
	= 2.117 quadrillion Btu/year
	= 105.914 million short tons coal/year
	= 96.085 million metric tons coal/year
	= 2.059 trillion ft^3 natural gas/year
	= 2.233 exajoules/year
1 billion bbl crude oil/year	= 2.740 million bbl crude oil/day
	= 5.800 quadrillion Btu/year
	= 290.174 million short tons coal/year
	= 263.246 million metric tons coal/year
	= 5.642 trillion ft^3 natural gas/year
	= 6.119 exajoules/year
1 quadrillion Btu/year	= 0.5219 gasoline gallon equivalents
	= 0.472 million bbl crude oil/day
	= 172.414 million bbl crude oil/year
	= 50.030 million short tons coal/year
	= 45.387 million metric tons coal/year
	= 972.763 billion ft^3 natural gas/year
	= 1.055 exajoules/year
1 billion short tons coal/year	= 0.907 billion metric tons coal/year
	= 9.442 million bbl crude oil/day
	= 3.446 billion bbl crude oil/year
	= 19.988 quadrillion Btu/year
	= 19.444 trillion ft^3 natural gas/year
	= 21.087 exajoules/year
1 billion metric tons coal/year	= 1.102 billion short tons coal/year
	= 8.565 million bbl crude oi l/day
	= 3.126 billion bbl crude oil/year
	= 18.133 quadrillion btu/year
	= 17.639 trillion ft^3 natural gas/year
	= 19.130 exajoules/year
1 trillion ft^3 natural gas/year	= 0.486 million bbl crude oil/day
	= 0.177 billion bbl crude oil/year
	= 1.028 quadrillion Btu/year
	= 51.431 million short tons coal/year
	= 46.658 million metric tons coal/year
	= 1.085 exajoules/year
1 exajoule/year	= 447.741 thousand bbl crude oil/day
	= 163.425 million bbl crude oil/year
	= 0.948 quadrillion Btu/year
	= 47.421 million short tons coal/year
	= 43.021 million metric tons coal/year
	= 0.922 trillion ft^3 natural gas/year

Table B.6
Energy Unit Conversions

1 Btu	= 778.2 ft-lb	1 kWhr	= 3412 Btu[a]
	= 107.6 kg-m		= 2.655×10^{6} ft-lb
	= 1055 J		= 3.671×10^{5} kg-m
	= 39.30×10^{-5} hp-h		= 3.600×10^{6} J
	= 39.85×10^{-5} metric hp-h		= 1.341 hp-h
	= 29.31×10^{-5} kWhr		= 1.360 metric hp-h
1 kg-m	= 92.95×10^{-4} Btu	1 Joule	= 94.78×10^{-5} Btu
	= 7.233 ft-lb		= 0.7376 ft-lb
	= 9.806 J		= 0.1020 kg-m
	= 36.53×10^{-7} hp-h		= 37.25×10^{-8} hp-h
	= 37.04×10^{-7} metric hp-h		= 37.77×10^{-8} metric hp-h
	= 27.24×10^{-7} kWhr		= 27.78×10^{-8} kWhr
1 hp-h	= 2544 Btu	1 metric hp-h	= 2510 Btu
	= 1.98×10^{6} ft-lb		= 1.953×10^{6} ft-lb
	= 2.738×10^{6} kgm		= 27.00×10^{4} kg-m
	= 2.685×10^{6} J		= 2.648×10^{6} J
	= 1.014 metric hp-h		= 0.9863 hp-h
	= 0.7475 kWhr		= 0.7355 kWhr

[a]This figure does not take into account the fact that electricity generation and distribution efficiency is approximately 33%. If generation and distribution efficiency are taken into account, 1 kWhr = 10,339 Btu.

Table B.7
International Energy Conversions

To:	Terajoules	Giga-calories	Million tonnes of oil equivalent	Million Btu	Gigawatt-hours
From:	*multiply by:*				
Terajoules	1	238.8	2.388×10^{-5}	947.8	0.2778
Gigacalories	4.1868×10^{-3}	1	10^{-7}	3.968	1.163×10^{-3}
Million tonnes of oil equivalent	4.1868×10^{4}	10^{7}	1	3.968×10^{7}	11,630
Million Btu	1.0551×10^{-3}	0.252	$2.52 \text{ X } 10^{-8}$	1	2.931×10^{-4}
Gigawatthours	3.6	860	8.6×10^{-5}	3412	1

Table B.8
Distance and Velocity Conversions

1 in.	= 83.33 x 10^{-3} ft	1 ft	= 12.0 in.
	= 27.78 x 10^{-3} yd		= 0.33 yd
	= 15.78 x 10^{-6} mile		= 189.4 x 10^{-3} mile
	= 25.40 x 10^{-3} m		= 0.3048 m
	= 0.2540 x 10^{-6} km		= 0.3048 x 10^{-3} km
1 mile	= 63360 in.	1 km	= 39370 in.
	= 5280 ft		= 3281 ft
	= 1760 yd		= 1093.6 yd
	= 1609 m		= 0.6214 mile
	= 1.609 km		= 1000 m

1 ft/sec = 0.3048 m/s = 0.6818 mph = 1.0972 km/h
1 m/sec = 3.281 ft/s = 2.237 mph = 3.600 km/h
1 km/h = 0.9114 ft/s = 0.2778 m/s = 0.6214 mph
1 mph = 1.467 ft/s = 0.4469 m/s = 1.609 km/h

Table B.9
Alternative Measures of Greenhouse Gases

1 pound methane, measured in carbon units (CH_4)	=	1.333 pounds methane, measured at full molecular weight (CH_4)
1 pound carbon dioxide, measured in carbon units (CO_2-C)	=	3.6667 pounds carbon dioxide, measured at full molecular weight (CO_2)
1 pound carbon monoxide, measured in carbon units (CO-C)	=	2.333 pounds carbon monoxide, measured at full molecular weight (CO)
1 pound nitrous oxide, measured in nitrogen units (N_2O-N)	=	1.571 pounds nitrous oxide, measured at full molecular weight (N_2O)

Table B.10
Volume and Flow Rate Conversions[a]

1 U.S. gal	= 231 $in.^3$	1 liter	= 61.02 $in.^3$
	= 0.1337 ft^3		= 3.531 x 10^{-2} ft^3
	= 3.785 liters		= 0.2624 U.S. gal
	= 0.8321 imperial gal		= 0.2200 imperial gal
	= 0.0238 bbl		= 6.29 x 10^{-3} bbl
	= 0.003785 m^3		= 0.001 m^3
A U.S. gallon of gasoline weighs 6.2 pounds			
1 imperial gal	= 277.4 $in.^3$	1 bbl	= 9702 $in.^3$
	= 0.1606 ft^3		= 5.615 ft^3
	= 4.545 liters		= 158.97 liters
	= 1.201 U.S. gal		= 42 U.S. gal
	= 0.0286 bbl		= 34.97 imperial gal
	= 0.004546 m^3		= 0.15897 m^3
1 U.S. gal/hr	= 3.209 ft^3/day		= 1171 ft^3/year
	= 90.84 liter/day		= 33157 liter/year
	= 19.97 imperial gal/day		= 7289 imperial gal/year
	= 0.5712 bbl/day		= 207.92 bbl/year
For Imperial gallons, multiply above values by 1.201			
1 liter/hr	= 0.8474 ft^3/day		= 309.3 ft^3/year
	= 6.298 U.S. gal/day		= 2299 U.S. gal/year
	= 5.28 imperial gal/day		= 1927 imperial gal/year
	= 0.1510 bbl/day		= 55.10 bbl/year
1 bbl/hr	= 137.8 ft^3/year		= 49187 ft^3 year
	= 1008 U.S. gal/day		= 3.679 x 10^5 U.S. gal/year
	= 839.3 imperial gal/day		= 3.063 x 10^5 imperial gal/year
	= 3815 liter/day		= 1.393 x 10^6 liter/day

[a]The conversions for flow rates are identical to those for volume measures, if the time units are identical.

Table B.11
Power Conversions

FROM	TO: Horsepower	Kilowatts	Metric horsepower	Ft-lb per sec	Kilocalories per sec	Btu per sec
Horsepower	1	0.7457	1.014	550	0.1781	0.7068
Kilowatts	1.341	1	1.360	737.6	0.239	0.9478
Metric horsepower	0.9863	0.7355	1	542.5	0.1757	0.6971
Ft-lb per sec	1.36×10^{-3}	1.356×10^{-3}	1.84×10^{-3}	1	0.3238×10^{-3}	1.285×10^{-3}
Kilocalories per sec	5.615	4.184	5.692	3088	1	3.968
Btu per sec	1.415	1.055	1.434	778.2	0.2520	1

Table B.12
Mass Conversions

	TO				
FROM	Pound	Kilogram	Short ton	Long ton	Metric ton
Pound	1	0.4536	5.0×10^{-4}	4.4643×10^{-4}	4.5362×10^{-4}
Kilogram	2.205	1	1.1023×10^{-3}	9.8425×10^{-4}	1.0×10^{-3}
Short ton	2,000	907.2	1	0.8929	0.9072
Long ton	2,240	1,016	1.12	1	1.016
Metric ton	2,205	1,000	1.102	0.9842	1

Table B.13
Fuel Efficiency Conversions

MPG	Miles/liter	Kilometers/L	L/100 kilometers	Grams of CO_2 per mile[a]	Pounds of CO_2 per mile[a]
10	2.64	4.25	23.52	877.80	1.94
15	3.96	6.38	15.68	585.20	1.29
20	5.28	8.50	11.76	438.90	0.97
25	6.60	10.63	9.41	351.12	0.78
30	7.92	12.75	7.84	292.60	0.65
35	9.25	14.88	6.72	250.80	0.55
40	10.57	17.00	5.88	219.45	0.49
45	11.89	19.13	5.23	195.07	0.43
50	13.21	21.25	4.70	175.56	0.39
55	14.53	23.38	4.28	159.60	0.35
60	15.85	25.51	3.92	146.30	0.32
65	17.17	27.63	3.62	135.05	0.30
70	18.49	29.76	3.36	125.40	0.28
75	19.81	31.88	3.14	117.04	0.26
80	21.13	34.01	2.94	109.73	0.24
85	22.45	36.13	2.77	103.27	0.23
90	23.77	38.26	2.61	97.53	0.22
95	25.09	40.38	2.48	92.40	0.20
100	26.42	42.51	2.35	87.78	0.19
105	27.74	44.64	2.24	83.60	0.18
110	29.06	46.76	2.14	79.80	0.18
115	30.38	48.89	2.05	76.33	0.17
120	31.70	51.01	1.96	73.15	0.16
125	33.02	53.14	1.88	70.22	0.16
130	34.34	55.26	1.81	67.52	0.15
135	35.66	57.39	1.74	65.02	0.14
140	36.98	59.51	1.68	62.70	0.14
145	38.30	61.64	1.62	60.54	0.13
150	39.62	63.76	1.57	58.52	0.13
Formula	MPG/3.785	MPG/[3.785/1.609]	235.24/MPG	8,778/MPG	19.4/MPG

[a] For gasoline-fueled vehicles.

Table B.14
SI Prefixes and Their Values

	Value	Prefix	Symbol
One million million millionth	10^{-18}	atto	a
One thousand million millionth	10^{-15}	femto	f
One million millionth	10^{-12}	pico	p
One thousand millionth	10^{-9}	nano	n
One millionth	10^{-6}	micro	µ
One thousandth	10^{-3}	milli	m
One hundredth	10^{-2}	centi	c
One tenth	10^{-1}	deci	
One	10^{0}		
Ten	10^{1}	deca	
One hundred	10^{2}	hecto	
One thousand	10^{3}	kilo	k
One million	10^{6}	mega	M
One billion[a]	10^{9}	giga	G
One trillion[a]	10^{12}	tera	T
One quadrillion[a]	10^{15}	peta	P
One quintillion[a]	10^{18}	exa	E

[a]Care should be exercised in the use of this nomenclature, especially in foreign correspondence, as it is either unknown or carries a different value in other countries. A "billion," for example, signifies a value of 10^{12} in most other countries.

Table B.15
Metric Units and Abbreviations

Quantity	Unit name	Symbol
Energy	joule	J
Specific energy	joule/kilogram	J/kg
Specific energy consumption	joule/kilogram•kilometer	J/(kg•km)
Energy consumption	joule/kilometer	J/km
Energy economy	kilometer/kilojoule	km/kJ
Power	kilowatt	Kw
Specific power	watt/kilogram	W/kg
Power density	watt/meter^3	W/m^3
Speed	kilometer/hour	km/h
Acceleration	meter/second^2	m/s^2
Range (distance)	kilometer	km
Weight	kilogram	kg
Torque	newton•meter	N•m
Volume	meter^3	m^3
Mass; payload	kilogram	kg
Length; width	meter	m
Brake specific fuel consumption	kilogram/joule	kg/J
Fuel economy (heat engine)	liters/100 km	L/100 km

Table B.16
Carbon Coefficients, 2002
(Million metric tons carbon per quadrillion Btu)

Fuel Type	
Coal	
Coal (residential)	26.04
Coal (commercial)	26.04
Coal (industrial coking)	25.63
Coal (industrial other)	25.74
Coal (electric utility)	25.98
Natural gas	
Natural gas (pipeline)	14.47
Natural gas (flared)	14.92
Petroleum	
Asphalt and road oil	20.62
Aviation gasoline	18.87
Crude oil	20.30
Distillate fuel	19.95
Jet fuel	19.33
Kerosene	19.72
LPG	16.99
Lubricants	20.24
Motor gasoline	19.34
Petrochemical feed.	19.37
Petroleum coke	27.85
Residual fuel	21.49
Waxes	19.81

Note: All coefficients based on Higher Heating (Gross Calorific) Value and assume 100 percent combustion.

Conversion of Constant Dollar Values

Many types of information in this data book are expressed in dollars. Generally, constant dollars are used–that is, dollars of a fixed value for a specific year, such as 1990 dollars. Converting current dollars to constant dollars, or converting constant dollars for one year to constant dollars for another year, requires conversion factors (Table B.17 and B.18). Table B.17 shows conversion factors for the Consumer Price Index inflation factors. Table B.18 shows conversion factors using the Gross National Product inflation factors.

Table B.17
Consumer Price Inflation (CPI) Index

From:	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979
1970	1.000	1.044	1.077	1.144	1.271	1.387	1.466	1.562	1.680	1.871
1971	0.958	1.000	1.032	1.096	1.217	1.328	1.405	1.496	1.610	1.793
1972	0.928	0.969	1.000	1.062	1.179	1.287	1.361	1.450	1.560	1.737
1973	0.874	0.912	0.941	1.000	1.110	1.212	1.282	1.365	1.468	1.635
1974	0.787	0.822	0.848	0.901	1.000	1.091	1.154	1.229	1.323	1.473
1975	0.721	0.753	0.777	0.825	0.916	1.000	1.058	1.126	1.212	1.349
1976	0.682	0.712	0.735	0.780	0.866	0.946	1.000	1.065	1.146	1.276
1977	0.640	0.668	0.690	0.733	0.814	0.888	0.939	1.000	1.076	1.198
1978	0.595	0.621	0.641	0.681	0.756	0.825	0.873	0.929	1.000	1.113
1979	0.534	0.558	0.576	0.612	0.679	0.741	0.784	0.835	0.898	1.000
1980	0.471	0.492	0.507	0.539	0.598	0.653	0.691	0.735	0.791	0.881
1981	0.427	0.446	0.460	0.488	0.542	0.592	0.626	0.667	0.717	0.799
1982	0.402	0.420	0.433	0.460	0.511	0.558	0.590	0.628	0.676	0.752
1983	0.390	0.407	0.420	0.446	0.495	0.540	0.571	0.608	0.655	0.729
1984	0.373	0.390	0.402	0.427	0.474	0.518	0.548	0.583	0.628	0.699
1985	0.361	0.376	0.388	0.413	0.458	0.500	0.529	0.563	0.606	0.675
1986	0.354	0.370	0.381	0.405	0.450	0.491	0.519	0.553	0.595	0.662
1987	0.342	0.357	0.368	0.391	0.434	0.474	0.501	0.533	0.574	0.639
1988	0.328	0.342	0.353	0.375	0.417	0.455	0.481	0.512	0.551	0.614
1989	0.313	0.327	0.337	0.358	0.398	0.434	0.459	0.489	0.526	0.585
1990	0.297	0.310	0.320	0.340	0.377	0.412	0.435	0.464	0.499	0.555
1991	0.285	0.297	0.307	0.326	0.362	0.395	0.418	0.445	0.479	0.533
1992	0.277	0.289	0.298	0.316	0.351	0.383	0.406	0.432	0.465	0.517
1993	0.269	0.280	0.289	0.307	0.341	0.372	0.394	0.419	0.451	0.502
1994	0.262	0.273	0.282	0.300	0.333	0.363	0.384	0.409	0.440	0.490
1995	0.255	0.266	0.274	0.291	0.323	0.353	0.373	0.398	0.428	0.476
1996	0.247	0.258	0.266	0.283	0.314	0.343	0.363	0.386	0.416	0.463
1997	0.242	0.252	0.260	0.277	0.307	0.335	0.355	0.378	0.406	0.452
1998	0.238	0.248	0.256	0.272	0.302	0.330	0.349	0.372	0.400	0.445
1999	0.233	0.243	0.251	0.267	0.296	0.323	0.342	0.364	0.391	0.436
2000	0.225	0.235	0.243	0.258	0.286	0.312	0.330	0.352	0.379	0.422
2001	0.219	0.229	0.236	0.251	0.278	0.304	0.321	0.342	0.368	0.410
2002	0.216	0.225	0.232	0.247	0.274	0.299	0.316	0.337	0.362	0.404
2003	0.211	0.220	0.227	0.241	0.268	0.292	0.309	0.329	0.354	0.395
2004	0.205	0.214	0.221	0.235	0.261	0.285	0.301	0.321	0.345	0.384
2005	0.199	0.207	0.214	0.227	0.252	0.275	0.291	0.310	0.334	0.372
2006	0.192	0.201	0.207	0.220	0.245	0.267	0.282	0.301	0.323	0.360
2007	0.187	0.195	0.202	0.214	0.238	0.259	0.274	0.292	0.314	0.350
2008	0.180	0.188	0.194	0.206	0.229	0.250	0.264	0.281	0.303	0.337

Table B.17
Consumer Price Inflation (CPI) Index (Continued)

From:	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989
1970	2.124	2.343	2.487	2.567	2.678	2.773	2.825	2.928	3.049	3.196
1971	2.035	2.244	2.383	2.459	2.565	2.657	2.706	2.805	2.921	3.062
1972	1.971	2.175	2.309	2.383	2.486	2.574	2.622	2.718	2.830	2.967
1973	1.856	2.047	2.173	2.243	2.340	2.423	2.468	2.559	2.664	2.793
1974	1.671	1.844	1.957	2.020	2.108	2.183	2.223	2.304	2.400	2.515
1975	1.532	1.690	1.794	1.851	1.931	2.000	2.037	2.112	2.199	2.305
1976	1.448	1.598	1.696	1.750	1.826	1.891	1.926	1.996	2.079	2.179
1977	1.360	1.500	1.592	1.644	1.715	1.776	1.809	1.875	1.952	2.046
1978	1.264	1.394	1.480	1.528	1.594	1.650	1.681	1.742	1.814	1.902
1979	1.135	1.252	1.329	1.372	1.431	1.482	1.510	1.565	1.629	1.708
1980	1.000	1.103	1.171	1.209	1.261	1.306	1.330	1.379	1.436	1.505
1981	0.906	1.000	1.062	1.096	1.143	1.184	1.206	1.250	1.301	1.364
1982	0.854	0.942	1.000	1.032	1.077	1.115	1.136	1.177	1.226	1.285
1983	0.827	0.913	0.969	1.000	1.043	1.080	1.100	1.141	1.188	1.245
1984	0.793	0.875	0.929	0.959	1.000	1.036	1.055	1.093	1.139	1.193
1985	0.766	0.845	0.897	0.926	0.966	1.000	1.019	1.056	1.099	1.152
1986	0.752	0.829	0.880	0.909	0.948	0.982	1.000	1.036	1.079	1.131
1987	0.725	0.800	0.849	0.877	0.915	0.947	0.965	1.000	1.041	1.092
1988	0.697	0.768	0.816	0.842	0.878	0.910	0.926	0.960	1.000	1.048
1989	0.665	0.733	0.778	0.803	0.838	0.868	0.884	0.916	0.954	1.000
1990	0.630	0.695	0.738	0.762	0.795	0.823	0.839	0.869	0.905	0.949
1991	0.605	0.667	0.709	0.731	0.763	0.790	0.805	0.834	0.869	0.910
1992	0.587	0.648	0.688	0.710	0.741	0.767	0.781	0.810	0.843	0.884
1993	0.570	0.629	0.668	0.689	0.719	0.745	0.758	0.786	0.819	0.858
1994	0.556	0.613	0.651	0.672	0.701	0.726	0.740	0.767	0.798	0.837
1995	0.541	0.596	0.633	0.654	0.682	0.706	0.719	0.745	0.776	0.814
1996	0.525	0.579	0.615	0.635	0.662	0.686	0.699	0.724	0.754	0.790
1997	0.513	0.566	0.601	0.621	0.647	0.670	0.683	0.708	0.737	0.773
1998	0.506	0.558	0.592	0.611	0.637	0.660	0.672	0.697	0.726	0.761
1999	0.495	0.546	0.579	0.598	0.624	0.646	0.658	0.682	0.710	0.744
2000	0.479	0.528	0.560	0.578	0.603	0.625	0.636	0.660	0.687	0.720
2001	0.465	0.513	0.545	0.562	0.587	0.608	0.619	0.641	0.668	0.700
2002	0.458	0.505	0.536	0.554	0.578	0.598	0.609	0.631	0.658	0.689
2003	0.448	0.494	0.524	0.541	0.565	0.585	0.596	0.617	0.643	0.674
2004	0.436	0.481	0.511	0.527	0.550	0.570	0.580	0.601	0.626	0.656
2005	0.422	0.465	0.494	0.510	0.532	0.551	0.561	0.582	0.606	0.635
2006	0.409	0.451	0.479	0.494	0.515	0.534	0.544	0.563	0.587	0.615
2007	0.397	0.438	0.465	0.480	0.501	0.519	0.529	0.548	0.571	0.598
2008	0.383	0.422	0.448	0.463	0.483	0.500	0.509	0.528	0.549	0.576

Table B.17
Consumer Price Inflation (CPI) Index (Continued)

From:	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
1970	3.369	3.510	3.616	3.724	3.820	3.928	4.044	4.137	4.201	4.294
1971	3.227	3.363	3.464	3.568	3.659	3.763	3.874	3.963	4.025	4.114
1972	3.127	3.258	3.356	3.457	3.545	3.646	3.754	3.840	3.900	3.986
1973	2.944	3.068	3.160	3.255	3.338	3.432	3.534	3.615	3.671	3.752
1974	2.651	2.763	2.846	2.931	3.006	3.091	3.183	3.256	3.306	3.379
1975	2.429	2.532	2.608	2.686	2.755	2.833	2.916	2.983	3.030	3.097
1976	2.297	2.394	2.466	2.540	2.605	2.678	2.757	2.821	2.865	2.928
1977	2.157	2.248	2.315	2.384	2.446	2.515	2.589	2.649	2.690	2.749
1978	2.005	2.089	2.152	2.216	2.273	2.337	2.406	2.462	2.500	2.555
1979	1.800	1.876	1.933	1.990	2.041	2.099	2.161	2.211	2.245	2.295
1980	1.586	1.653	1.703	1.754	1.799	1.850	1.904	1.948	1.978	2.022
1981	1.438	1.498	1.543	1.590	1.630	1.677	1.726	1.766	1.793	1.833
1982	1.354	1.411	1.454	1.497	1.536	1.579	1.626	1.663	1.689	1.726
1983	1.312	1.367	1.409	1.451	1.488	1.530	1.575	1.611	1.637	1.673
1984	1.258	1.311	1.350	1.391	1.426	1.467	1.510	1.545	1.569	1.603
1985	1.215	1.266	1.304	1.343	1.377	1.416	1.458	1.492	1.515	1.548
1986	1.193	1.243	1.280	1.318	1.352	1.391	1.432	1.464	1.487	1.520
1987	1.151	1.199	1.235	1.272	1.305	1.342	1.381	1.413	1.435	1.467
1988	1.105	1.151	1.186	1.221	1.253	1.288	1.326	1.357	1.378	1.408
1989	1.054	1.098	1.131	1.165	1.195	1.229	1.265	1.294	1.315	1.344
1990	1.000	1.042	1.073	1.106	1.134	1.166	1.200	1.228	1.247	1.275
1991	0.960	1.000	1.030	1.061	1.088	1.119	1.152	1.178	1.197	1.223
1992	0.932	0.971	1.000	1.030	1.056	1.086	1.118	1.144	1.162	1.187
1993	0.904	0.943	0.971	1.000	1.026	1.055	1.086	1.111	1.128	1.153
1994	0.882	0.919	0.947	0.975	1.000	1.028	1.059	1.083	1.100	1.124
1995	0.858	0.894	0.921	0.948	0.972	1.000	1.030	1.053	1.070	1.093
1996	0.833	0.868	0.894	0.921	0.945	0.971	1.000	1.023	1.039	1.062
1997	0.814	0.849	0.874	0.900	0.923	0.950	0.978	1.000	1.016	1.038
1998	0.802	0.836	0.861	0.887	0.909	0.935	0.963	0.985	1.000	1.022
1999	0.785	0.818	0.842	0.867	0.890	0.915	0.942	0.963	0.978	1.000
2000	0.759	0.791	0.815	0.839	0.861	0.885	0.911	0.932	0.947	0.967
2001	0.738	0.769	0.792	0.816	0.837	0.861	0.886	0.906	0.920	0.941
2002	0.727	0.757	0.780	0.803	0.824	0.847	0.872	0.892	0.906	0.926
2003	0.710	0.740	0.763	0.785	0.805	0.828	0.853	0.872	0.886	0.905
2004	0.692	0.721	0.743	0.765	0.785	0.807	0.831	0.850	0.863	0.882
2005	0.669	0.697	0.718	0.740	0.759	0.780	0.803	0.822	0.835	0.853
2006	0.648	0.676	0.696	0.717	0.735	0.756	0.778	0.796	0.809	0.826
2007	0.630	0.657	0.677	0.697	0.715	0.735	0.757	0.774	0.786	0.804
2008	0.607	0.633	0.652	0.671	0.688	0.708	0.729	0.745	0.757	0.774

Table B.17
Consumer Price Inflation (CPI) Index (Continued)

From:	2000	2001	2002	2003	2004	2005	2006	2007	2008
1970	4.438	4.564	4.637	4.742	4.869	5.034	5.196	5.344	5.549
1971	4.252	4.373	4.442	4.543	4.664	4.822	4.978	5.120	5.316
1972	4.120	4.237	4.304	4.402	4.519	4.672	4.823	4.960	5.151
1973	3.878	3.989	4.052	4.144	4.255	4.399	4.541	4.670	4.849
1974	3.493	3.592	3.649	3.732	3.832	3.961	4.089	4.206	4.367
1975	3.201	3.292	3.344	3.420	3.511	3.630	3.747	3.854	4.002
1976	3.026	3.112	3.162	3.234	3.320	3.432	3.543	3.644	3.784
1977	2.842	2.922	2.969	3.036	3.117	3.223	3.327	3.421	3.553
1978	2.641	2.716	2.759	2.822	2.897	2.995	3.092	3.180	3.302
1979	2.372	2.439	2.478	2.534	2.602	2.690	2.777	2.856	2.966
1980	2.090	2.149	2.183	2.233	2.292	2.370	2.447	2.516	2.613
1981	1.894	1.948	1.979	2.024	2.078	2.149	2.218	2.281	2.369
1982	1.784	1.835	1.864	1.907	1.958	2.024	2.089	2.149	2.231
1983	1.729	1.778	1.806	1.847	1.897	1.961	2.024	2.082	2.162
1984	1.657	1.705	1.731	1.771	1.818	1.880	1.940	1.996	2.072
1985	1.600	1.646	1.672	1.710	1.756	1.815	1.874	1.927	2.001
1986	1.571	1.616	1.641	1.679	1.724	1.782	1.839	1.892	1.964
1987	1.516	1.559	1.584	1.620	1.663	1.719	1.775	1.825	1.895
1988	1.456	1.497	1.521	1.555	1.597	1.651	1.704	1.753	1.820
1989	1.389	1.428	1.451	1.484	1.523	1.575	1.626	1.672	1.736
1990	1.318	1.355	1.376	1.408	1.445	1.494	1.542	1.586	1.647
1991	1.264	1.300	1.321	1.351	1.387	1.434	1.480	1.522	1.581
1992	1.227	1.262	1.282	1.311	1.346	1.392	1.437	1.478	1.535
1993	1.192	1.226	1.245	1.273	1.307	1.352	1.395	1.435	1.490
1994	1.162	1.195	1.214	1.242	1.275	1.318	1.360	1.399	1.453
1995	1.130	1.162	1.180	1.207	1.240	1.281	1.323	1.360	1.413
1996	1.098	1.129	1.147	1.173	1.204	1.245	1.285	1.321	1.372
1997	1.073	1.103	1.121	1.146	1.177	1.217	1.256	1.292	1.341
1998	1.056	1.087	1.104	1.129	1.159	1.198	1.237	1.272	1.321
1999	1.034	1.063	1.080	1.104	1.134	1.172	1.210	1.245	1.292
2000	1.000	1.028	1.045	1.069	1.097	1.134	1.171	1.204	1.250
2001	0.972	1.000	1.016	1.039	1.067	1.103	1.138	1.171	1.216
2002	0.957	0.984	1.000	1.023	1.050	1.086	1.121	1.153	1.197
2003	0.936	0.963	0.978	1.000	1.027	1.061	1.096	1.127	1.170
2004	0.912	0.938	0.952	0.974	1.000	1.034	1.067	1.098	1.140
2005	0.882	0.907	0.921	0.942	0.967	1.000	1.032	1.062	1.102
2006	0.854	0.878	0.892	0.913	0.937	0.969	1.000	1.028	1.068
2007	0.831	0.854	0.868	0.887	0.911	0.942	0.972	1.000	1.038
2008	0.800	0.823	0.836	0.855	0.877	0.907	0.936	0.963	1.000

Source:
U.S. Bureau of Labor Statistics.

Table B.18
Gross National Product Implicit Price Deflator

From:	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979
1970	1.000	1.050	1.096	1.157	1.261	1.380	1.460	1.553	1.662	1.800
1971	0.952	1.000	1.043	1.102	1.201	1.315	1.391	1.479	1.583	1.714
1972	0.913	0.958	1.000	1.056	1.151	1.260	1.333	1.418	1.517	1.643
1973	0.864	0.908	0.947	1.000	1.090	1.193	1.262	1.342	1.437	1.556
1974	0.793	0.833	0.869	0.917	1.000	1.094	1.158	1.231	1.318	1.427
1975	0.724	0.761	0.794	0.838	0.914	1.000	1.058	1.125	1.204	1.304
1976	0.685	0.719	0.750	0.792	0.864	0.945	1.000	1.064	1.138	1.233
1977	0.644	0.676	0.705	0.745	0.812	0.889	0.940	1.000	1.070	1.159
1978	0.602	0.632	0.659	0.696	0.759	0.830	0.878	0.934	1.000	1.083
1979	0.555	0.583	0.609	0.643	0.701	0.767	0.811	0.863	0.923	1.000
1980	0.509	0.535	0.558	0.589	0.642	0.703	0.744	0.791	0.847	0.917
1981	0.466	0.489	0.510	0.539	0.587	0.643	0.680	0.723	0.774	0.838
1982	0.439	0.461	0.481	0.508	0.553	0.606	0.641	0.682	0.729	0.790
1983	0.422	0.443	0.462	0.488	0.532	0.583	0.616	0.656	0.702	0.760
1984	0.407	0.427	0.446	0.471	0.513	0.562	0.594	0.632	0.676	0.732
1985	0.395	0.415	0.433	0.457	0.498	0.545	0.576	0.613	0.656	0.711
1986	0.386	0.406	0.423	0.447	0.487	0.533	0.564	0.600	0.642	0.695
1987	0.376	0.395	0.412	0.435	0.747	0.519	0.549	0.584	0.625	0.677
1988	0.364	0.382	0.398	0.421	0.459	0.502	0.531	0.565	0.604	0.654
1989	0.350	0.368	0.384	0.405	0.442	0.483	0.511	0.544	0.582	0.631
1990	0.337	0.354	0.369	0.390	0.425	0.465	0.492	0.524	0.561	0.607
1991	0.326	0.342	0.357	0.377	0.411	0.450	0.476	0.506	0.542	0.587
1992	0.319	0.334	0.349	0.369	0.402	0.440	0.465	0.495	0.530	0.573
1993	0.311	0.327	0.341	0.360	0.393	0.430	0.455	0.483	0.517	0.560
1994	0.305	0.320	0.334	0.353	0.384	0.421	0.445	0.473	0.507	0.549
1995	0.299	0.314	0.327	0.346	0.377	0.412	0.436	0.464	0.497	0.538
1996	0.293	0.308	0.321	0.339	0.370	0.405	0.428	0.455	0.487	0.528
1997	0.288	0.303	0.316	0.334	0.364	0.398	0.421	0.448	0.479	0.519
1998	0.285	0.299	0.312	0.330	0.360	0.394	0.416	0.443	0.474	0.513
1999	0.281	0.295	0.308	0.325	0.355	0.388	0.410	0.437	0.467	0.506
2000	0.275	0.289	0.301	0.318	0.347	0.380	0.402	0.427	0.457	0.495
2001	0.269	0.282	0.294	0.311	0.339	0.371	0.392	0.417	0.447	0.484
2002	0.264	0.277	0.289	0.306	0.333	0.365	0.386	0.410	0.439	0.475
2003	0.259	0.272	0.283	0.299	0.326	0.357	0.378	0.402	0.430	0.465
2004	0.251	0.264	0.276	0.291	0.317	0.347	0.367	0.391	0.418	0.453
2005	0.244	0.256	0.267	0.282	0.308	0.337	0.356	0.379	0.406	0.439
2006	0.236	0.248	0.259	0.273	0.298	0.326	0.345	0.367	0.392	0.425
2007	0.230	0.241	0.252	0.266	0.290	0.317	0.335	0.357	0.382	0.413
2008	0.225	0.236	0.246	0.260	0.283	0.310	0.328	0.349	0.374	0.405

Table B.18
Gross National Product Implicit Price Deflator (Continued)

From:	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989
1970	1.963	2.148	2.279	2.369	2.458	2.533	2.589	2.660	2.751	2.855
1971	1.870	2.046	2.170	2.256	2.341	2.413	2.466	2.533	2.620	2.719
1972	1.792	1.960	2.080	2.162	2.244	2.312	2.363	2.428	2.510	2.606
1973	1.697	1.857	1.970	2.048	2.125	2.190	2.238	2.299	2.378	2.468
1974	1.557	1.703	1.807	1.879	1.949	2.009	2.053	2.109	2.181	2.264
1975	1.422	1.556	1.651	1.716	1.781	1.835	1.876	1.927	1.993	2.068
1976	1.344	1.471	1.561	1.623	1.683	1.735	1.773	1.822	1.884	1.955
1977	1.264	1.383	1.467	1.525	1.583	1.631	1.667	1.713	1.771	1.838
1978	1.181	1.292	1.371	1.425	1.479	1.524	1.557	1.600	1.655	1.717
1979	1.091	1.193	1.266	1.316	1.366	1.407	1.438	1.478	1.528	1.586
1980	1.000	1.094	1.161	1.207	1.252	1.290	1.319	1.355	1.401	1.454
1981	0.914	1.000	1.061	1.103	1.144	1.179	1.205	1.238	1.281	1.329
1982	0.861	0.943	1.000	1.040	1.079	1.112	1.136	1.167	1.207	1.253
1983	0.829	0.907	0.962	1.000	1.038	1.069	1.093	1.123	1.161	1.205
1984	0.799	0.874	0.927	0.964	1.000	1.031	1.053	1.082	1.119	1.161
1985	0.775	0.848	0.900	0.935	0.970	1.000	1.022	1.050	1.086	1.127
1986	0.758	0.830	0.880	0.915	0.950	0.978	1.000	1.027	1.063	1.103
1987	0.738	0.808	0.857	0.891	0.924	0.952	0.973	1.000	1.034	1.073
1988	0.714	0.781	0.828	0.861	0.894	0.921	0.941	0.967	1.000	1.038
1989	0.688	0.752	0.798	0.830	0.861	0.887	0.907	0.932	0.963	1.000
1990	0.662	0.724	0.768	0.799	0.829	0.854	0.873	0.897	0.928	0.963
1991	0.640	0.700	0.743	0.772	0.801	0.825	0.844	0.867	0.896	0.930
1992	0.625	0.684	0.726	0.755	0.783	0.807	0.825	0.847	0.876	0.909
1993	0.611	0.669	0.709	0.738	0.765	0.789	0.806	0.828	0.856	0.889
1994	0.598	0.655	0.695	0.722	0.749	0.772	0.789	0.811	0.838	0.870
1995	0.586	0.642	0.681	0.708	0.734	0.757	0.773	0.794	0.822	0.853
1996	0.575	0.630	0.668	0.694	0.721	0.743	0.759	0.780	0.806	0.837
1997	0.566	0.619	0.657	0.683	0.709	0.730	0.746	0.767	0.793	0.823
1998	0.560	0.613	0.650	0.676	0.701	0.722	0.738	0.759	0.784	0.814
1999	0.552	0.604	0.641	0.666	0.691	0.712	0.728	0.748	0.773	0.803
2000	0.540	0.591	0.627	0.652	0.676	0.697	0.712	0.732	0.757	0.785
2001	0.528	0.577	0.612	0.637	0.660	0.681	0.696	0.715	0.739	0.767
2002	0.518	0.567	0.602	0.626	0.649	0.669	0.684	0.702	0.726	0.754
2003	0.508	0.555	0.589	0.613	0.636	0.655	0.669	0.688	0.711	0.738
2004	0.494	0.540	0.573	0.596	0.618	0.637	0.651	0.669	0.692	0.718
2005	0.479	0.524	0.556	0.578	0.600	0.618	0.632	0.649	0.671	0.697
2006	0.463	0.507	0.538	0.559	0.580	0.598	0.611	0.628	0.649	0.674
2007	0.451	0.493	0.523	0.544	0.564	0.582	0.594	0.611	0.632	0.656
2008	0.441	0.483	0.512	0.533	0.533	0.569	0.582	0.598	0.618	0.642

Table B.18
Gross National Product Implicit Price Deflator (Continued)

From:	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
1970	2.966	3.069	3.140	3.212	3.281	3.348	3.412	3.468	3.507	3.557
1971	2.824	2.923	2.990	3.059	3.124	3.189	3.249	3.303	3.340	3.388
1972	2.707	2.801	2.865	2.932	2.994	3.056	3.114	3.165	3.200	3.247
1973	2.563	2.653	2.714	2.777	2.836	2.894	2.949	2.998	3.031	3.075
1974	2.351	2.433	2.489	2.547	2.601	2.655	2.705	2.750	2.780	2.821
1975	2.148	2.224	2.274	2.327	2.377	2.426	2.472	2.513	2.540	2.577
1976	2.031	2.102	2.150	2.200	2.247	2.293	2.336	2.375	2.401	2.436
1977	1.909	1.976	2.021	2.068	2.112	2.156	2.197	2.233	2.258	2.290
1978	1.784	1.846	1.889	1.932	1.974	2.014	2.052	2.086	2.109	2.140
1979	1.647	1.705	1.744	1.785	1.822	1.860	1.895	1.927	1.948	1.976
1980	1.510	1.563	1.599	1.636	1.671	1.705	1.738	1.767	1.786	1.812
1981	1.381	1.429	1.462	1.496	1.527	1.559	1.588	1.615	1.633	1.656
1982	1.301	1.347	1.378	1.410	1.440	1.469	1.497	1.522	1.539	1.561
1983	1.252	1.295	1.325	1.356	1.385	1.413	1.440	1.464	1.480	1.501
1984	1.206	1.249	1.277	1.307	1.335	1.362	1.388	1.411	1.426	1.447
1985	1.171	1.212	1.239	1.268	1.295	1.322	1.347	1.369	1.384	1.404
1986	1.145	1.186	1.213	1.241	1.267	1.293	1.318	1.340	1.354	1.374
1987	1.115	1.154	1.180	1.208	1.233	1.259	1.283	1.304	1.318	1.337
1988	1.078	1.116	1.141	1.168	1.193	1.217	1.240	1.261	1.275	1.293
1989	1.039	1.075	1.100	1.125	1.149	1.173	1.195	1.215	1.228	1.246
1990	1.000	1.035	1.059	1.083	1.106	1.129	1.150	1.170	1.182	1.200
1991	0.966	1.000	1.023	1.047	1.069	1.091	1.112	1.130	1.143	1.159
1992	0.945	0.978	1.000	1.023	1.045	1.066	1.087	1.105	1.117	1.133
1993	0.923	0.955	0.977	1.000	1.021	1.042	1.062	1.080	1.092	1.107
1994	0.904	0.935	0.957	0.979	1.000	1.021	1.040	1.057	1.069	1.084
1995	0.886	0.917	0.938	0.959	0.980	1.000	1.019	1.036	1.047	1.062
1996	0.869	0.900	0.920	0.942	0.962	0.981	1.000	1.017	1.028	1.043
1997	0.855	0.885	0.905	0.926	0.946	0.965	0.984	1.000	1.011	1.026
1998	0.846	0.875	0.895	0.916	0.936	0.955	0.973	0.989	1.000	1.014
1999	0.834	0.863	0.883	0.903	0.922	0.941	0.959	0.975	0.986	1.000
2000	0.816	0.844	0.864	0.884	0.903	0.921	0.939	0.954	0.965	0.979
2001	0.797	0.825	0.844	0.863	0.882	0.900	0.917	0.932	0.942	0.956
2002	0.783	0.811	0.829	0.848	0.866	0.884	0.901	0.916	0.926	0.939
2003	0.767	0.794	0.812	0.831	0.848	0.866	0.882	0.897	0.907	0.920
2004	0.746	0.772	0.789	0.808	0.825	0.842	0.858	0.872	0.882	0.894
2005	0.724	0.749	0.766	0.784	0.801	0.817	0.833	0.846	0.856	0.868
2006	0.700	0.724	0.741	0.758	0.774	0.790	0.805	0.819	0.828	0.840
2007	0.681	0.705	0.721	0.738	0.753	0.769	0.783	0.796	0.805	0.817
2008	0.667	0.690	0.706	0.722	0.737	0.753	0.767	0.780	0.788	0.800

Table B.18
Gross National Product Implicit Price Deflator (Continued)

From:	2000	2001	2002	2003	2004	2005	2006	2007	2008
1970	3.635	3.722	3.787	3.867	3.977	4.097	4.237	4.355	4.449
1971	3.462	3.544	3.606	3.683	3.787	3.902	4.035	4.147	4.237
1972	3.317	3.397	3.456	3.529	3.630	3.739	3.867	3.975	4.061
1973	3.142	3.217	3.273	3.343	3.438	3.542	3.662	3.764	3.846
1974	2.882	2.951	3.002	3.066	3.153	3.249	3.359	3.453	3.528
1975	2.633	2.696	2.743	2.802	2.881	2.968	3.069	3.155	3.223
1976	2.489	2.549	2.593	2.648	2.723	2.806	2.901	2.982	3.047
1977	2.340	2.396	2.438	2.490	2.561	2.638	2.728	2.804	2.865
1978	2.186	2.239	2.278	2.326	2.392	2.465	2.548	2.620	2.676
1979	2.019	2.067	2.103	2.148	2.209	2.276	2.353	2.419	2.472
1980	1.851	1.896	1.929	1.970	2.026	2.087	2.158	2.218	2.266
1981	1.692	1.733	1.763	1.800	1.852	1.908	1.972	2.027	2.071
1982	1.595	1.633	1.662	1.697	1.745	1.798	1.859	1.911	1.952
1983	1.534	1.571	1.598	1.632	1.679	1.729	1.788	1.838	1.878
1984	1.479	1.514	1.540	1.573	1.618	1.667	1.723	1.772	1.810
1985	1.435	1.469	1.495	1.527	1.570	1.617	1.672	1.719	1.756
1986	1.404	1.438	1.463	1.494	1.536	1.583	1.636	1.682	1.719
1987	1.366	1.399	1.424	1.454	1.495	1.540	1.593	1.637	1.673
1988	1.321	1.353	1.377	1.406	1.446	1.490	1.540	1.583	1.617
1989	1.273	1.304	1.326	1.355	1.393	1.435	1.484	1.525	1.558
1990	1.226	1.255	1.277	1.304	1.341	1.382	1.429	1.468	1.500
1991	1.184	1.213	1.234	1.260	1.296	1.335	1.380	1.419	1.450
1992	1.158	1.185	1.206	1.232	1.267	1.305	1.349	1.387	1.417
1993	1.131	1.159	1.179	1.204	1.238	1.275	1.319	1.356	1.385
1994	1.108	1.134	1.154	1.179	1.212	1.249	1.291	1.327	1.356
1995	1.086	1.112	1.131	1.155	1.188	1.224	1.265	1.301	1.329
1996	1.065	1.091	1.110	1.134	1.166	1.201	1.242	1.276	1.304
1997	1.048	1.073	1.092	1.115	1.147	1.181	1.222	1.256	1.283
1998	1.037	1.061	1.080	1.103	1.134	1.168	1.208	1.242	1.269
1999	1.022	1.046	1.064	1.087	1.118	1.152	1.191	1.224	1.251
2000	1.000	1.024	1.042	1.064	1.094	1.127	1.166	1.198	1.224
2001	0.977	1.000	1.017	1.039	1.069	1.101	1.138	1.170	1.195
2002	0.960	0.983	1.000	1.021	1.050	1.082	1.119	1.150	1.175
2003	0.940	0.962	0.979	1.000	1.028	1.059	1.096	1.126	1.150
2004	0.914	0.936	0.952	0.972	1.000	1.030	1.065	1.095	1.118
2005	0.887	0.908	0.924	0.944	0.970	1.000	1.031	1.060	1.083
2006	0.858	0.878	0.894	0.913	0.939	0.969	1.000	1.027	1.049
2007	0.835	0.855	0.870	0.888	0.914	0.943	0.974	1.000	1.022
2008	0.817	0.837	0.851	0.869	0.894	0.923	0.953	0.979	1.000

Source:
U.S. Department of Commerce, Bureau of Economic Analysis, *Survey of Current Business*, Washington, DC, monthly.

APPENDIX C

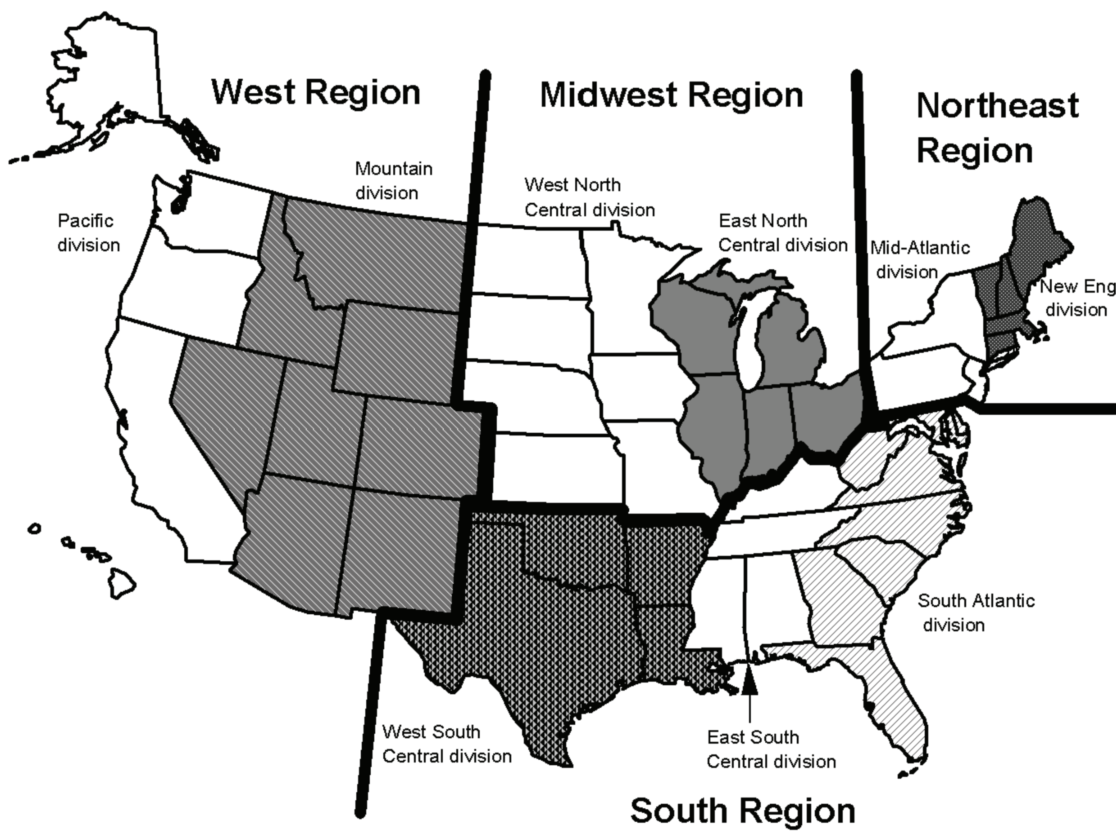
MAPS

Table C.1
Census Regions and Divisions

Region	Division	States
Northeast Region	Mid-Atlantic division	New Jersey, New York, Pennsylvania
Northeast Region	New England division	Connecticut, Maine, Massachusetts, New Hampshire, Rhode Island, Vermont
South Region	West South Central division	Arkansas, Louisiana, Oklahoma, Texas
South Region	East South Central division	Alabama, Kentucky, Mississippi, Tennessee
South Region	South Atlantic division	Delaware, Florida, Georgia, Maryland, North Carolina, South Carolina, Virginia, Washington, DC, West Virginia
West Region	Pacific division	Alaska, California, Hawaii, Oregon, Washington
West Region	Mountain division	Arizona, Colorado, Idaho, Montana, Nevada, New Mexico, Utah, Wyoming
Midwest Region	West North Central division	Iowa, Kansas, Minnesota, Missouri, Nebraska, North Dakota, South Dakota
Midwest Region	East North Central division	Illinois, Indiana, Michigan, Ohio, Wisconsin

Source:
U.S. Census Bureau.

Figure C1. Census Regions and Divisions



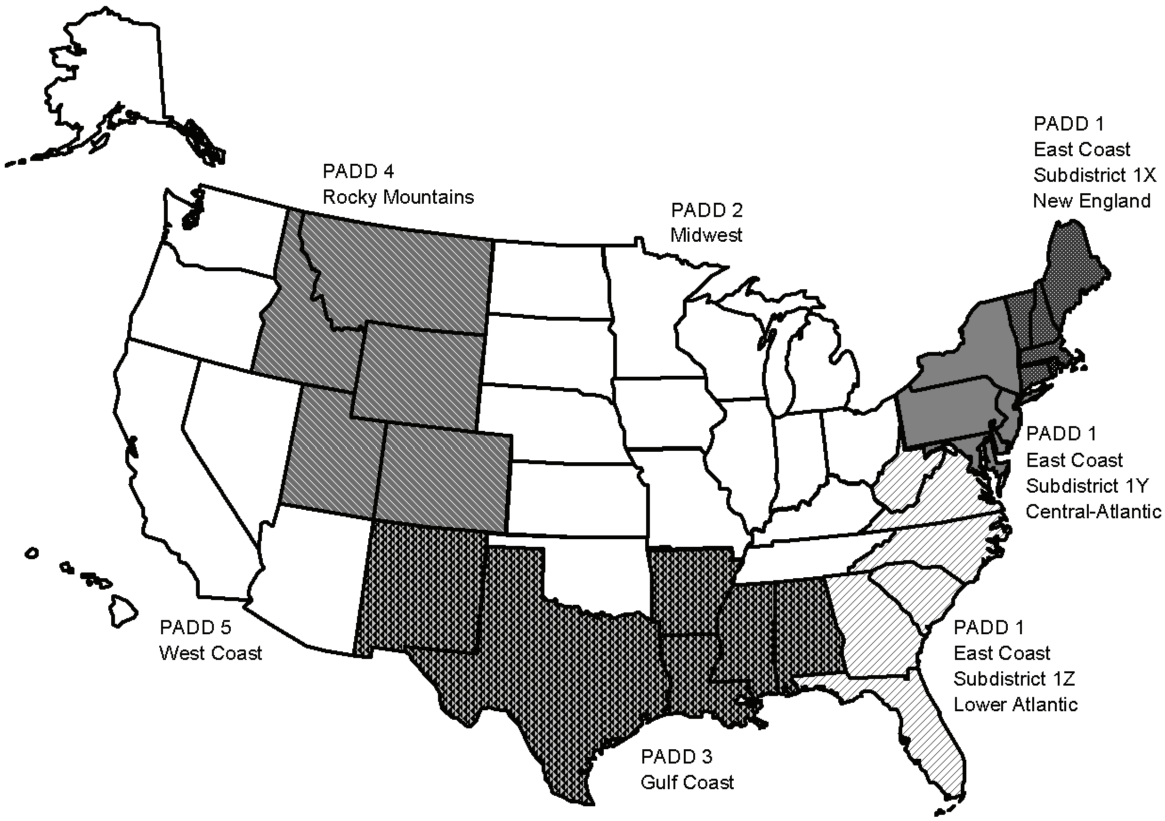
Source: See Table C.1.

Table C.2
Petroleum Administration for Defense Districts (PADD)

District	Subdistrict	States
PAD District 1 East Coast	Subdistrict 1X New England	Connecticut, Maine, Massachusetts, New Hampshire, Rhode Island, Vermont
	Subdistrict 1Y Central Atlantic	Delaware, District of Columbia, Maryland, New Jersey, New York, Pennsylvania
	Subdistrict 1Z Lower Atlantic	Florida, Georgia, North Carolina, South Carolina, Virginia, West Virginia
PAD District 2 Midwest		Illinois, Indiana, Iowa, Kansas, Kentucky, Michigan, Minnesota, Missouri, Nebraska, North Dakota, South Dakota, Ohio, Oklahoma, Tennessee, Wisconsin
PAD District 3 Gulf Coast		Alabama, Arkansas, Louisiana, Mississippi, New Mexico, Texas
PAD District 4 Rocky Mountains		Colorado Idaho, Montana, Utah, Wyoming
PAD District 5 West Coast		Alaska, Arizona, California, Hawaii, Nevada, Oregon, Washington

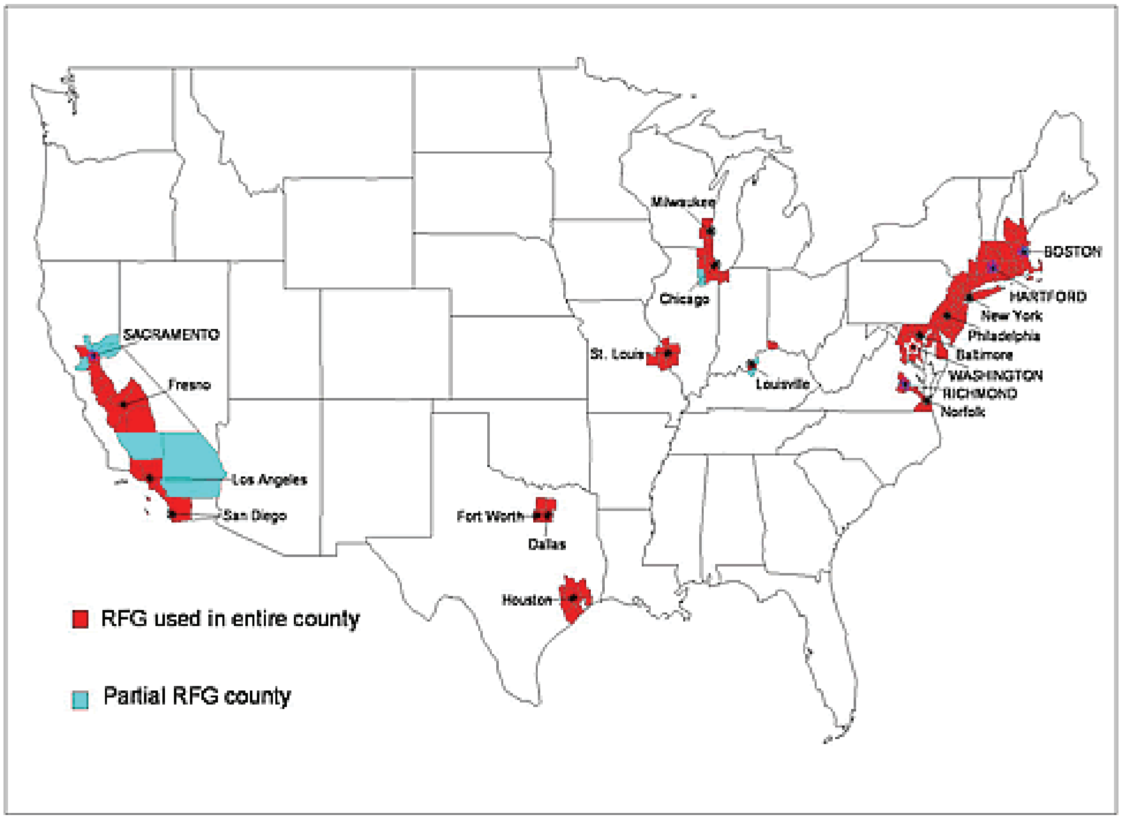
Source:
Energy Information Administration web site: http://tonto.eia.doe.gov/oog/info/twip/padddef.html

Figure C.2. Petroleum Administration for Defense Districts



Source: See Table C.2.

Figure C.3. Map of Places where Reformulated Gasoline is Sold



Source:
U.S. Environmental Protection Agency, www.epa.gov/otaq/rfg/whereyoulive.htm.

Note: Reformulated gasoline is a motor gasoline specially formulated to achieve significant reductions in vehicle emissions of ozone-forming and toxic air pollutants. The Clean Air Act of 1990 mandates reformulated gasoline use in areas with ozone-air pollution problems.

GLOSSARY

Acceleration power - Measured in kilowatts. Pulse power obtainable from a battery used to accelerate a vehicle. This is based on a constant current pulse for 30 seconds at no less than 2/3 of the maximum open-circuit-voltage, at 80% depth-of-discharge relative to the battery's rated capacity and at 20° C ambient temperature.

Air Carrier - The commercial system of air transportation consisting of certificated air carriers, air taxis (including commuters), supplemental air carriers, commercial operators of large aircraft, and air travel clubs.

Certificated route air carrier: An air carrier holding a Certificate of Public Convenience and Necessity issued by the Department of Transportation to conduct scheduled interstate services. Nonscheduled or charter operations may also be conducted by these carriers. These carriers operate large aircraft (30 seats or more, or a maximum payload capacity of 7,500 pounds or more) in accordance with Federal Aviation Regulation part 121.

Domestic air operator: Commercial air transportation within and between the 50 States and the District of Columbia. Includes operations of certificated route air carriers, Pan American, local service, helicopter, intra-Alaska, intra-Hawaii, all-cargo carriers and other carriers. Also included are transborder operations conducted on the domestic route segments of U.S. air carriers. Domestic operators are classified based on their operating revenue as follows:

Majors - over $1 billion
Nationals - $100-1,000 million
Large Regionals - $10-99.9 million
Medium Regionals - $0-9.99 million

International air operator: Commercial air transportation outside the territory of the United States, including operations between the U.S. and foreign countries and between the U.S. and its territories and possessions.

Supplemental air carrier: A class of air carriers which hold certificates authorizing them to perform passenger and cargo charter services supplementing the scheduled service of the certificated route air carriers. Supplemental air carriers are often referred to as nonscheduled air carriers or "nonskeds."

Alcohol - The family name of a group of organic chemical compounds composed of carbon, hydrogen, and oxygen. The molecules in the series vary in chain length and are composed of a hydrocarbon plus a hydroxyl group. Alcohol includes methanol and ethanol.

Amtrak - See *Rail*.

Anthropogenic - Human made. Usually used in the context of emissions that are produced as the result of human activities.

Automobile size classifications - Size classifications of automobiles are established by the Environmental Protection Agency (EPA) as follows:

Minicompact - less than 85 cubic feet of passenger and luggage volume.
Subcompact - between 85 to 100 cubic feet of passenger and luggage volume.
Compact - between 100 to 110 cubic feet of passenger and luggage volume.
Midsize - between 110 to 120 cubic feet of passenger and luggage volume.
Large - more than 120 cubic feet of passenger and luggage volume.
Two seater - automobiles designed primarily to seat only two adults.

Station wagons are included with the size class for the sedan of the same name.

Aviation - See *General aviation*.

Aviation gasoline - All special grades of gasoline for use in aviation reciprocating engines, as given in the American Society for Testing and Materials (ASTM) Specification D 910. Includes all refinery products within the gasoline range that are to be marketed straight or in blends as aviation gasoline without further processing (any refinery operation except mechanical blending). Also included are finished components in the gasoline range which will be used for blending or compounding into aviation gasoline.

Barges - Shallow, nonself-propelled vessels used to carry bulk commodities on the rivers and the Great Lakes.

Battery efficiency - Measured in percentage. Net DC energy delivered on discharge, as a percentage of the total DC energy required to restore the initial state-of-charge. The efficiency value must include energy losses resulting from self-discharge, cell equalization, thermal loss compensation, and all battery-specific auxiliary equipment.

Btu - British thermal unit. The amount of energy required to raise the temperature of 1 pound of water 1 degree Fahrenheit at or near 39.2 degrees Fahrenheit. An average Btu content of fuel is the heat value per quantity of fuel as determined from tests of fuel samples.

Bunker - A storage tank.

Bunkering fuels - Fuels stored in ship bunkers.

Bus -

Intercity bus: A standard size bus equipped with front doors only, high backed seats, luggage compartments separate from the passenger compartment and usually with restroom facilities, for high-speed long distance service.

Motor bus: Rubber-tired, self-propelled, manually-steered bus with fuel supply on board the vehicle. Motor bus types include intercity, school, and transit.

School and other nonrevenue bus: Bus services for which passengers are not directly charged for transportation, either on a per passenger or per vehicle basis.

Transit bus: A bus designed for frequent stop service with front and center doors, normally with a rear-mounted diesel engine, low-back seating, and without luggage storage compartments or restroom facilities.

Trolley coach: Rubber-tired electric transit vehicle, manually-steered, propelled by a motor drawing current, normally through overhead wires, from a central power source not on board the vehicle.

Calendar year - The period of time between January 1 and December 31 of any given year.

Captive imports - Products produced overseas specifically for domestic manufacturers.

Carbon dioxide (CO_2) - A colorless, odorless, non-poisonous gas that is a normal part of the ambient air. Carbon dioxide is a product of fossil fuel combustion.

Carbon monoxide (CO) - A colorless, odorless, highly toxic gas that is a by-product of incomplete fossil fuel combustion. Carbon monoxide, one of the major air pollutants, can be harmful in small amounts if breathed over a certain period of time.

Car-mile (railroad) - A single railroad car moved a distance of one mile.

Cargo ton-mile - See *Ton-mile*.

Certificated route air carriers - See *Air carriers*.

Class I freight railroad - See *Rail*.

Coal slurry - Finely crushed coal mixed with sufficient water to form a fluid.

Combination trucks - Consist of a power unit (a truck tractor) and one or more trailing units (a semi-trailer or trailer). The most frequently used combination is popularly referred to as a "tractor-semitrailer" or "tractor trailer".

Commercial sector - An energy-consuming sector that consists of service-providing facilities of: businesses; Federal, State, and local governments; and other private and public organizations, such as religious, social or fraternal groups. Includes institutional living quarters.

Commuter railroad - See *Rail*.

Compact car - See *Automobile size classifications*.

Constant dollars - A time series of monetary figures is expressed in constant dollars when the effect of change over time in the purchasing power of the dollar has been removed. Usually the data are expressed in terms of dollars of a selected year or the average of a set of years.

Consumer Price Index (CPI) - An index issued by the U.S. Department of Labor, Bureau of Labor Statistics. The CPI is designed to measure changes in the prices of goods and services bought by wage earners and clerical workers in urban areas. It represents the cost of a typical consumption bundle at current prices as a ratio to its cost at a base year.

Continuous discharge capacity - Measured as percent of rated energy capacity. Energy delivered in a constant power discharge required by an electric vehicle for hill climbing and/or high-speed cruise, specified as the percent of its rated energy capacity delivered in a one hour constant-power discharge.

Corporate Average Fuel Economy (CAFE) standards - CAFE standards were originally established by Congress for new automobiles, and later for light trucks, in Title V of the Motor Vehicle Information and Cost Savings Act (15 U.S.C.1901, et seq.) with subsequent amendments. Under CAFE, automobile manufacturers are required by law to produce vehicle fleets with a composite sales-weighted fuel economy which cannot be lower than the CAFE standards in a given year, or for every vehicle which does not meet the standard, a fine of $5.00 is paid for every one-tenth of a mpg below the standard.

Crude oil - A mixture of hydrocarbons that exists in the liquid phase in natural underground reservoirs and remains liquid at atmospheric pressure after passing through surface separating facilities. Crude oil production is measured at the wellhead and includes lease condensate.

Crude oil imports - The volume of crude oil imported into the 50 States and the District of Columbia, including imports from U.S. territories, but excluding imports of crude oil into the Hawaiian Foreign Trade Zone.

Curb weight - The weight of a vehicle including all standard equipment, spare tire and wheel, all fluids and lubricants to capacity, full tank of fuel, and the weight of major optional accessories normally found on the vehicle.

Current dollars - Represents dollars current at the time designated or at the time of the transaction. In most contexts, the same meaning would be conveyed by the use of the term "dollars." See also constant dollars.

Demand Response - A transit mode that includes passenger cars, vans, and small buses operating in response to calls from passengers to the transit operator who dispatches the vehicles. The vehicles do not operate over a fixed route on a fixed schedule. Can also be known as paratransit or dial-a-ride.

Diesel fuel - See distillate fuel oil.

Disposable personal income - See *Income*.

Distillate fuel oil - The lighter fuel oils distilled off during the refining process. Included are products known as ASTM grades numbers 1 and 2 heating oils, diesel fuels, and number 4 fuel oil. The major uses of distillate fuel oils include heating, fuel for on-and off-highway diesel engines, and railroad diesel fuel.

Domestic air operator - See *Air carrier*.

E85 - 85% ethanol and 15% gasoline.

E95 - 95% ethanol and 5% gasoline.

Domestic water transportation - See *Internal water transportation*.

Electric utilities sector - Consists of privately and publicly owned establishments which generate electricity primarily for resale.

Emission standards - Standards for the levels of pollutants emitted from automobiles and trucks. Congress established the first standards in the Clean Air Act of 1963. Currently, standards are set for four vehicle classes - automobiles, light trucks, heavy-duty gasoline trucks, and heavy-duty diesel trucks.

Energy capacity - Measured in kilowatt hours. The energy delivered by the battery, when tested at C/3 discharge rate, up to termination of discharge specified by the battery manufacturer. The required acceleration power must be delivered by the battery at any point up to 80% of the battery's energy capacity rating.

Energy efficiency - In reference to transportation, the inverse of energy intensiveness: the ratio of outputs from a process to the energy inputs; for example, miles traveled per gallon of fuel (mpg).

Energy intensity - In reference to transportation, the ratio of energy inputs to a process to the useful outputs from that process; for example, gallons of fuel per passenger-mile or Btu per ton-mile.

Ethanol (C_2H_5OH) - Otherwise known as ethyl alcohol, alcohol, or grain-spirit. A clear, colorless, flammable oxygenated hydrocarbon with a boiling point of 78.5 degrees Celsius in the anhydrous state. In transportation, ethanol is used as a vehicle fuel by itself (E100 – 100% ethanol by volume), blended with gasoline (E85 – 85% ethanol by volume), or as a gasoline octane enhancer and oxygenate (10% by volume).

Fixed operating cost - See *Operating cost*.

Fleet vehicles -

Private fleet vehicles: Ideally, a vehicle could be classified as a member of a fleet if it is:

a) operated in mass by a corporation or institution,
b) operated under unified control, or
c) used for non-personal activities.

However, the definition of a fleet is not consistent throughout the fleet industry. Some companies make a distinction between cars that were bought in bulk rather than singularly, or whether they are operated in bulk, as well as the minimum number of vehicles that constitute a fleet (i.e. 4 or 10).

Government fleet vehicles: Includes vehicles owned by all Federal, state, county, city, and metro units of government, including toll road operations.

Foreign freight - Movements between the United States and foreign countries and between Puerto Rico, the Virgin Islands, and foreign countries. Trade between U.S. territories and possessions (e.g. Guam, Wake, American Samoa) and foreign countries is excluded. Traffic to or from the Panama Canal Zone is included.

Gas Guzzler Tax - Originates from the 1978 Energy Tax Act (Public Law 95-618). A new car purchaser is required to pay the tax if the car purchased has a combined city/highway fuel economy rating that is below the standard for that year. For model years 1986 and later, the standard is 22.5 mpg.

Gasohol - A mixture of 10% anhydrous ethanol and 90% gasoline by volume; 7.5% anhydrous ethanol and 92.5% gasoline by volume; or 5.5% anhydrous ethanol and 94.5% gasoline by volume. There are other fuels that contain methanol and gasoline, but these fuels are not referred to as gasohol.

Gasoline - See *Motor gasoline*.

General aviation - That portion of civil aviation which encompasses all facets of aviation except air carriers. It includes any air taxis, commuter air carriers, and air travel clubs which do not hold Certificates of Public Convenience and Necessity.

Gross National Product - A measure of monetary value of the goods and services becoming available to the nation from economic activity. Total value at market prices of all goods and services produced by the nation's economy. Calculated quarterly by the Department of Commerce, the Gross National Product is the broadest available measure of the level of economic activity.

Gross vehicle weight (gvw) - The weight of the empty truck plus the maximum anticipated load weight.

Gross vehicle weight rating (gvwr) - The gross vehicle weight which is assigned to each new truck by the manufacturer. This rating may be different for trucks of the same model because of certain features, such as heavy-duty suspension. Passenger cars do not have gross vehicle weight ratings.

Heavy-heavy truck - See *Truck size classifications*.

Household - Consists of all persons who occupy a housing unit, including the related family members and all unrelated persons, if any, who share the housing unit.

Housing unit - A house, apartment, a group of rooms, or a single room occupied or intended for occupancy as separate living quarters. Separate living quarters are those in which the occupants do not live and eat with any other persons in the structure and which have either (1) direct access from the outside of the building or through a common hallway intended to be used by the occupants of another unit or by the general public, or (2) complete kitchen facilities for the exclusive use of the occupants. The occupants may be a single family, one person living alone, two or more families living together, or any other group of related or unrelated persons who share living arrangements.

Hydrocarbon (HC) - A compound that contains only hydrogen and carbon. The simplest and lightest forms of hydrocarbon are gaseous. With greater molecular weights they are liquid, while the heaviest are solids.

Income -

Disposable personal income: Personal income less personal tax and non-tax payments.

National income: The aggregate earnings of labor and property which arise in the current production of goods and services by the nation's economy.

Personal income: The current income received by persons from all sources, net of contributions for social insurance.

Industrial sector - Construction, manufacturing, agricultural and mining establishments.

Inertia weight - The curb weight of a vehicle plus 300 pounds.

Intercity bus - See *Bus*.

Internal water transportation - Includes all local (intraport) traffic and traffic between ports or landings wherein the entire movement takes place on inland waterways. Also termed internal are movements involving carriage on both inland waterways and the water of the Great Lakes, and inland movements that cross short stretches of open water that link inland systems.

International air operator - See *Air carrier*.

International freight - See *Foreign freight*.

Jet fuel - Includes both naphtha-type and kerosene-type fuels meeting standards for use in aircraft turbine engines. Although most jet fuel is used in aircraft, some is used for other purposes such as generating electricity in gas turbines.

Kerosene-type jet fuel: A quality kerosene product with an average gravity of 40.7 degrees API and 10% to 90% distillation temperatures of 217 to 261 degrees centigrade. Used primarily as fuel for commercial turbojet and turboprop aircraft engines. It is a relatively low freezing point distillate of the kerosene type.

Naphtha-type jet fuel: A fuel in the heavy naphtha boiling range with an average gravity of 52.8 degrees API and 10% to 90% distillation temperatures of 117 to 233 degrees centigrade used for turbojet and turboprop aircraft engines, primarily by the military. Excludes ramjet and petroleum.

Kerosene - A petroleum distillate in the 300 to 500 degrees Fahrenheit boiling range and generally having a flash point higher than 100 degrees Fahrenheit by the American Society of Testing and Material (ASTM) Method D56, a gravity range from 40 to 46 degrees API, and a burning point in the range of 150 to 175 degrees Fahrenheit. It is a clean-burning product suitable for use as an illuminant when burned in wick lamps. Includes grades of kerosene called range oil having properties similar to Number 1 fuel oil, but with a gravity of about 43 degrees API and an end point of 625 degrees Fahrenheit. Used in space heaters, cooking stoves, and water heaters.

Kerosene-type jet fuel - See *Jet fuel*.

Large car - See *Automobile size classifications*.

Lease Condensate - A liquid recovered from natural gas at the well or at small gas/oil separators in the field. Consists primarily of pentanes and heavier hydrocarbons (also called field condensate).

Light duty vehicles - Automobiles and light trucks combined.

Light truck - Unless otherwise noted, light trucks are defined in this publication as two-axle, four-tire trucks. The U.S. Bureau of Census classifies all trucks with a gross vehicle weight less than 10,000 pounds as light trucks (See *Truck size classifications*).

Light-heavy truck - See *Truck size classifications*.

Liquified petroleum gas (lpg) - Consists of propane and butane and is usually derived from natural gas. In locations where there is no natural gas and the gasoline consumption is low, naphtha is converted to lpg by catalytic reforming.

Load factor - Total passenger miles divided by total vehicle miles.

Low emission vehicle - Any vehicle certified to the low emission standards which are set by the Federal government and/or the state of California.

M85 - 85% methanol and 15% gasoline.

M100 - 100% methanol.

Medium truck - See *Truck size classifications*.

Methanol (CH_3OH) - A colorless highly toxic liquid with essentially no odor and very little taste. It is the simplest alcohol and boils at 64.7 degrees Celsius. In transportation, methanol is used as a vehicle fuel by itself (M100), or blended with gasoline (M85).

Midsize car - See *Automobile size classifications*.

Minicompact car - See *Automobile size classifications*.

Model year - In this publication, model year is referring to the "sales" model year, the period from October 1 to the next September 31.

Motor bus - See *Bus*.

Motor gasoline - A mixture of volatile hydrocarbons suitable for operation of an internal combustion engine whose major components are hydrocarbons with boiling points ranging from 78 to 217 degrees centigrade and whose source is distillation of petroleum and cracking, polymerization, and other chemical reactions by which the naturally occurring petroleum hydrocarbons are converted into those that have superior fuel properties.

Regular gasoline: Gasoline having an antiknock index, i.e., octane rating, greater than or equal to 85 and less than 88. *Note:* Octane requirements may vary by altitude.

Midgrade gasoline: Gasoline having an antiknock index, i.e., octane rating, greater than or equal to 88 and less than or equal to 90. *Note:* Octane requirements may vary by altitude.

Premium gasoline: Gasoline having an antiknock index, i.e., octane rating, greater than 90. *Note:* Octane requirements may vary by altitude.

Reformulated gasoline: Finished motor gasoline formulated for use in motor vehicles, the composition and properties of which meet the requirements of the reformulated gasoline regulations promulgated by the U.S. Environmental Protection Agency under Section 211(k) of the Clean Air Act. For details on this clean fuel program see http://www.epa.gov/otaq/rfg.htm. *Note:* This category includes oxygenated fuels program reformulated gasoline (OPRG) but excludes reformulated gasoline blendstock for oxygenate blending (RBOB).

MTBE - Methyl Tertiary Butyl Ether - a colorless, flammable, liquid oxygenated hydrocarbon containing 18.15 percent oxygen.

Naphtha-type jet fuel - See *Jet fuel*.

National income - See *Income*.

Nationwide Personal Transportation Survey (NPTS) - A nationwide survey of households that provides information on the characteristics and personal travel patterns of the U.S. population. Surveys were conducted in 1969, 1977, 1983, 1990, and 1995 by the U.S. Bureau of Census for the U.S. Department of Transportation.

Natural gas - A mixture of hydrocarbon compounds and small quantities of various non-hydrocarbons existing in the gaseous phase or in solution with crude oil in natural underground reservoirs at reservoir conditions.

Natural gas, dry: Natural gas which remains after: 1) the liquefiable hydrocarbon portion has been removed from the gas stream; and 2) any volumes of nonhydrocarbon gases have been removed where they occur in sufficient quantity to render the gas unmarketable. Dry natural gas is also known as consumer-grade natural gas. The parameters for measurement are cubic feet at 60 degrees Fahrenheit and 14.73 pounds per square inch absolute.

Natural gas, wet: The volume of natural gas remaining after removal of lease condensate in lease and/or field separation facilities, if any, and after exclusion of nonhydrocarbon gases where they occur in sufficient quantity to render the gas unmarketable. Natural gas liquids may be recovered from volumes of natural gas, wet after lease separation, at natural gas processing plants.

Natural gas plant liquids: Natural gas liquids recovered from natural gas in processing plants and from natural gas field facilities and fractionators. Products obtained include ethane, propane, normal butane, isobutane, pentanes plus, and other products from natural gas processing plants.

Nitrogen oxides (NO_x) - A product of combustion of fossil fuels whose production increases with the temperature of the process. It can become an air pollutant if concentrations are excessive.

Nonattainment area - Any area that does not meet the national primary or secondary ambient air quality standard established by the Environmental Protection Agency for designated pollutants, such as carbon monoxide and ozone.

Oil Stocks - Oil stocks include crude oil (including strategic reserves), unfinished oils, natural gas plant liquids, and refined petroleum products.

Operating cost -

Fixed operating cost: In reference to passenger car operating cost, refers to those expenditures that are independent of the amount of use of the car, such as insurance costs, fees for license and registration, depreciation and finance charges.

Variable operating cost: In reference to passenger car operating cost, expenditures which are dependent on the amount of use of the car, such as the cost of gas and oil, tires, and other maintenance.

Organization for Economic Cooperation and Development (OECD) - Consists of Australia, Austria, Belgium, Canada, Czech Republic, Denmark, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Japan, Luxembourg, Mexico, Netherlands, New Zealand, Norway, Poland, Portugal, South Korea, Spain, Sweden, Switzerland, Turkey, United Kingdom, and United States. Total OECD includes the United States Territories (Guam, Puerto Rico, and the U.S. Virgin Islands). Total OECD excludes data for Czech Republic, Hungary, Mexico, Poland, and South Korea which are not yet available.

OECD Europe: Consists of Austria, Belgium, Czech Republic, Denmark, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Luxembourg, Netherlands, Norway, Poland, Portugal, Spain, Sweden, Switzerland, Turkey, and United Kingdom. OECD Europe excludes data for Czech Republic, Hungary, and Poland which are not yet available.

OECD Pacific: Consists of Australia, Japan, and New Zealand.

Organization for Petroleum Exporting Countries (OPEC) - Includes Saudi Arabia, Iran, Venezuela, Libya, Indonesia, United Arab Emirates, Algeria, Nigeria, Ecuador, Gabon, Iraq, Kuwait, and Qatar. Data for Saudi Arabia and Kuwait include their shares from the Partitioned Zone (formerly the Neutral Zone). Angola joined OPEC in December 2006, thus, beginning in 2007, data on OPEC will include Angola.

Arab OPEC - Consists of Algeria, Iraq, Kuwait, Libya, Qatar, Saudi Arabia and the United Arab Emirates.

Other single-unit truck - See *Single-unit truck*.

Oxygenate - A substance which, when added to gasoline, increases the amount of oxygen in that gasoline blend. Includes fuel ethanol, methanol, and methyl tertiary butyl ether (MTBE).

Particulates - Carbon particles formed by partial oxidation and reduction of the hydrocarbon fuel. Also included are trace quantities of metal oxides and nitrides, originating from engine wear, component degradation, and inorganic fuel additives. In the transportation sector, particulates are emitted mainly from diesel engines.

Passenger-miles traveled (PMT) - One person traveling the distance of one mile. Total passenger-miles traveled, thus, give the total mileage traveled by all persons.

Passenger rail - See *Rail, "Amtrak" and "Transit Railroad"*.

Persian Gulf countries - Consists of Bahrain, Iran, Iraq, Kuwait, Qatar, Saudi Arabia, and the United Emirates.

Personal Consumption Expenditures (PCE) - As used in the national accounts, the market value of purchases of goods and services by individuals and nonprofit institutions and the value of food, clothing, housing, and financial services received by them as income in kind. It includes the rental value of owner-occupied houses but excludes purchases of dwellings, which are classified as capital goods (investment).

Personal income - See *Income*.

Petroleum - A generic term applied to oil and oil products in all forms, such as crude oil, lease condensate, unfinished oil, refined petroleum products, natural gas plant liquids, and non-hydrocarbon compounds blended into finished petroleum products.

Petroleum consumption: A calculated demand for petroleum products obtained by summing domestic production, imports of crude petroleum and natural gas liquids, imports of petroleum products, and the primary stocks at the beginning of the period and then subtracting the exports and the primary stocks at the end of the period.

Petroleum exports: Shipments of petroleum products from the 50 States and the District of Columbia to foreign countries, Puerto Rico, the Virgin Islands, and other U.S. possessions and territories.

Petroleum imports: All imports of crude petroleum, natural gas liquids, and petroleum products from foreign countries and receipts from Guam, Puerto Rico, the Virgin Islands, and the Hawaiian Trade Zone. The commodities included are crude oil, unfinished oils, plant condensate, and refined petroleum products.

Petroleum inventories: The amounts of crude oil, unfinished oil, petroleum products, and natural gas liquids held at refineries, at natural gas processing plants, in pipelines, at bulk terminals operated by refining and pipeline companies, and at independent bulk terminals. Crude oil held in storage on leases is also included; these stocks are know as primary stocks. Secondary stocks - those held by jobbers dealers, service station operators, and consumers -are excluded. Prior to 1975, stock held at independent bulk terminals were classified as secondary stocks.

Petroleum products supplied: For each petroleum product, the amount supplied is calculated by summing production, crude oil burned directly, imports, and net withdrawals from primary stocks and subtracting exports.

Processing Gain - The amount by which the total volume of refinery output is greater than the volume of input for given period of time. The processing gain arises when crude oil and other hydrocarbons are processed into products that are, on average, less dense than the input.

Processing Loss - The amount by which the total volume of refinery output is less than the volume of input for given period of time. The processing loss arises when crude oil and other hydrocarbons are processed into products that are, on average, more dense than the input.

Proved Reserves of Crude Oil - The estimated quantities of all liquids defined as crude oil, which geological and engineering data demonstrate with reasonable certainty to be recoverable in future years from known reservoirs under existing economic and operating conditions.

Quad - Quadrillion, 10^{15}. In this publication, a Quad refers to Quadrillion Btu.

Rail -

Amtrak (American Railroad Tracks): Operated by the National Railroad Passenger Corporation of Washington, DC. This rail system was created by President Nixon in 1970, and was given the responsibility for the operation of intercity, as distinct from suburban, passenger trains between points designated by the Secretary of Transportation.

Class I freight railroad: Defined by the Interstate Commerce Commission each year based on annual operating revenue. A railroad is dropped from the Class I list if it fails to meet the annual earnings threshold for three consecutive years.

Commuter railroad: Those portions of mainline railroad (not electric railway) transportation operations which encompass urban passenger train service for local travel between a central city and adjacent suburbs. Commuter railroad service - using both locomotive-hauled and self-propelled railroad passenger cars - is characterized by multi-trip tickets, specific station-to-station fares, and usually only one or two stations in the central business district. Also known as suburban railroad.

Transit railroad: Includes "heavy" and "light" transit rail. **Heavy transit rail** is characterized by exclusive rights-of-way, multi-car trains, high speed rapid acceleration, sophisticated signaling, and high platform loading. Also known as subway, elevated railway, or metropolitan railway (metro). **Light transit rail** may be on exclusive or shared rights-of-way, high or low platform loading, multi-car trains or single cars, automated or manually operated. In generic usage, light rail includes streetcars, trolley cars, and tramways.

Reformulated gasoline (RFG) - See *Motor gasoline*.

RFG area - An ozone nonattainment area designated by the Environmental Protection Agency which requires the use of reformulated gasoline.

Residential sector - An energy consuming sector that consists of living quarters for private households. Excludes institutional living quarters.

Residential Transportation Energy Consumption Survey (RTECS) - This survey was designed by the Energy Information Administration of the Department of Energy to provide information on how energy is used by households for personal vehicles. It has been conducted five times since 1979, the most recent being 1991.

Residual fuel oil - The heavier oils that remain after the distillate fuel oils and lighter hydrocarbons are boiled off in refinery operations. Included are products know as ASTM grade numbers 5 and 6 oil, heavy diesel oil, Navy Special Fuel Oil, Bunker C oil, and acid sludge and pitch used as refinery fuels. Residual fuel oil is used for the production of electric power, for heating, and for various industrial purposes.

Rural - Usually refers to areas with population less than 5,000.

Sales period - October 1 of the previous year to September 30 of the given year. Approximately the same as a model year.

Sales-weighted miles per gallon (mpg) - Calculation of a composite vehicle fuel economy based on the distribution of vehicle sales.

Scrappage rate - As applied to motor vehicles, it is usually expressed as the percentage of vehicles of a certain type in a given age class that are retired from use (lacking registration) in a given year.

School and other nonrevenue bus - See *Bus*.

Single-unit truck - Includes two-axle, four-tire trucks and other single-unit trucks.

Two-axle, four-tire truck: A motor vehicle consisting primarily of a single motorized device with two axles and four tires.

Other single-unit truck: A motor vehicle consisting primarily of a single motorized device with more than two axles or more than four tires.

Special fuels - Consist primarily of diesel fuel with small amount of liquified petroleum gas, as defined by the Federal Highway Administration.

Specific acceleration power - Measured in watts per kilogram. Acceleration power divided by the battery system weight. Weight must include the total battery system.

Specific energy - Measured in watt hours per kilogram. The rated energy capacity of the battery divided by the total battery system weight.

Subcompact car - See *Automobile size classifications*.

Supplemental air carrier - See *Air carrier*.

Test weight - The weight setting at which a vehicle is tested on a dynomometer by the U.S. Environmental Protection Agency (EPA). This weight is determined by the EPA using the inertia weight of the vehicle.

Ton-mile - The movement of one ton of freight the distance of one mile. Ton-miles are computed by multiplying the weight in tons of each shipment transported by the distance hauled.

Transmission types -

A3 - Automatic three speed
A4 - Automatic four speed
A5 - Automatic five speed
L4 - Automatic lockup four speed
M5 - Manual five speed

Transit bus - See *Bus*.

Transit railroad - See *Rail*.

Transportation sector - Consists of both private and public passenger and freight transportation, as well as government transportation, including military operations.

Truck Inventory and Use Survey (TIUS) - Survey designed to collect data on the characteristics and operational use of the nation's truck population. It is conducted every five years by the U.S. Bureau of the Census. Surveys were conducted in 1963, 1967, 1972, 1977, 1982, 1987, and 1992. For the 1997 survey, it was renamed the Vehicle Inventory and Use Survey in anticipation of including additional vehicle types. However, no additional vehicle types were added to the 1997 survey.

Trolley coach - See *Bus*.

Truck size classifications - U.S. Bureau of the Census has categorized trucks by gross vehicle weight (gvw) as follows:

Light - Less than 10,000 pounds gvw (Also see *Light Truck*.)
Medium - 10,001 to 20,000 pounds gvw
Light-heavy - 20,001 to 26,000 pounds gvw
Heavy-heavy - 26,001 pounds gvw or more.

Two-axle, four-tire truck - See *Single-unit truck*.

Two seater car - See *Automobile size classifications*.

Ultra-low emission vehicle - Any vehicle certified to the ultra-low emission standards which are set by the Federal government and/or the state of California.

Urban - Usually refers to areas with population of 5,000 or greater.

Vanpool - A transit mode made up of vans and sometimes small buses operating as a ridesharing arrangement to provide transportation to a group of individuals traveling directly between their homes and a regular destination within the same geographical area. Most vanpools are privately-operated, are not available to the public, and are not considered public transportation. Vanpool data in this report are for vanpools that are owned, purchased or leased by a public entity and are publicly available.

Variable operating cost - See *Operating cost*.

Vehicle Inventory and Use Survey - See Truck Inventory and Use Survey.

Vehicle-miles traveled (vmt) - One vehicle traveling the distance of one mile. Total vehicle miles, thus, is the total mileage traveled by all vehicles.

Zero-emission vehicle - Any vehicle certified to the zero emission standards which are set by the Federal government and/or the state of California. These standards apply to the vehicle emissions only.

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USEFUL WEB SITES

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AMERICAN PUBLIC TRANSPORTATION ASSOCIATION	www.apta.com
AMTRAK	www.amtrak.com
ASSOCIATION OF AMERICAN RAILROADS	www.aar.org
ASSOCIATION OF OIL PIPELINES	www.aopl.org
CALIFORNIA AIR RESOURCES BOARD	www.arb.ca.gov
CALIFORNIA ENERGY COMMISSION	www.energy.ca.gov
ENO FOUNDATION FOR TRANSPORTATION	www.enotrans.com
ELECTRIC DRIVE TRANSPORTATION ASSOCIATION	www.electricdrive.org
INTERNATIONAL ENERGY AGENCY	www.iea.org
NATIONAL AUTOMOBILE DEALERS ASSOCIATION	www.nada.org
RUNZHEIMER INTERNATIONAL	www.runzheimer.com
TEXAS TRANSPORTATION INSTITUTE	tti.tamu.edu
TRANSPORT CANADA	www.tc.gc.ca
TRANSPORTATION RESEARCH BOARD	www.trb.org
WARD'S COMMUNICATIONS	www.wardsauto.com
WORLD ENERGY ASSESSMENT	www.undp.org/energy/activities/wea

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