Transportation Energy Data Book

Edition 34

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

Transportation Energy Data Book
Quick Facts

Petroleum

- In 2014 the U.S. produced almost 12 million barrels of petroleum per day (mmbd), or 13% of the world's 87.9 mmbd.
- The U.S. consumed 19.0 mmbd, or 21% of the world's 91.2 mmbd in 2013.
- U.S. transportation petroleum use was 70% of total U.S. petroleum use in 2014.
- In 2014 U.S. transportation petroleum use was 110% of total U.S. petroleum production.
- Petroleum comprised 92% of U.S. transportation energy use in 2014.
- Cars and light trucks accounted for 63% of U.S. transportation petroleum use in 2013.
- Medium trucks (Class 3-6) accounted for 4% of U.S. transportation petroleum use in 2013.
- Heavy trucks (Class 3-6) & buses accounted for 19% of U.S. transportation petroleum use in 2013.
- Nonhighway modes accounted for the rest of U.S. transportation petroleum use in 2013 (14%).

Energy

- In 2014 U.S. transportation energy use accounted for 28% of total U.S. energy use.
- Ninety-eight percent of ethanol consumed in the U.S. is ethanol in gasohol (2011-latest data).
- Cars and light trucks accounted for 58% of U.S. transportation energy use in 2013.
- Medium trucks accounted for 5% of U.S. transportation energy use in 2013.
- Heavy trucks accounted for 18% of U.S. transportation energy use in 2013.

Light Vehicle Characteristics

- In 2013 there were 114 million cars and 121 million light trucks in the U.S. (235 million total light vehicles).
- U.S. cars:
  - 7,688,000 cars were sold in 2014.
  - In 2014 the average age of a U.S. car was 11.5 years; the average car lifetime was 16.9 years (1990 study).
  - In 2013 the average fuel economy for the U.S. car fleet (all cars on the road today) was 25.2 mpg.
  - Cars comprised 48% of new light vehicle sales in 2014.
- U.S. light trucks:
  - 8,484,000 light trucks were sold in 2014.
  - In 2014 the average age of a U.S. light truck was 11.5 years; the average light truck lifetime is 15.5 years (1990 study).
  - In 2013 the average fuel economy for the U.S. light truck fleet (all light trucks on the road today) was 18.8 mpg.
  - Light trucks comprised 52.5% of new light vehicle sales in 2014.
- U.S. car registrations accounted for 15% of total world car registrations in 2013.
- In 2013 U.S. truck and bus registrations accounted for 37% of total world truck and bus registrations.
- The average U.S. household vehicle travels 11,300 miles per year (2009 NHTS).

Heavy Truck Characteristics

- 10,597,000 heavy trucks were registered in the U.S. in 2013.
- In 2002 (the last time a survey was conducted), heavy trucks accounted for 80% of medium and heavy truck fuel use.

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TRANSPORTATION ENERGY DATA BOOK: EDITION 34

Stacy C. Davis
Susan W. Diegel
Oak Ridge National Laboratory

Robert G. Boundy
Roltek, Inc.

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Stacy C. Davis
Oak Ridge National Laboratory
National Transportation Research Center
2360 Cherahala Boulevard
Knoxville, Tennessee 37932
Telephone: (865) 946-1256
FAX: (865) 946-1314
E-mail: DAVISSC@ornl.gov
Website Location: cta.ornl.gov/data

Jacob W. Ward
Vehicle Technologies Office
Energy Efficiency and Renewable Energy
Department of Energy, EE-3V
Forrestal Building
1000 Independence Avenue, S.W.
Washington, D.C. 20585
Telephone: (202) 586-7606
FAX: (202) 586-1600
E-mail: JACOB.WARD@ee.doe.gov
Website Location: vehicles.energy.gov

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FOREWORD

Welcome to this 34th edition of the *Transportation Energy Data Book*. Twenty-six editions of this Data Book have been produced by Stacy Davis; DOE is grateful for the dedication, consistency, and skill she has brought to this effort.

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

- **Figure 1.3 and Table 1.5** have been expanded to show not only the most current year data, but also data from 1980 and 1993 (**Figures 1.1 and 1.2**).
- **Table 2.3** is a new table containing the distribution of transportation energy consumption by source from 1950 to 2014.
- **Figure 2.4 and Table 2.4** were formerly in Chapter 1 and have also been expanded to show not only the most current year data, but also data from 1980 and 1993 (**Figures 2.2 and 2.3**).
- **Figure 2.5** was formerly in Chapter 6 Alternative Fuel and Advanced Technology Vehicles and Characteristics.
- **Figure 2.6** is a new graphic which summarizes domestic transportation fuel use by mode. The width of the bars shows the relationship of fuel use by mode and the colors represent the different fuel types.
- **Figures 3.1 and 3.2** are new figures depicting the World production of cars and trucks from 1983 to 2013, providing historical data similar to what is provided on **Table 3.1**.
- On **page 5-5** information is available on the planning of a new Vehicle Inventory and Use Survey. If you are interested in knowing more about this study, email VIUS@dot.gov.
- **Table 11.1**, which formerly contained World carbon dioxide data from the latest year compared to 1990 data, has an intervening year of data –2005.
- **Figure 11.1** is a new historical representation of World carbon dioxide emissions from 1990 to 2012.
- **Tables 11.3 and 11.5** on greenhouse gas emissions/carbon emissions have been expanded to include additional years of data.
- **Table 11.6** is a new table comparing the transportation sector carbon dioxide emissions data from two sources.
- **Tables 11.7 and 11.8** were reworked from previous years to include additional historical data.
- **Tables 11.9, 11.10, and 11.11** are now in metric tons of carbon dioxide instead of short tons of carbon dioxide. Please be sure to note this difference.

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

Jacob W. Ward
Analysis Manager, Vehicle Technologies Office
U.S. Department of Energy

ACKNOWLEDGMENTS

The authors would like to express their gratitude to the many individuals who assisted in the preparation of this document. First, we would like to thank Jacob Ward and the Vehicle Technologies Office staff for their continued support of the Transportation Energy Data Book project. We would also like to thank Mark Robbins for the cover design. We are indebted to Debbie Bain, who has masterfully prepared the manuscript since 1998.

This book would not be possible without the leadership, guidance, and vision of Phil Patterson, who began this book in the 1970's. We hope to continue this report into the future with the same level of excellence. The authors and the transportation research community will be forever grateful for his efforts.

ABSTRACT

The *Transportation Energy Data Book: Edition 34* 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 Office. 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. This work continues today in the Vehicle Technologies Office.

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 34 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.

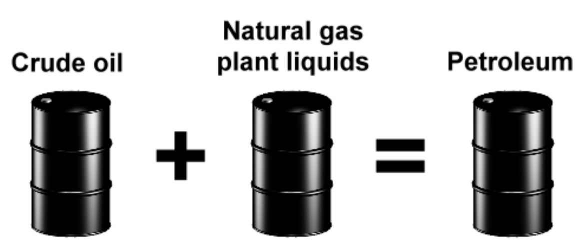
The majority of the statistics contained in the data book are taken directly from published sources, although these data may be reformatted for presentation by ORNL. Consequently, neither ORNL nor DOE endorses the validity of these data.

Chapter 1
Petroleum

Summary Statistics from Tables/Figures in this Chapter

Source			
Table 1.3	World Petroleum Production, 2014 (million barrels per day)[a]		87.85
	U.S. Production (million barrels per day)		11.62
	U.S. Share		13.2%
Table 1.4	World Petroleum Consumption, 2013 (million barrels per day)		91.19
	U.S. Consumption (million barrels per day)		18.96
	U.S. Share		20.8%
Figure 1.6	Average Refinery Yield, 2014	OECD[b] Europe	OECD[b] Americas
	Gasoline	*18.5%*	*40.3%*
	Diesel oil	*41.4%*	*29.2%*
	Residual fuel	*11.5%*	*4.6%*
	Kerosene	*7.5%*	*8.1%*
	Other	*12.6%*	*13.8%*
Table 1.12	U.S. transportation petroleum use as a percent of U.S. petroleum production, 2014		109.9%
Table 1.12	Net imports as a percentage of U.S. petroleum consumption, 2014		26.5%
Table 1.13	Transportation share of U.S. petroleum consumption, 2014		68.9%
Table 1.16	Highway share of transportation petroleum consumption, 2013		86.4%
Table 1.16	Light vehicle share of transportation petroleum consumption, 2013		63.4%

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



[a] Because other liquids and processing gain are not included, the world production is smaller than world petroleum consumption.

[b] Organization for Economic Co-operation and Development.

As new technologies appear and new areas are explored, the amount of proved reserves of crude oil and natural gas has grown. Although the reserves of natural gas in the United States were 68% higher in 2014 than it was in 1980, the U.S. share of World natural gas reserves is lower. The U.S. share of crude oil reserves has risen in recent years and was 2.2% in 2014.

Table 1.1
Proved Reserves of Crude Oil and Natural Gas, 1980–2014

Year	Crude Oil Reserves (billion barrels)		U.S. Share of Crude Oil Reserves	Natural Gas Reserves (trillion cubic feet)		U.S. Share of Natural Gas Reserves
	World	United States		World	United States	
1980	643.3	31.2	4.9%	2,592.0	201.0	7.8%
1981	650.7	31.3	4.8%	2,653.9	199.0	7.5%
1982	669.0	31.0	4.6%	2,927.0	201.7	6.9%
1983	667.2	29.5	4.4%	3,038.4	201.5	6.6%
1984	668.1	29.3	4.4%	3,208.5	200.2	6.2%
1985	699.3	30.0	4.3%	3,407.2	197.5	5.8%
1986	700.1	29.9	4.3%	3,490.1	193.4	5.5%
1987	699.4	28.3	4.1%	3,648.7	191.6	5.3%
1988	888.9	28.7	3.2%	3,796.6	187.2	4.9%
1989	907.4	28.2	3.1%	3,933.2	168.0	4.3%
1990	1,001.9	27.9	2.8%	3,987.5	167.1	4.2%
1991	1,000.0	27.6	2.8%	4,215.6	169.3	4.0%
1992	990.7	25.9	2.6%	4,376.7	167.1	3.8%
1993	997.3	25.0	2.5%	4,884.4	165.0	3.4%
1994	999.5	24.1	2.4%	5,013.8	162.4	3.2%
1995	1,000.4	23.6	2.4%	4,981.9	163.8	3.3%
1996	1,008.6	23.5	2.3%	4,935.3	165.1	3.3%
1997	1,019.8	23.3	2.3%	4,947.0	166.5	3.4%
1998	1,021.4	23.9	2.3%	5,087.6	167.2	3.3%
1999	1,034.1	22.4	2.2%	5,141.9	164.0	3.2%
2000	1,018.2	23.2	2.3%	5,150.0	167.4	3.3%
2001	1,029.6	23.5	2.3%	5,288.9	177.4	3.4%
2002	1,033.4	23.8	2.3%	5,457.6	183.5	3.4%
2003	1,214.5	24.0	2.0%	5,505.4	186.9	3.4%
2004	1,266.2	23.1	1.8%	6,079.1	189.0	3.1%
2005	1,278.4	22.6	1.8%	6,046.6	192.5	3.2%
2006	1,294.2	23.0	1.8%	6,124.6	204.4	3.3%
2007	1,318.0	22.3	1.7%	6,190.9	211.1	3.4%
2008	1,333.5	22.8	1.7%	6,213.7	237.7	3.8%
2009	1,341.4	20.6	1.5%	6,262.4	244.7	3.9%
2010	1,357.4	22.3	1.6%	6,638.2	272.5	4.1%
2011	1,475.7	25.2	1.7%	6,708.2	304.6	4.5%
2012	1,528.4	29.0	1.9%	6,809.3	334.1	4.9%
2013	1,648.9	33.4	2.0%	6,845.2	308.0	4.5%
2014	1,655.6	36.5	2.2%	6,972.5	338.3	4.9%
			Average Annual Percentage Change			
1970-2014	2.8%	0.5%		3.0%	1.5%	
2004-2014	2.7%	4.7%		1.4%	6.0%	

Source:
U.S. Department of Energy, Energy Information Administration, *International Energy Statistics*, June 2015.
(Additional resources: www.eia.doe.gov)

In 2014, the Organization of Petroleum Exporting Countries (OPEC) accounted for 41.7% of world oil production. The U.S. production of crude oil increased to 8.65 million barrels per day, which is the highest production since 1986. The U.S. production has risen to 11.1% of World production.

Table 1.2
World Crude Oil Production, 1960–2014[a]
(million barrels per day)

Year	United States	U.S. share	Total OPEC[b]	OPEC share	Total non-OPEC	World
1960	7.04	33.5%	8.70	41.4%	12.29	20.99
1965	7.80	25.7%	14.35	47.3%	15.98	30.33
1970	9.64	21.0%	23.30	50.8%	22.59	45.89
1975	8.38	15.9%	25.79	48.8%	27.04	52.83
1980	8.60	14.4%	25.38	42.6%	34.17	59.56
1985	8.97	16.6%	15.37	28.5%	38.60	53.97
1986	8.68	15.4%	17.59	31.2%	38.74	56.33
1987	8.35	14.7%	17.73	31.3%	38.92	56.65
1988	8.14	13.9%	19.74	33.6%	38.96	58.70
1989	7.61	12.7%	21.41	35.8%	38.40	59.80
1990	7.36	12.2%	22.50	37.2%	38.00	60.50
1991	7.42	12.3%	22.42	37.3%	37.71	60.13
1992	7.17	11.9%	23.73	39.5%	36.37	60.10
1993	6.85	11.4%	24.46	40.7%	35.71	60.17
1994	6.66	10.9%	24.88	40.7%	36.30	61.17
1995	6.56	10.5%	25.50	40.8%	36.93	62.43
1996	6.46	10.1%	26.00	40.7%	37.81	63.82
1997	6.45	9.8%	27.27	41.4%	38.53	65.81
1998	6.25	9.3%	28.35	42.3%	38.69	67.03
1999	5.88	8.9%	27.20	41.2%	38.77	65.97
2000	5.82	8.5%	28.94	42.2%	39.58	68.53
2001	5.80	8.5%	28.13	41.3%	40.00	68.13
2002	5.74	8.5%	26.47	39.3%	40.82	67.29
2003	5.65	8.1%	27.98	40.3%	41.48	69.46
2004	5.44	7.5%	30.43	41.9%	42.16	72.60
2005	5.18	7.0%	31.90	43.2%	41.97	73.87
2006	5.09	6.9%	31.61	43.0%	41.87	73.48
2007	5.08	6.9%	31.35	42.9%	41.81	73.16
2008	5.00	6.8%	32.72	44.2%	41.34	74.06
2009	5.35	7.3%	31.04	42.6%	41.84	72.87
2010	5.48	7.3%	32.00	42.9%	42.66	74.65
2011	5.64	7.6%	32.23	43.1%	42.52	74.73
2012	6.50	8.5%	33.40	43.9%	42.76	76.16
2013	7.44	9.8%	32.46	42.6%	43.76	76.25
2014	8.65	11.1%	32.43	41.7%	45.45	77.83
			Average annual percentage change			
1960–2014	0.4%		2.5%		2.5%	2.5%
1970–2014	-0.2%		0.8%		1.6%	1.2%
2004–2014	4.7%		0.6%		0.8%	0.7%

Source:
U.S. Department of Energy, Energy Information Administration, *International Energy Statistics Website*, June 2015. (Additional resources: www.eia.doe.gov)

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[a] Includes lease condensate. Excludes natural gas plant liquids.
[b] See Glossary for membership.

This table shows petroleum production, which includes both crude oil and natural gas plant liquids. Because other liquids and processing gain are not included, the world total is smaller than world petroleum consumption (Table 1.4). The United States was responsible for 13.2% of the world's petroleum production in 2014 and 11.1% of the world's crude oil production (Table 1.2).

Table 1.3
World Petroleum Production, 1973–2014[a]
(million barrels per day)

Year	United States	U.S. share	Total OPEC[b]	OPEC share	Total non-OPEC	Non-OPEC share	World
1973	10.95	18.7%	29.99	51.3%	28.48	48.7%	58.47
1975	10.01	18.0%	26.16	47.0%	28.48	51.2%	55.62
1980	10.17	16.1%	26.05	41.3%	35.77	56.8%	63.00
1985	10.58	18.3%	16.20	28.0%	40.90	70.6%	57.90
1986	10.23	16.9%	18.53	30.6%	41.17	68.1%	60.49
1987	9.94	16.3%	18.70	30.7%	41.47	68.1%	60.93
1988	9.77	15.5%	20.80	32.9%	41.86	66.2%	63.20
1989	9.16	14.2%	22.52	35.0%	41.18	64.0%	64.31
1990	8.91	13.7%	23.71	36.4%	40.80	62.6%	65.14
1991	9.08	14.0%	23.65	36.4%	40.53	62.4%	64.95
1992	8.87	13.7%	25.02	38.5%	39.37	60.6%	64.95
1993	8.58	13.2%	25.83	39.6%	38.82	59.5%	65.23
1994	8.39	12.6%	26.52	39.8%	39.21	58.9%	66.55
1995	8.32	12.2%	27.19	40.0%	40.21	59.1%	68.01
1996	8.29	11.9%	27.70	39.8%	41.26	59.3%	69.52
1997	8.27	11.5%	29.05	40.5%	42.05	58.7%	71.65
1998	8.01	11.0%	30.21	41.4%	42.33	58.0%	73.04
1999	7.73	10.7%	29.13	40.4%	43.02	59.6%	72.15
2000	7.73	10.3%	30.95	41.3%	43.95	58.7%	74.90
2001	7.67	10.3%	30.35	40.6%	44.47	59.4%	74.83
2002	7.62	10.3%	28.79	38.9%	45.31	61.1%	74.10
2003	7.37	9.6%	30.44	39.8%	46.08	60.2%	76.52
2004	7.25	9.0%	33.34	41.6%	46.79	58.4%	80.12
2005	6.90	8.4%	35.14	43.0%	46.65	57.0%	81.79
2006	6.83	8.4%	34.90	42.7%	46.76	57.3%	81.66
2007	6.86	8.4%	34.76	42.6%	46.80	57.4%	81.56
2008	6.78	8.2%	36.27	43.9%	46.31	56.1%	82.58
2009	7.26	8.9%	34.60	42.4%	46.91	57.6%	81.51
2010	7.56	9.0%	35.59	42.6%	47.97	57.4%	83.55
2011	7.86	9.4%	35.86	42.8%	48.01	57.2%	83.86
2012	8.90	10.4%	37.18	43.4%	48.48	56.6%	85.66
2013	10.05	11.7%	36.17	42.1%	49.71	57.9%	85.88
2014	11.62	13.2%	36.07	41.1%	51.77	58.9%	87.85
			Average annual percentage change				
1973–2014	0.1%		0.5%		1.5%		1.0%
2004–2014	4.8%		0.8%		1.0%		0.9%

Source:
U.S. Department of Energy, Energy Information Administration, *International Energy Statistics Website*, June 2015. (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.

During the 1980s and 1990s, the United States accounted for about one-quarter of the world's petroleum consumption, but from 2000 to 2012 that share had been decreasing. In 2013 the United States accounted for only 20.8%. World petroleum consumption decreased in 2009 but has continued to increase beginning with 2010. Non-OECD consumption has continued to increase.

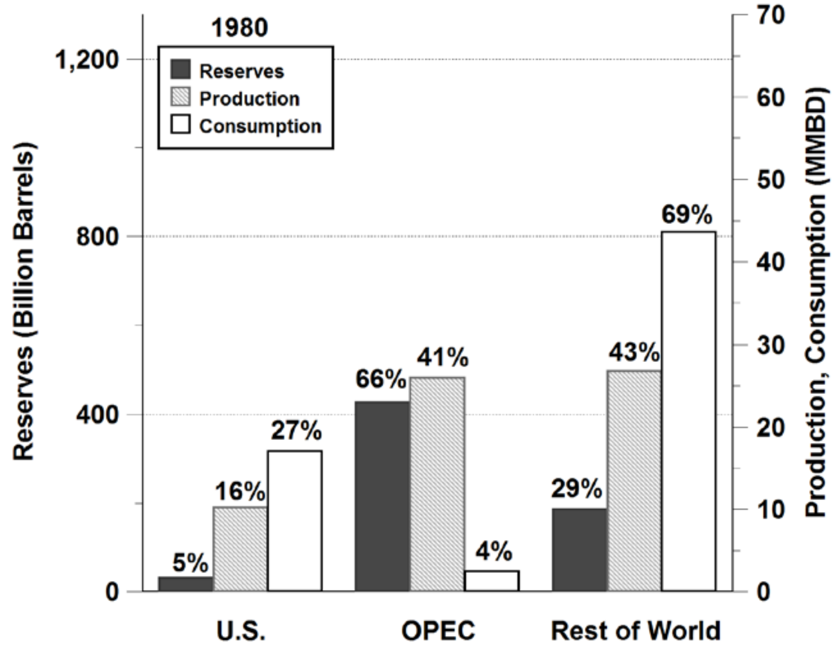
Table 1.4
World Petroleum Consumption, 1960–2013
(million barrels per day)

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
1980	17.06	27.0%	42.03	21.09	63.12
1981	16.06	26.3%	39.76	21.20	60.95
1982	15.30	25.7%	38.03	21.52	59.55
1983	15.23	25.9%	37.16	21.63	58.78
1984	15.73	26.3%	37.90	21.89	59.80
1985	15.73	26.2%	37.70	22.39	60.08
1986	16.28	26.3%	38.83	22.99	61.82
1987	16.67	26.4%	39.59	23.51	63.11
1988	17.28	26.6%	40.92	24.05	64.98
1989	17.33	26.2%	41.62	24.47	66.09
1990	16.99	25.5%	41.75	24.79	66.54
1991	16.71	24.9%	42.22	24.97	67.19
1992	17.03	25.3%	43.25	24.15	67.40
1993	17.24	25.5%	43.69	23.93	67.62
1994	17.72	25.7%	44.92	24.09	69.01
1995	17.72	25.2%	45.40	24.86	70.26
1996	18.31	25.5%	46.53	25.35	71.88
1997	18.62	25.3%	47.30	26.29	73.60
1998	18.92	25.5%	47.49	26.78	74.27
1999	19.52	25.7%	48.48	27.50	75.98
2000	19.70	25.6%	48.51	28.42	76.93
2001	19.65	25.3%	48.55	29.19	77.73
2002	19.76	25.2%	48.52	29.93	78.46
2003	20.03	25.0%	49.24	30.85	80.09
2004	20.73	25.0%	50.06	33.00	83.06
2005	20.80	24.6%	50.39	34.17	84.56
2006	20.69	24.2%	50.17	35.40	85.57
2007	20.68	23.8%	50.06	36.67	86.72
2008	19.50	22.7%	48.33	37.71	86.05
2009	18.77	22.1%	46.31	38.66	84.97
2010	19.18	21.8%	46.94	41.22	88.16
2011	18.88	21.2%	46.32	42.78	89.11
2012	18.49	20.5%	45.87	44.47	90.34
2013	18.96	20.8%	46.03	45.17	91.19
		Average annual percentage change			
1960–2013	1.3%		2.0%	4.0%	2.8%
1970–2013	0.6%		0.7%	3.1%	1.6%
2003–2013	-0.5%		-0.7%	3.9%	1.3%

Source:
U.S. Department of Energy, Energy Information Administration, *International Energy Statistics Website*, June 2015. (Additional resources: www.eia.doe.gov)

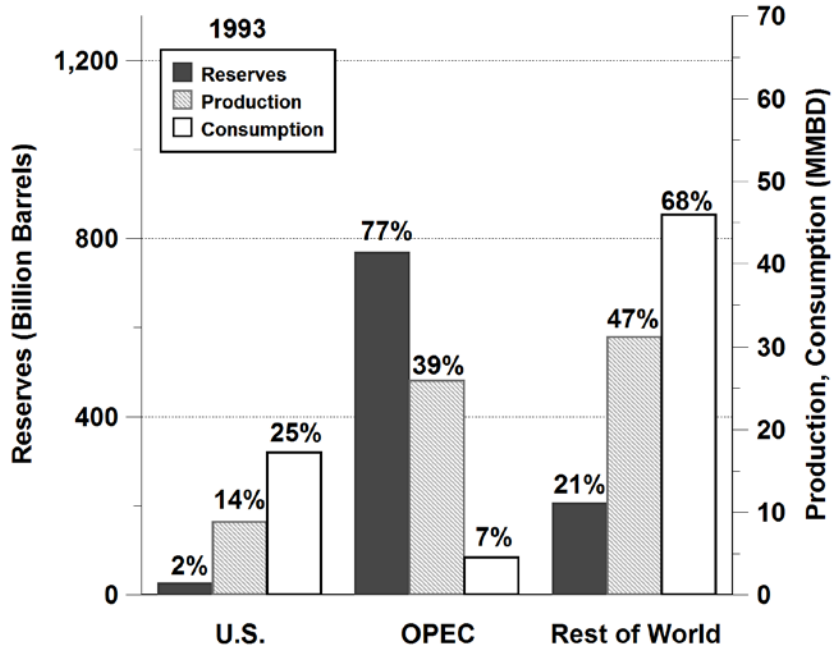
[a] Organization for Economic Cooperation and Development. See Glossary for membership.

Figure 1.1. World Oil Reserves, Production, and Consumption, 1980



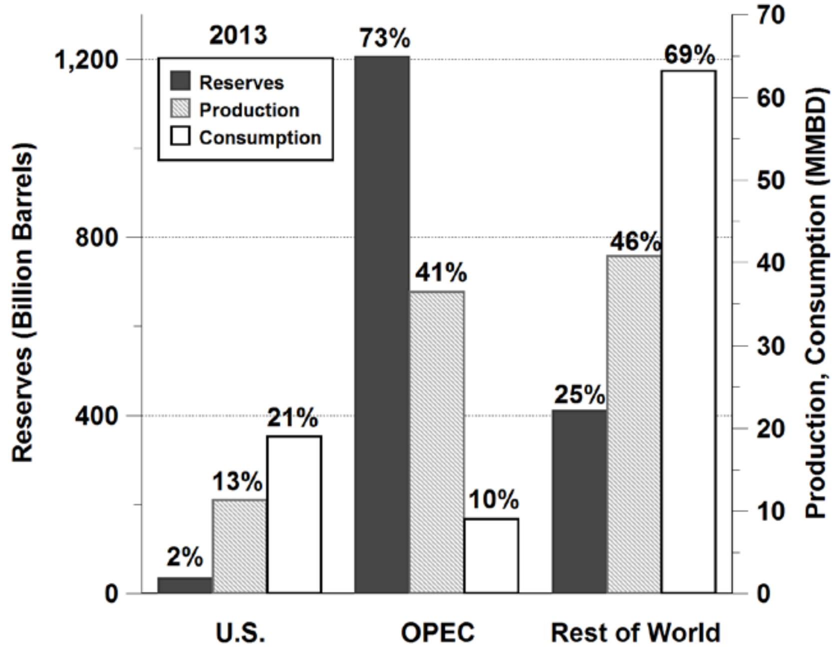
Source:
See Table 1.5.

Figure 1.2. World Oil Reserves, Production, and Consumption, 1993



Source:
See Table 1.5.

Figure 1.3. World Oil Reserves, Production, and Consumption, 2013



Source:
See Table 1.5.

Table 1.5
World Oil Reserves, Production, and Consumption, 1980, 1993 and 2013

	Crude oil reserves (billion barrels)	Reserve share	Petroleum production (million barrels per day)	Production share	Petroleum consumption (million barrels per day)	Consumption share
				1980		
United States	31.2	5%	10.2	16%	17.1	27%
OPEC	426.7	66%	26.0	41%	2.5	4%
Rest of world	185.4	29%	26.8	43%	43.6	69%
				1993		
United States	25.0	2%	8.84	14%	17.2	25%
OPEC	767.2	77%	25.85	39%	4.5	7%
Rest of world	205.2	21%	31.18	47%	45.9	68%
				2013		
United States	33.4	2%	11.3	13%	19.0	21%
OPEC	1204.7	73%	36.4	41%	9.0	10%
Rest of world	410.7	25%	40.8	46%	63.2	69%

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, Angola, United Arab Emirates, Algeria, Libya, Nigeria, Indonesia, Gabon, and Ecuador.

Sources:
Energy Information Administration, *International Energy Statistics*, June 2015. (Additional resources: www.eia.doe.gov)

The share of petroleum imported to the United States can be calculated using total imports or net imports. Net imports, which are the preferred data, rose to over 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. Net imports as a share of consumption decreased to 26.5% in 2014—the lowest since 1985.

Table 1.6
U.S. Petroleum Imports, 1960–2014
(million barrels per day)

Year	Net OPEC[a] imports	Net OPEC[a] share	Net imports	Net imports as a share of U.S. consumption	Total imports
1960	1.23	68.0%	1.61	16.5%	1.81
1965	1.44	58.3%	2.28	19.8%	2.47
1970	1.29	37.8%	3.16	21.5%	3.42
1975	3.60	59.5%	5.85	35.8%	6.06
1980	4.30	62.2%	6.36	37.3%	6.91
1985	1.83	36.1%	4.29	27.3%	5.07
1986	2.84	45.6%	5.44	33.4%	6.22
1987	3.06	45.8%	5.91	35.5%	6.68
1988	3.52	47.6%	6.59	38.1%	7.40
1989	4.14	51.4%	7.20	41.6%	8.06
1990	4.30	53.6%	7.16	42.2%	8.02
1991	4.09	53.7%	6.63	39.6%	7.63
1992	4.09	51.9%	6.94	40.7%	7.89
1993	4.27	49.6%	7.62	44.2%	8.62
1994	4.25	47.2%	8.05	45.5%	9.00
1995	4.00	45.3%	7.89	44.5%	8.83
1996	4.21	44.4%	8.50	46.4%	9.48
1997	4.57	45.0%	9.16	49.2%	10.16
1998	4.91	45.8%	9.76	51.6%	10.71
1999	4.95	45.6%	9.91	50.8%	10.85
2000	5.20	45.4%	10.42	52.9%	11.46
2001	5.53	46.6%	10.90	55.5%	11.87
2002	4.61	39.9%	10.55	53.4%	11.53
2003	5.16	42.1%	11.24	56.1%	12.26
2004	5.70	43.4%	12.10	58.4%	13.15
2005	5.59	40.7%	12.55	60.3%	13.71
2006	5.52	40.2%	12.39	59.9%	13.71
2007	5.98	44.4%	12.04	58.2%	13.47
2008	5.95	46.1%	11.11	57.0%	12.92
2009	4.78	40.9%	9.67	51.5%	11.69
2010	4.91	41.6%	9.44	49.2%	11.79
2011	4.56	39.8%	8.45	44.8%	11.44
2012	4.27	40.3%	7.39	40.0%	10.60
2013	3.72	37.7%	6.24	32.9%	9.86
2014	3.22	35.0%	5.04	26.5%	9.22
			Average annual percentage change		
1960–2014	1.8%		2.1%		3.1%
1970–2014	2.1%		1.1%		2.3%
2004–2014	-5.6%		-8.4%		-3.5%

Source:
U.S. Department of Energy, Energy Information Administration, *Monthly Energy Review*, Washington, DC, May 2015, Table 3.3a. (Additional resources: www.eia.gov)

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

Just over half of the oil imported to the United States in 2014 was from the western hemisphere. Canada, Mexico, and Venezuela provided most of the oil from the western hemisphere, along with small amounts from Brazil, Columbia, Ecuador, and the U.S. Virgin Islands (these countries are not listed separately).

Table 1.7
Imported Crude Oil by Country of Origin, 1973–2014
(million barrels per day)

Year	Saudi Arabia	Venezuela	Nigeria	Other OPEC[a] countries	Canada	Mexico	Russia	Other non-OPEC countries	Total imports
1973	0.49	1.13	0.46	0.91	1.32	0.02	0.03	1.90	6.26
1975	0.71	0.70	0.76	1.42	0.85	0.07	0.01	1.52	6.06
1980	1.26	0.48	0.86	1.70	0.45	0.53	0.00	1.62	6.91
1981	1.13	0.41	0.62	1.17	0.45	0.52	0.00	1.70	6.00
1982	0.55	0.41	0.51	0.67	0.48	0.68	0.00	1.80	5.11
1983	0.34	0.42	0.30	0.80	0.55	0.83	0.00	1.81	5.05
1984	0.32	0.55	0.22	0.96	0.63	0.75	0.01	2.00	5.44
1985	0.17	0.60	0.29	0.76	0.77	0.82	0.01	1.64	5.07
1986	0.68	0.79	0.44	0.92	0.81	0.70	0.02	1.86	6.22
1987	0.75	0.80	0.53	0.97	0.85	0.65	0.01	2.10	6.68
1988	1.07	0.79	0.62	1.03	1.00	0.75	0.03	2.11	7.40
1989	1.22	0.87	0.82	1.23	0.93	0.77	0.05	2.17	8.06
1990	1.34	1.02	0.80	1.13	0.93	0.76	0.04	1.99	8.02
1991	1.80	1.03	0.70	0.55	1.03	0.81	0.03	1.67	7.63
1992	1.72	1.17	0.68	0.52	1.07	0.83	0.02	1.88	7.89
1993	1.41	1.30	0.74	0.82	1.18	0.92	0.05	2.19	8.62
1994	1.40	1.33	0.64	0.87	1.27	0.98	0.03	2.46	9.00
1995	1.34	1.48	0.63	0.55	1.33	1.07	0.02	2.41	8.83
1996	1.36	1.68	0.62	0.56	1.42	1.24	0.03	2.57	9.48
1997	1.41	1.77	0.70	0.69	1.56	1.39	0.01	2.63	10.16
1998	1.49	1.72	0.70	1.00	1.60	1.35	0.02	2.83	10.71
1999	1.48	1.49	0.66	1.33	1.54	1.32	0.09	2.95	10.85
2000	1.57	1.55	0.90	1.19	1.81	1.37	0.07	3.00	11.46
2001	1.66	1.55	0.89	1.43	1.83	1.44	0.09	2.98	11.87
2002	1.55	1.40	0.62	1.03	1.97	1.55	0.21	3.20	11.53
2003	1.77	1.38	0.87	1.14	2.07	1.62	0.25	3.15	12.26
2004	1.56	1.55	1.14	1.45	2.14	1.66	0.30	3.34	13.15
2005	1.54	1.53	1.17	1.36	2.18	1.66	0.41	3.87	13.71
2006	1.46	1.42	1.11	1.52	2.35	1.71	0.37	3.76	13.71
2007	1.48	1.36	1.13	2.00	2.45	1.53	0.41	3.09	13.47
2008	1.53	1.19	0.99	2.25	2.49	1.30	0.47	2.70	12.92
2009	1.00	1.06	0.81	1.90	2.48	1.21	0.56	2.66	11.69
2010	1.10	0.99	1.02	1.80	2.54	1.28	0.61	2.46	11.79
2011	1.19	0.95	0.82	1.59	2.73	1.21	0.62	2.32	11.44
2012	1.37	0.96	0.44	1.51	2.95	1.03	0.48	1.87	10.60
2013	1.33	0.81	0.28	1.30	3.14	0.92	0.46	1.62	9.86
2014	1.17	0.79	0.09	1.18	3.39	0.84	0.33	1.44	9.22

Sources:
U.S. Department of Energy, Energy Information Administration, *Monthly Energy Review*, Washington, DC, May 2015, Tables 3.3c and 3.3d. (Additional resources: www.eia.gov)

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

The Strategic Petroleum Reserve (SPR) began in October 1977 as a result of the 1975 Energy Policy and Conservation Act. Its purpose is to provide protection against oil supply disruptions. The U.S. consumed 19 million barrels per day in 2014. At that rate of consumption, the SPR supply would last 36 days if used exclusively and continuously.

Table 1.8
Crude Oil Supplies, 1973-2014

Year	Strategic Petroleum Reserve	Other crude oil stocks[a] (million barrels)	Total crude oil stocks	U.S. petroleum consumption (million barrels per day)	Number of days the SPR would supply the U.S.[b]
1973	0.0	242.5	242.5	17.3	0
1980	107.8	358.2	466.0	17.1	6
1981	230.3	363.5	593.8	16.1	14
1982	293.8	349.7	643.6	15.3	19
1983	379.1	343.9	722.9	15.2	25
1984	450.5	345.4	795.9	15.7	29
1985	493.3	320.9	814.2	15.7	31
1986	511.6	331.2	842.8	16.3	31
1987	540.6	349.0	889.6	16.7	32
1988	559.5	330.4	889.9	17.3	32
1989	579.9	341.3	921.1	17.3	33
1990	585.7	322.7	908.4	17.0	34
1991	568.5	324.6	893.1	16.7	34
1992	574.7	318.1	892.9	17.0	34
1993	587.1	335.4	922.5	17.2	34
1994	591.7	337.2	928.9	17.7	33
1995	591.6	303.3	895.0	17.7	33
1996	565.8	283.9	849.7	18.3	31
1997	563.4	304.7	868.1	18.6	30
1998	571.4	323.5	894.9	18.9	30
1999	567.2	284.5	851.7	19.5	29
2000	540.7	285.5	826.2	19.7	27
2001	550.2	312.0	862.2	19.6	28
2002	599.1	277.6	876.7	19.8	30
2003	638.4	268.9	907.3	20.0	32
2004	675.6	285.7	961.3	20.7	33
2005	684.5	323.7	1,008.2	20.8	33
2006	688.6	312.3	1,000.9	20.7	33
2007	696.9	286.1	983.0	20.7	34
2008	701.8	325.8	1,027.7	19.5	36
2009	726.6	325.2	1,051.8	18.8	39
2010	726.5	333.4	1,060.0	19.2	38
2011	696.0	330.7	1,026.6	18.9	37
2012	695.3	365.5	1,060.8	18.5	38
2013	696.0	357.1	1,053.0	19.0	37
2014	691.0	393.7	1,084.7	19.0	36

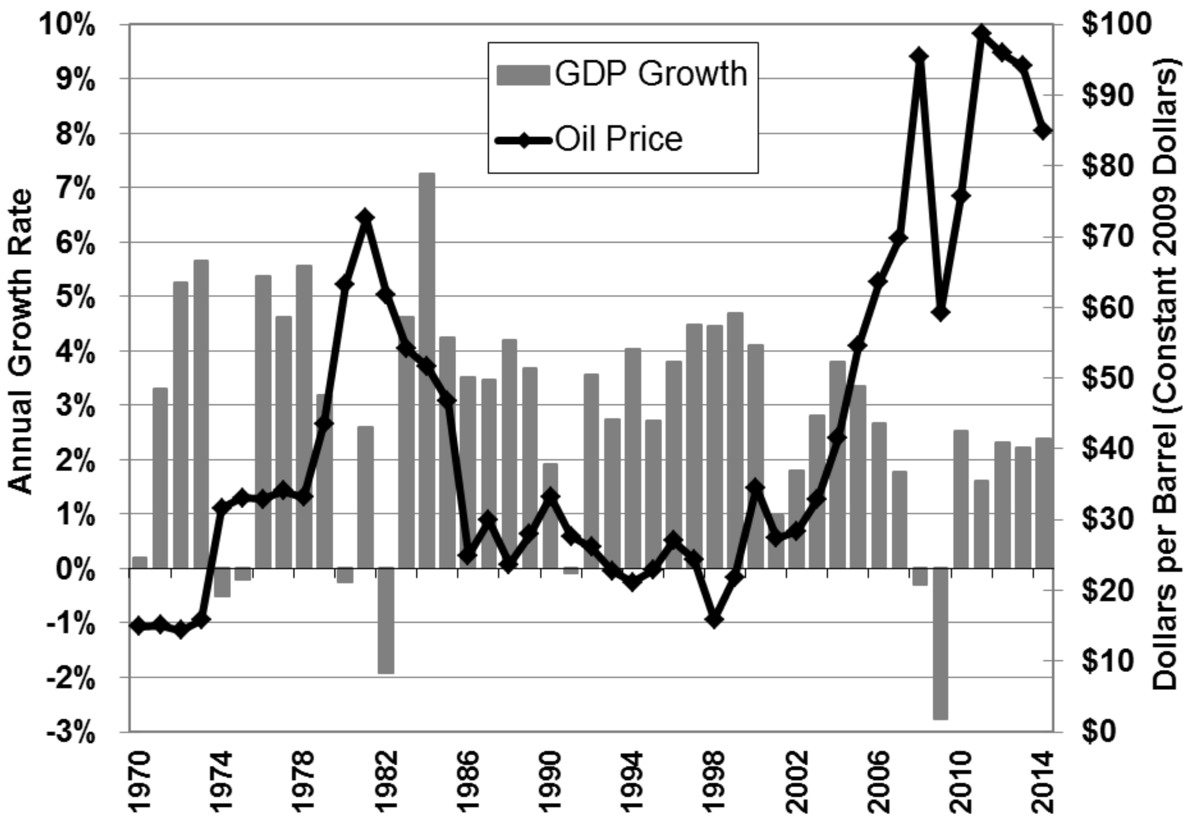
Sources:
U.S. Department of Energy, Energy Information Administration, *Monthly Energy Review*, Washington, DC, June 2015, Tables 3.1 and 3.4. (Additional resources: www.eia.gov)

[a] Other crude oil stocks include stocks held by petroleum companies, as well as stocks of Alaskan crude oil in transit.

[b] Strategic Petroleum Reserves divided by U.S. consumption per day. This would only hold true if the SPR were the only oil used for that many days.

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.

Figure 1.4. Oil Price and Economic Growth, 1970–2014

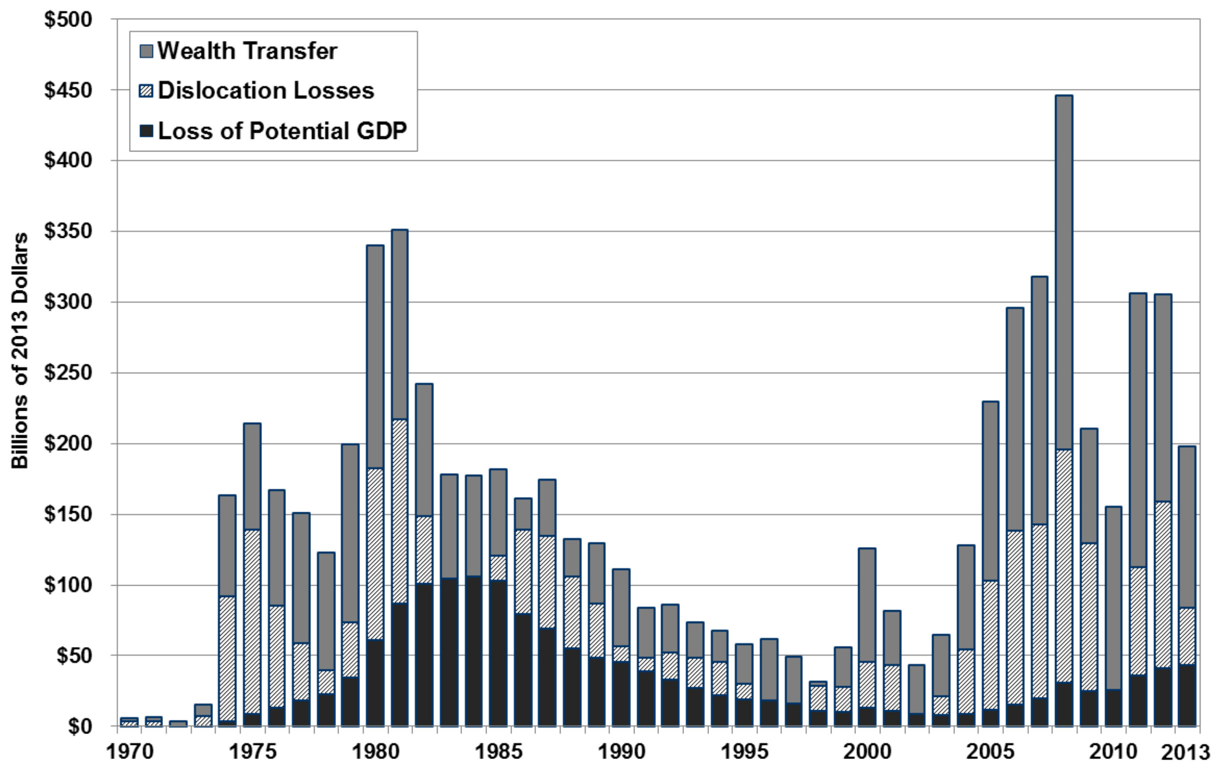


Source:

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, 2015. (Additional resources: cta.ornl.gov/cta/publications.shtml)

The United States has long recognized the problem of oil dependence and the economic problems that arise from it. According to Oak Ridge National Laboratory (ORNL) researchers, oil dependence is a combination of four factors: (1) a noncompetitive world oil market strongly influenced by the OPEC cartel, (2) high levels of U.S. imports, (3) the importance of oil to the U.S. economy, and (4) the lack of economical and readily available substitutes for oil. ORNL developed a model to estimate the historical cost of oil dependence and analyze the potential effectiveness of policies on likely future costs. The most recent study using this model shows that the U.S. economy suffered the greatest losses in 2008 when wealth transfer and GDP losses (combined) amounted to just under half a trillion dollars. However, when comparing oil dependence to the size of the economy, the year 1981 is the highest. Oil dependence costs were over 5% of GDP in 1981, but were 3% in 2008. In 2009, the average oil price fell to about $60 per barrel and oil dependence costs fell to about $200 billion for 2009 and even lower for 2010. However, the cost rose again in 2011 and 2012, only to fall again in 2013.

Figure 1.5. Costs of Oil Dependence to the U.S. Economy, 1970–2013



Notes:

Wealth Transfer is the product of total U.S. oil imports and the difference between the actual market price of oil (influenced by market power) and what the price would have been in a competitive market.

Dislocation Losses are temporary reductions in GDP as a result of oil price shocks.

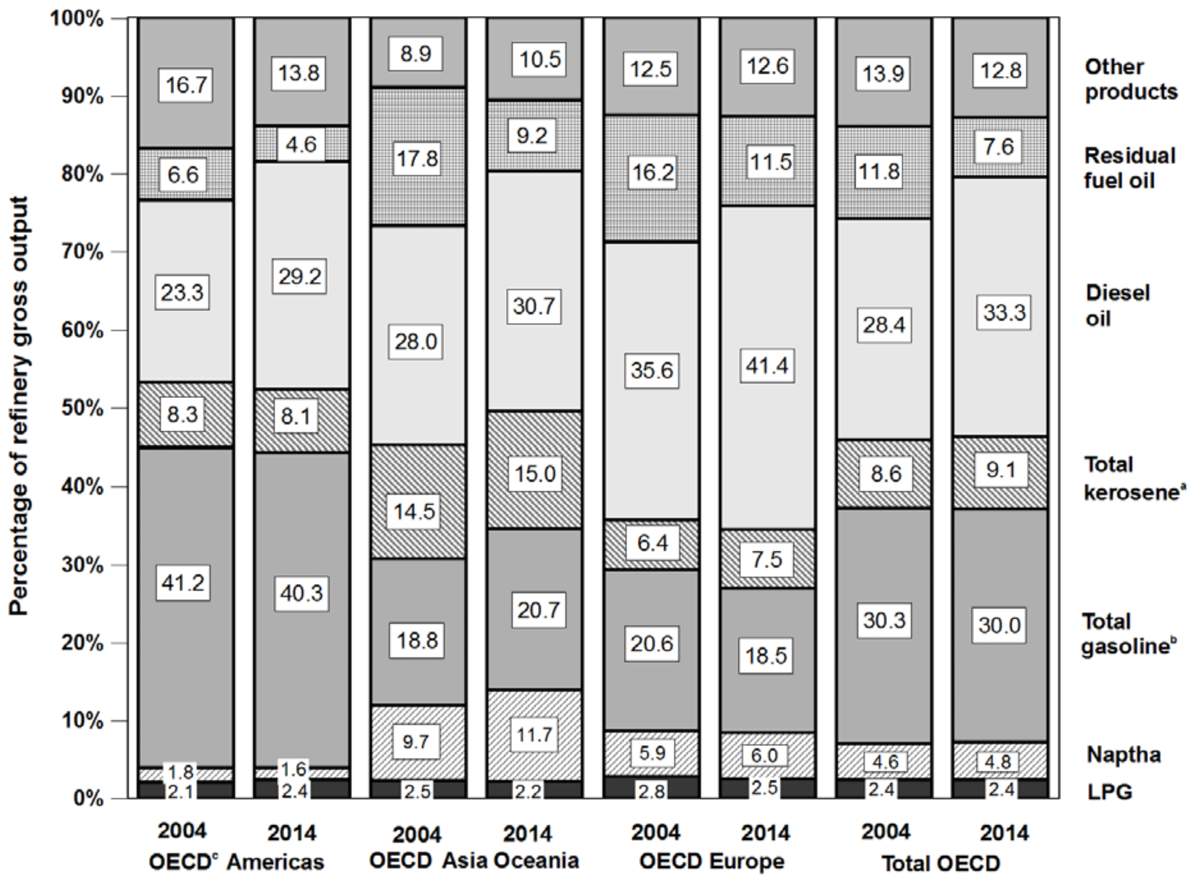
Loss of Potential Gross Domestic Product (GDP) results because a basic resource used by the economy to produce output has become more expensive. As a consequence, with the same endowment of labor, capital, and other resources, our economy cannot produce quite as much as it could have at a lower oil price.

Source:

Greene, David L., Roderick Lee, and Janet L. Hopson, "OPEC and the Costs to the U.S. Economy of Oil Dependence: 1970-2010," Oak Ridge National Laboratory Memorandum, 2011, and updates from Changzheng Liu.

Other parts of the world refine crude oil to produce more diesel fuel and less gasoline than does OECD Americas. The OECD Europe countries produce the lowest share of gasoline in 2014.

Figure 1.6. Refinery Gross Output by World Region, 2004 and 2014



Source:
International Energy Agency, *Monthly Oil Survey*, February 2015. (Additional resources: www.iea.org)

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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 many states banning the additive. The other hydrocarbons and liquids category includes unfinished oils, motor gasoline blending components and aviation gasoline blending components.

Table 1.9
U.S. Refinery Input of Crude Oil and Petroleum Products, 1987–2013
(thousand barrels)

Year	Crude oil	Natural gas liquids	Oxygenates			Other hydrocarbons and liquids	Total input to refineries
			Fuel ethanol	MTBE[a]	Other oxygenates[b]		
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
2008	5,361,287	177,559	190,084	480	0	548,843	6,277,893
2009	5,232,656	177,194	240,955	90	0	518,998	6,169,893
2010	5,374,094	161,479	285,883	901	0	523,015	6,345,372
2011	5,404,347	178,884	297,266	1,154	0	541,059	6,422,710
2012	5,489,516	186,270	304,155	806	0	425,946	6,406,693
2013	5,589,006	181,112	310,568	915	0	495,476	6,577,077
			Average annual percentage change				
1987–2013	0.7%	-1.7%	[d]	[d]	[d]	5.2%	1.0%
2003–2013	0.0%	1.7%	18.8%	-35.0%	-100.0%	11.7%	0.9%

Source:
U.S. Department of Energy, Energy Information Administration, *Petroleum Supply Annual 2013, Vol. 1,* September 2014, Table 16, and annual. (Additional resources: www.eia.doe.gov)

[a] Methyl tertiary butyl ether (MTBE).
[b] Includes methanol and other oxygenates.
[c] Reported in "Other hydrocarbons and liquids" 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
U.S. Refinery Yield of Petroleum Products from a Barrel of Crude Oil, 1978–2014
(percentage)

Year	Motor gasoline	Distillate fuel oil	Jet fuel	Liquefied 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	9.2	4.1	24.2	105.5
1994	45.5	22.3	9.8	4.2	23.8	105.6
1995	46.4	21.8	9.7	4.5	23.3	105.7
1996	45.7	22.7	10.4	4.5	22.6	105.9
1997	45.7	22.5	10.3	4.6	22.6	105.7
1998	46.2	22.3	9.9	4.4	23.1	105.9
1999	46.5	22.3	10.2	4.5	22.6	106.1
2000	46.2	23.1	10.3	4.5	22.1	106.2
2001	46.2	23.8	9.8	4.3	21.6	105.7
2002	47.3	23.2	9.8	4.3	21.4	106.0
2003	46.9	23.7	9.5	4.2	22.2	106.5
2004	46.8	23.9	9.7	4.0	22.4	106.8
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	21.7	106.5
2008	44.2	27.8	9.7	4.1	20.8	106.6
2009	46.1	26.9	9.3	4.1	20.0	106.4
2010	45.7	27.5	9.3	4.3	20.0	106.8
2011	44.9	28.9	9.4	4.0	19.4	106.6
2012	45.0	29.1	9.5	4.1	18.8	106.5
2013	45.0	29.5	9.5	3.9	18.6	106.5
2014	44.9	29.8	9.5	4.1	18.1	106.4

Source:
Department of Energy, Energy Information Administration, *Petroleum Supply Navigator*, May 2015. (Additional resources: www.eia.doe.gov)

[a] Includes aviation gasoline (0.1%), kerosene (0.1%), residual fuel oil (2.7%), naphtha and other oils for petrochemical feedstock use (1.3%), other oils for petrochemical feedstock use (0.7%), special naphthas (0.3%), lubricants (1.0%), petroleum coke (5.4%) asphalt and road oil (2.0%), 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.

Domestic petroleum production increased in 2009 for the first time in 20 years and has continued to increase. 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, 1950–2014
(million barrels per day)

	Domestic production			Net 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	0.36	0.85	0.10	0.21	0.31
1955	6.81	0.77	7.58	0.78	0.47	1.25	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
1985	8.97	1.61	10.58	3.20	1.87	5.07	0.20	0.58	0.78
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	0.88	1.00
1992	7.17	1.70	8.87	6.08	1.80	7.89	0.09	0.86	0.95
1993	6.85	1.74	8.58	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	8.83	0.09	0.85	0.95
1996	6.46	1.83	8.29	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	0.83	0.94
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	5.74	1.88	7.62	9.14	2.39	11.53	0.01	0.97	0.98
2003	5.65	1.72	7.37	9.66	2.60	12.26	0.01	1.01	1.03
2004	5.44	1.81	7.25	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	1.16
2006	5.09	1.74	6.83	10.12	3.59	13.71	0.02	1.29	1.32
2007	5.08	1.78	6.86	10.03	3.44	13.47	0.03	1.41	1.43
2008	5.00	1.78	6.78	9.78	3.13	12.92	0.03	1.77	1.80
2009	5.35	1.91	7.26	9.01	2.68	11.69	0.04	1.98	2.02
2010	5.48	2.07	7.56	9.21	2.58	11.79	0.04	2.31	2.35
2011	5.64	2.22	7.86	8.94	2.50	11.44	0.05	2.94	2.99
2012	6.50	2.41	8.90	8.53	2.07	10.60	0.07	3.14	3.20
2013	7.47	2.61	10.07	7.73	2.13	9.86	0.13	3.49	3.62
2014	8.71	2.96	11.68	7.34	1.88	9.22	0.35	3.83	4.18
				Average annual percentage change					
1950–2014	0.7%	2.8%	1.1%	4.3%	2.6%	3.8%	2.0%	4.6%	4.1%
1970–2014	-0.2%	1.3%	0.1%	4.0%	-0.3%	2.3%	8.4%	6.4%	6.5%
2004–2014	4.8%	5.0%	4.9%	-3.1%	-4.8%	-3.5%	28.8%	14.1%	14.8%

Source:
U.S. Department of Energy, Energy Information Administration, *Monthly Energy Review*, June 2015, Tables 3.1 and 3.3b. (Additional resources: www.eia.gov)

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

U.S. petroleum production has been increasing and petroleum imports decreasing over the last six years. Net imports of petroleum in 2014 were at a level not seen since the late 1980's.

Table 1.12
Petroleum Production and Transportation Petroleum Consumption in Context, 1950–2014

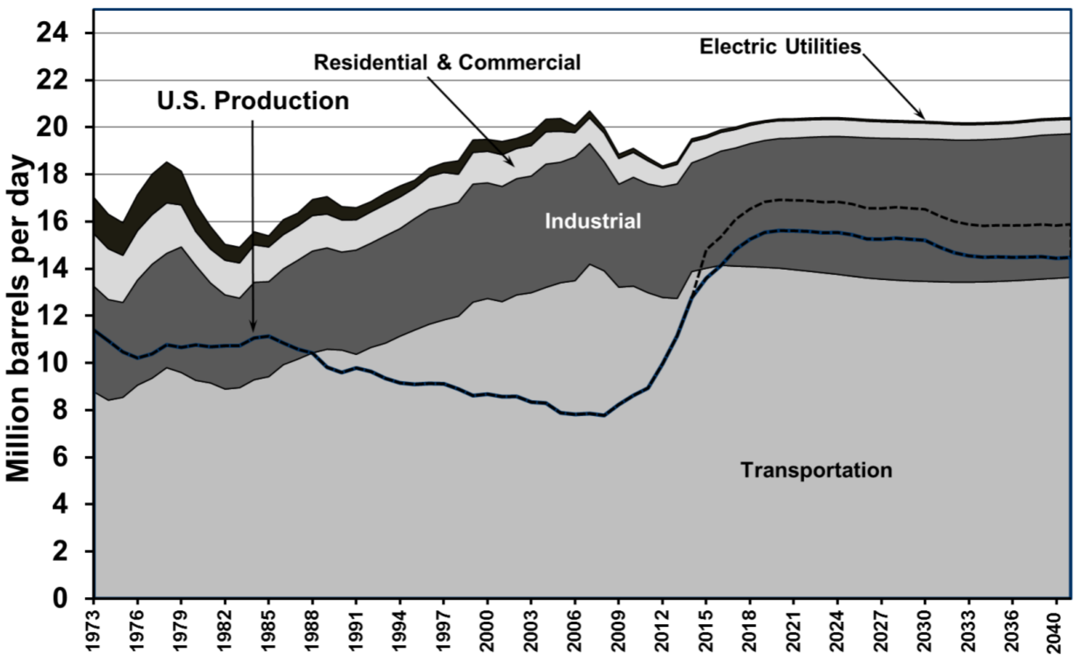
	Domestic petroleum production[a]	Net petroleum imports	Transportation petroleum consumption	U.S. petroleum consumption	World petroleum consumption	Net imports as a share of U.S. consumption	U.S. petroleum consumption as a share of world consumption	Transportation petroleum use as a share of domestic production
	(million barrels per day)							
1950	5.91	0.55	3.36	6.46	[b]	8.5%	[b]	56.9%
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	8.92	16.32	56.20	35.8%	29.0%	89.1%
1980	10.17	6.36	9.59	17.06	63.11	37.3%	27.0%	94.3%
1985	10.58	4.29	9.75	15.73	60.08	27.3%	26.2%	92.2%
1990	8.91	7.16	10.90	16.99	66.54	42.2%	25.5%	122.3%
1991	9.08	6.63	10.50	16.71	67.19	39.6%	24.9%	115.6%
1992	8.87	6.94	10.85	17.03	67.40	40.7%	25.3%	122.3%
1993	8.58	7.62	10.87	17.24	67.62	44.2%	25.5%	126.6%
1994	8.39	8.05	11.35	17.72	69.01	45.5%	25.7%	135.3%
1995	8.32	7.89	11.37	17.72	70.26	44.5%	25.2%	136.6%
1996	8.29	8.50	11.69	18.31	71.88	46.4%	25.5%	140.9%
1997	8.27	9.16	11.96	18.62	73.60	49.2%	25.3%	144.6%
1998	8.01	9.76	12.32	18.92	74.27	51.6%	25.5%	153.8%
1999	7.73	9.91	12.64	19.52	75.98	50.8%	25.7%	163.5%
2000	7.73	10.42	12.95	19.70	76.93	52.9%	25.6%	167.5%
2001	7.67	10.90	12.85	19.65	77.73	55.5%	25.3%	167.6%
2002	7.62	10.55	13.12	19.76	78.46	53.4%	25.2%	172.1%
2003	7.37	11.24	13.25	20.03	80.09	56.1%	25.0%	179.9%
2004	7.25	12.10	13.60	20.73	83.06	58.4%	25.0%	187.5%
2005	6.90	12.55	13.83	20.80	84.56	60.3%	24.6%	200.5%
2006	6.83	12.39	14.11	20.69	85.57	59.9%	24.2%	206.8%
2007	6.86	12.04	14.18	20.68	86.72	58.2%	23.8%	206.7%
2008	6.78	11.11	13.44	19.50	86.05	57.0%	22.7%	198.2%
2009	7.26	9.67	13.14	18.77	84.97	51.5%	22.1%	180.9%
2010	7.56	9.44	13.33	19.18	88.16	49.2%	21.8%	176.5%
2011	7.86	8.45	13.15	18.88	89.11	44.8%	21.2%	167.3%
2012	8.90	7.39	12.91	18.49	90.34	40.0%	20.5%	145.0%
2013	10.07	6.24	13.15	18.96	91.19	32.9%	20.8%	130.6%
2014	11.68	5.04	13.31	19.03	[b]	26.5%	[b]	114.0%
	Average annual percentage change							
1950–2014	1.1%	3.5%	2.2%	1.7%	[b]			
1970–2014	0.1%	1.1%	1.2%	0.6%	[b]			
2004–2014	4.9%	-8.4%	-0.2%	-0.9%	[b]			

Sources:
U.S. Department of Energy, Energy Information Administration, *Monthly Energy Review*, June 2015, 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 Statistics Website*, June 2015. (Additional resources: www.eia.doe.gov)

[a] Total domestic production includes crude oil, natural gas plant liquids and small amounts of other liquids.
[b] Data are not available.

Before 1989 the U.S. produced enough petroleum to meet the needs of the transportation sector, but was still short of meeting the petroleum needs of all the sectors, including industrial, residential and commercial, and electric utilities. In 1973 the gap between what the U.S. produced and what was consumed was 5.6 million barrels per day. Due to increased production, by 2040, the gap is expected to be only about 4.5 million barrels per day if petroleum and non-petroleum sources are included or 5.9 million barrels per day if only conventional petroleum sources are used.

Figure 1.7. United States Petroleum Production and Consumption – All Sectors, 1973–2040



Notes: The U.S. Production has two lines after 2013. The solid line is conventional sources of petroleum, including crude oil, natural gas plant liquids, and refinery gains. The dashed line adds in other non-petroleum sources, including ethanol, biomass, liquids from coal, other blending components, other hydrocarbons, and ethers.

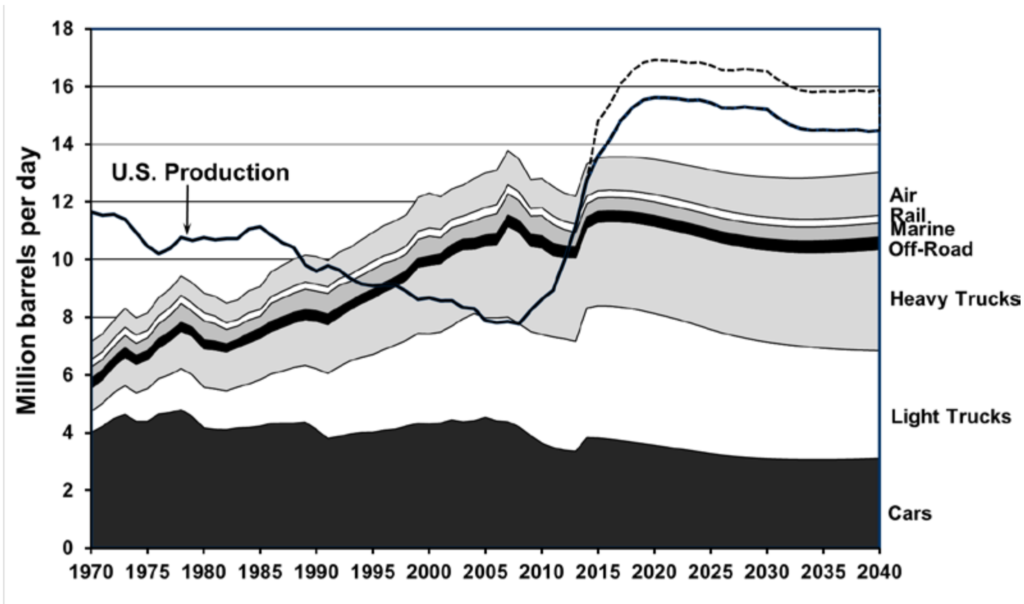
The sharp increase in values between 2006 and 2007 is the result of the FHWA's methodology change. The data change from historical to projected values occurs between 2013 and 2014.

Source:

See Table 1.11, 2.7 and 2.8. Projections are from the Energy Information Administration, *Annual Energy Outlook 2015*, April 2015.

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. In 2009, however, the U.S. production of petroleum began to increase. The Energy Information Administration expects petroleum production to be nearly equal to transportation consumption in 2015 and exceed it thereafter. When including non-petroleum sources, the production will exceed transportation demand by about 2.3 million barrels per day in 2040.

Figure 1.8. United States Petroleum Production and Transportation Consumption, 1970–2040



Notes: The U.S. Production has two lines after 2013. The solid line is conventional sources of petroleum, including crude oil, natural gas plant liquids, and refinery gains. The dashed line adds in other non-petroleum sources, including ethanol, biomass, liquids from coal, other blending components, other hydrocarbons, and ethers.

The sharp increase in values between 2013 and 2014 are caused by the data change from historical to projected values. The sharp increase in the value for heavy trucks between 2006 and 2007 is the result of the FHWA's methodology change.

Source:
See Table 1.11, 2.7 and 2.8. Projections are from the Energy Information Administration, *Annual Energy Outlook 2015*, April 2015.

Transportation accounted for almost 70% of the U.S. petroleum use from 2008 to 2014. Total petroleum consumption reached more than 20 million barrels per day from 2003 to 2007, but has been below that level from 2008 through present.

Table 1.13
Consumption of Petroleum by End-Use Sector, 1973–2014
(million barrels per day)

Year	Transportation	Percentage	Residential	Commercial	Industrial	Electric utilities	Total
1973	9.06	52.3%	1.46	0.77	4.48	1.54	17.31
1974	8.77	52.6%	1.32	0.83	4.27	1.47	16.65
1975	8.92	54.6%	1.29	0.71	4.02	1.38	16.32
1976	9.39	53.8%	1.40	0.70	4.45	1.52	17.46
1977	9.78	53.1%	1.39	0.71	4.83	1.71	18.43
1978	10.12	53.7%	1.35	0.79	4.85	1.74	18.85
1979	9.97	53.9%	1.07	0.71	5.33	1.43	18.51
1980	9.59	56.2%	0.89	0.55	4.87	1.16	17.06
1981	9.42	58.6%	0.79	0.65	4.24	0.96	16.06
1982	9.16	59.9%	0.73	0.73	3.99	0.68	15.30
1983	9.27	60.9%	0.71	0.78	3.80	0.67	15.23
1984	9.45	60.1%	0.78	0.81	4.13	0.55	15.73
1985	9.75	62.0%	0.81	0.66	4.03	0.47	15.73
1986	10.13	62.2%	0.80	0.66	4.06	0.63	16.28
1987	10.47	62.8%	0.84	0.61	4.20	0.55	16.67
1988	10.78	62.4%	0.86	0.64	4.32	0.68	17.28
1989	10.85	62.6%	0.87	0.56	4.30	0.74	17.33
1990	10.90	64.2%	0.74	0.62	4.16	0.57	16.99
1991	10.50	62.8%	0.72	0.56	4.42	0.51	16.71
1992	10.85	63.7%	0.75	0.58	4.42	0.43	17.03
1993	10.87	63.0%	0.76	0.57	4.55	0.49	17.24
1994	11.35	64.0%	0.76	0.59	4.56	0.47	17.72
1995	11.37	64.2%	0.73	0.57	4.73	0.33	17.72
1996	11.69	63.8%	0.80	0.60	4.86	0.35	18.31
1997	11.96	64.2%	0.78	0.65	4.83	0.41	18.62
1998	12.32	65.1%	0.72	0.48	4.83	0.57	18.92
1999	12.64	64.7%	0.81	0.53	5.01	0.53	19.52
2000	12.95	65.7%	0.87	0.47	4.91	0.51	19.70
2001	12.85	65.4%	0.85	0.50	4.89	0.56	19.65
2002	13.12	66.4%	0.82	0.47	4.93	0.43	19.76
2003	13.25	66.2%	0.87	0.43	4.95	0.54	20.03
2004	13.60	65.6%	0.84	0.53	5.23	0.54	20.73
2005	13.83	66.5%	0.81	0.50	5.11	0.55	20.80
2006	14.11	68.2%	0.69	0.34	5.25	0.29	20.69
2007	14.18	68.6%	0.72	0.37	5.12	0.30	20.68
2008	13.44	69.0%	0.77	0.44	4.63	0.21	19.50
2009	13.14	70.0%	0.70	0.39	4.37	0.18	18.77
2010	13.33	69.5%	0.68	0.38	4.62	0.18	19.18
2011	13.15	69.6%	0.64	0.34	4.62	0.14	18.88
2012	12.91	69.8%	0.54	0.24	4.70	0.10	18.49
2013	13.15	69.3%	0.60	0.23	4.86	0.12	18.96
2014	13.31	69.9%	0.60	0.27	4.72	0.14	19.03
			Average annual percentage change				
1973–2014	0.9%		-2.1%	-2.5%	0.1%	-5.7%	0.2%
2004–2014	-0.2%		-3.3%	-6.5%	-1.0%	-12.6%	-0.9%

Source:
U.S. Department of Energy, Energy Information Administration, *Monthly Energy Review*, June 2015, Tables 2.2–2.6. Converted to million barrels per day using Table A3. (Additional resources: www.eia.doe.gov)

Cars and light trucks use most of the petroleum in the transportation sector. Light trucks include pick-ups, minivans, sport-utility vehicles, and vans. See Table 2.9 for highway energy use in trillion Btu.

Table 1.14
Highway Transportation Petroleum Consumption by Mode, 1970–2013[a]
(thousand barrels per day)

Year	Cars	Light trucks	Light vehicle subtotal	Motor-cycles	Buses	Class 3-6 trucks	Class 7-8 trucks	Heavy Trucks subtotal	Highway subtotal	Total transportation[b]
1970	4,424	803	5,227	4	62	140	598	738	6,031	7,333
1975	4,836	1,245	6,081	7	58	181	771	952	7,099	8,472
1976	5,107	1,359	6,466	8	63	191	814	1,005	7,542	8,969
1977	5,157	1,460	6,617	8	65	212	903	1,114	7,805	9,314
1978	5,261	1,576	6,837	9	66	237	1,010	1,247	8,160	9,793
1979	4,996	1,595	6,591	11	68	247	1,052	1,299	7,969	9,725
1980	4,565	1,552	6,117	13	68	247	1,055	1,302	7,500	9,118
1981	4,508	1,546	6,054	14	69	253	1,077	1,329	7,466	9,175
1982	4,509	1,481	5,989	13	71	253	1,077	1,330	7,403	8,944
1983	4,587	1,562	6,149	11	72	257	1,097	1,354	7,586	9,077
1984	4,609	1,670	6,280	11	69	266	1,132	1,398	7,758	9,364
1985	4,665	1,785	6,450	12	72	265	1,131	1,396	7,930	9,537
1986	4,773	1,897	6,670	12	76	271	1,155	1,426	8,184	9,896
1987	4,782	1,996	6,778	12	77	279	1,190	1,469	8,336	10,111
1988	4,784	2,130	6,914	13	80	284	1,211	1,495	8,503	10,343
1989	4,821	2,170	6,992	14	79	291	1,242	1,534	8,618	10,505
1990	4,538	2,323	6,861	12	78	304	1,294	1,597	8,549	10,425
1991	4,196	2,493	6,688	12	83	310	1,320	1,630	8,413	10,246
1992	4,268	2,670	6,938	12	87	315	1,345	1,660	8,698	10,583
1993	4,374	2,795	7,169	13	86	325	1,386	1,711	8,979	10,820
1994	4,428	2,878	7,305	13	86	343	1,463	1,806	9,211	11,091
1995	4,440	2,975	7,415	13	87	357	1,523	1,881	9,396	11,346
1996	4,515	3,089	7,604	13	88	367	1,564	1,931	9,636	11,601
1997	4,559	3,222	7,781	13	91	370	1,579	1,949	9,834	11,776
1998	4,677	3,292	7,969	13	93	382	1,630	2,012	10,086	12,014
1999	4,780	3,448	8,228	14	96	420	1,792	2,212	10,550	12,644
2000	4,766	3,453	8,219	14	98	437	1,861	2,298	10,630	12,794
2001	4,798	3,491	8,290	13	93	436	1,859	2,295	10,690	12,665
2002	4,923	3,602	8,525	12	91	456	1,944	2,401	11,029	12,945
2003	4,866	3,963	8,829	12	90	443	1,890	2,334	11,265	13,128
2004	4,919	4,137	9,055	13	92	411	1,752	2,162	11,323	13,395
2005	5,050	3,840	8,890	12	93	461	1,965	2,426	11,422	13,563
2006	4,893	3,959	8,852	14	94	470	2,006	2,476 [c]	11,436	13,604
2007	4,852	4,034	8,885	31	92	585	2,495	3,080	12,089	14,295
2008	4,664	3,992	8,656	32	95	591	2,521	3,112	11,895	13,988
2009	4,344	4,033	8,376	31	95	549	2,341	2,890	11,392	13,260
2010	4,060	4,220	8,280	28	90	558	2,379	2,937	11,335	13,296
2011	3,891	4,291	8,182	28	92	525	2,240	2,766	11,068	13,005
2012	3,777	4,331	8,108	32	95	525	2,238	2,763	10,998	12,796
2013	3,737	4,276	8,013	31	97	537	2,288	2,824	10,965	12,694
						Average annual percentage change				
1970–2013	-0.4%	4.0%	1.0%	4.9%	1.0%	3.2%	3.2%	3.2%	1.4%	1.3%
2003–2013	-2.6%	0.8%	-1.0%	10.0%	0.8%	1.9%	1.9%	1.9%	-0.3%	-0.3%

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. 23 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).

[c] Due to changes in the FHWA fuel use methodology, motorcycle, bus, and heavy truck data are not comparable with data before the year 2007. Car and light truck data changed after 2008; see Appendix A for car/light truck shares.

Although about 19% of transportation energy use is for nonhighway modes, only 14% 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 2.10 for nonhighway transportation energy use in trillion Btu.

Table 1.15
Nonhighway Transportation Petroleum Consumption by Mode, 1970–2013[a]
(thousand barrels per day)

Year	Air	Water	Pipeline	Rail	Nonhighway subtotal	Total transportation[b]
1970	625	381	43	253	1,302	7,333
1975	651	423	50	249	1,373	8,472
1980	697	625	35	262	1,618	9,118
1981	706	722	29	253	1,709	9,175
1982	701	604	21	214	1,541	8,944
1983	699	561	20	212	1,491	9,077
1984	781	577	16	232	1,606	9,364
1985	814	564	13	216	1,606	9,537
1986	884	601	17	210	1,712	9,896
1987	920	626	15	213	1,775	10,111
1988	958	644	18	220	1,840	10,343
1989	960	688	18	221	1,887	10,505
1990	991	655	14	216	1,876	10,425
1991	928	690	12	202	1,833	10,246
1992	942	724	10	208	1,885	10,583
1993	961	653	11	215	1,841	10,820
1994	1,004	635	11	230	1,880	11,091
1995	1,036	668	7	239	1,950	11,346
1996	1,068	644	8	245	1,965	11,601
1997	1,113	574	9	246	1,942	11,776
1998	1,102	566	12	248	1,927	12,014
1999	1,202	625	11	257	2,095	12,644
2000	1,236	662	10	256	2,164	12,794
2001	1,161	546	11	257	1,975	12,665
2002	1,079	572	8	257	1,917	12,945
2003	1,094	496	10	263	1,863	13,128
2004	1,188	596	10	278	2,073	13,395
2005	1,226	625	10	281	2,142	13,563
2006	1,216	661	5	286	2,168	13,604
2007	1,215	709	5	277	2,206	14,295
2008	1,160	664	4	266	2,094	13,988
2009	1,029	613	3	221	1,867	13,260
2010	1,040	677	3	241	1,961	13,296
2011	1,044	638	3	253	1,938	13,005
2012	1,006	543	2	248	1,798	12,796
2013	987	486	2	254	1,729	12,694
			Average annual percentage change			
1970–2013	1.1%	0.6%	-6.9%	0.0%	0.7%	1.3%
2003–2013	-1.0%	-0.2%	-14.9%	-0.3%	-0.7%	-0.3%

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. 23 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 86.4% of all transportation petroleum use in 2013. See Table 2.9 for transportation energy use in trillion Btu.

Table 1.16
Transportation Petroleum Use by Mode, 2012–2013[a]

	Thousand barrels per day		Percentage of total[b]		Percentage of total U.S. petroleum consumption[b]	
	2012	2013	2012	2013	2012	2013
HIGHWAY	**10,997.5**	**10,965.3**	**85.9%**	**86.4%**	**59.5%**	**57.8%**
Light vehicles	**8,139.9**	**8,043.9**	**63.6%**	**63.4%**	**44.0%**	**42.4%**
Cars	3,776.8	3,737.1	29.5%	29.4%	20.4%	19.7%
Light trucks[c]	4,331.1	4,276.3	33.8%	33.7%	23.4%	22.6%
Motorcycles	32.0	30.5	0.3%	0.2%	0.2%	0.2%
Buses	**95.0**	**97.1**	**0.7%**	**0.8%**	**0.5%**	**0.5%**
Transit	42.7	43.4	0.3%	0.3%	0.2%	0.2%
Intercity	15.0	15.4	0.1%	0.1%	0.1%	0.1%
School	37.2	38.2	0.3%	0.3%	0.2%	0.2%
Medium/heavy trucks	**2,762.6**	**2,824.3**	**21.6%**	**22.2%**	**14.9%**	**14.9%**
Class 3-6	524.9	536.6	4.1%	4.2%	2.8%	2.8%
Class 7-8	2,237.7	2,287.7	17.5%	18.0%	12.1%	12.1%
NONHIGHWAY	**1,798.2**	**1,728.8**	**14.1%**	**13.6%**	**9.7%**	**9.1%**
Air	**1,005.7**	**986.8**	**7.9%**	**7.8%**	**5.4%**	**5.2%**
General aviation	112.5	100.9	0.9%	0.8%	0.6%	0.5%
Domestic air carriers	681.0	674.3	5.3%	5.3%	3.7%	3.6%
International air carriers	212.2	211.6	1.7%	1.7%	1.1%	1.1%
Water	**542.8**	**486.1**	**4.2%**	**3.8%**	**2.9%**	**2.6%**
Freight	417.7	360.9	3.3%	2.8%	2.3%	1.9%
Recreational	125.2	125.2	1.0%	1.0%	0.7%	0.7%
Pipeline	**1.9**	**2.4**	**0.0%**	**0.0%**	**0.0%**	**0.0%**
Rail	**247.8**	**253.6**	**1.9%**	**2.0%**	**1.3%**	**1.3%**
Freight (Class I)	237.1	242.2	1.9%	1.9%	1.3%	1.3%
Passenger	10.7	11.4	0.1%	0.1%	0.1%	0.1%
Transit	0.4	0.5	0.0%	0.0%	0.0%	0.0%
Commuter	6.2	6.6	0.0%	0.1%	0.0%	0.0%
Intercity	4.2	4.4	0.0%	0.0%	0.0%	0.0%
HWY & NONHWY TOTAL[d]	**12,795.7**	**12,694.1**	**100.0%**	**100.0%**	**69.2%**	**66.9%**
Off-Highway	**1,045.2**	**1,065.0**				

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. 23 for details.
[b] Percentages may not sum to totals due to rounding.
[c] Two-axle, four-tire trucks.
[d] Civilian consumption only. Totals may not include all possible uses of fuels for transportation (e.g., snowmobiles).

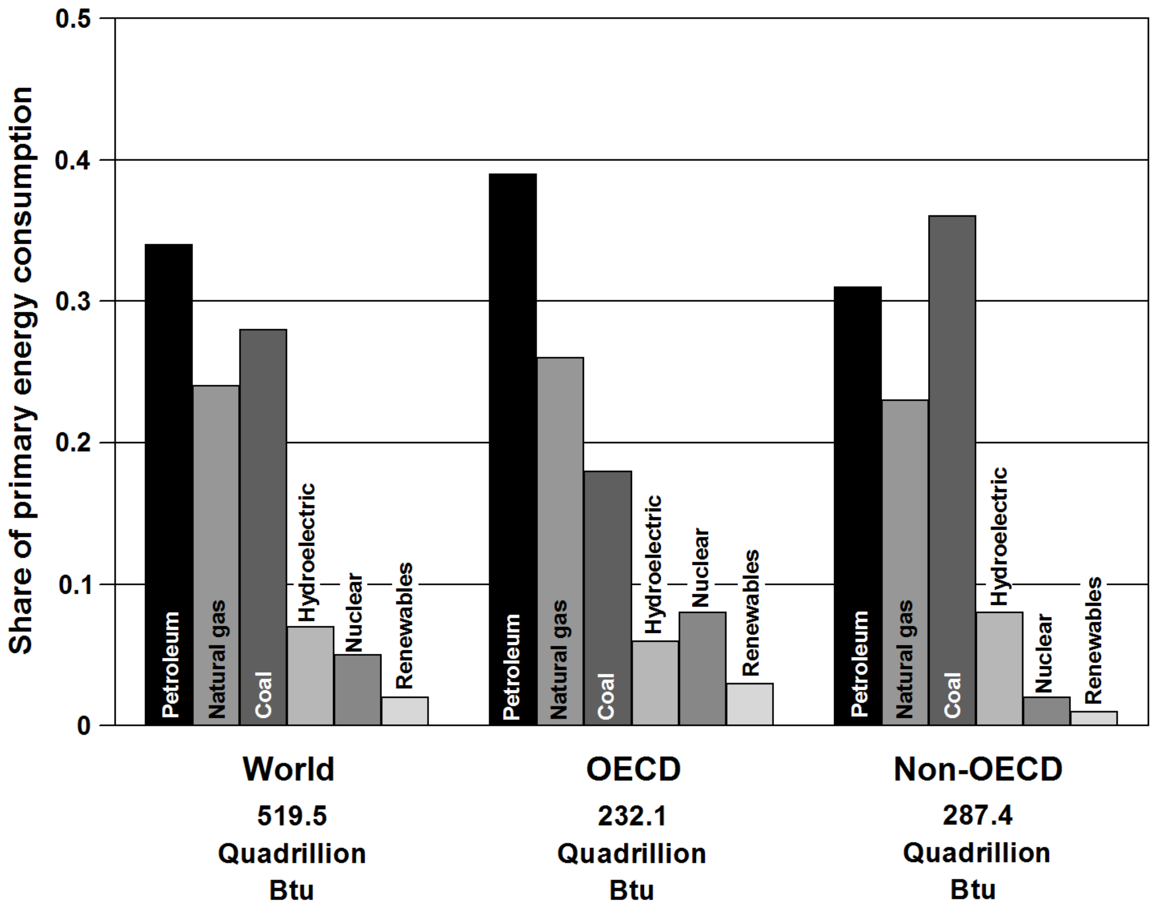
Chapter 2
Energy

Summary Statistics from Tables in this Chapter

Source			
Table 2.1	Transportation share of U.S. energy consumption, 2014		27.6%
Table 2.2	Petroleum share of transportation energy consumption, 2014		91.5%
Table 2.5	Alternative fuel and oxygenate consumption, 2011	(thousand gasoline equivalent gallons)	(share of Total alt fuel/oxygenates)
	Ethanol in gasohol	*8,563,841*	*85.7%*
	Compressed natural gas	*220,247*	*2.2%*
	E85	*137,165*	*1.4%*
	Liquefied petroleum gas	*124,457*	*1.2%*
	Liquefied natural gas	*26,242*	*0.3%*
	Electricity	*7,635*	*0.1%*
	MTBE	*0*	*0.0%*
Table 2.8	Transportation energy use by mode, 2013	(trillion Btu)	(transportation energy share)
	Cars	*7,047*	*26.9%*
	Light trucks	*8,077*	*30.9%*
	Medium/heavy trucks	*5,924*	*22.7%*
	Buses	*204*	*0.8%*
	Total Highway	*21,310*	*81.5%*
	Air	*2,037*	*7.8%*
	Water	*1,055*	*4.0%*
	Pipeline	*1,141*	*4.4%*
	Rail	*611*	*2.3%*

Petroleum accounted for 34% of the world's energy use in 2012. Though petroleum is the dominant energy source for OECD countries, the non-OECD countries rely on coal and petroleum.

Figure 2.1. World Consumption of Primary Energy, 2012



Source:
U.S. Department of Energy, Energy Information Administration, *International Energy Statistics Database,* August 2015. (Additional resources: www.eia.doe.gov)

Total energy use was 98.4 quads in 2014 with transportation using 27.6%. The Energy Information Administration includes renewable energy in each sector.

Table 2.1
U. S. Consumption of Total Energy by End-Use Sector, 1973–2014
(quadrillion Btu)

Year	Transportation	Percentage transportation of total	Industrial	Commercial	Residential	Total[a]
1973	18.6	24.6%	32.6	9.5	14.9	75.7
1975	18.2	25.4%	29.4	9.5	14.8	72.0
1976	19.1	25.1%	31.4	10.1	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	16.1	80.0
1979	20.5	25.3%	33.9	10.6	15.8	80.9
1980	19.7	25.2%	32.0	10.6	15.8	78.1
1981	19.5	25.6%	30.7	10.6	15.3	76.1
1982	19.1	26.1%	27.6	10.9	15.5	73.1
1983	19.2	26.3%	27.4	10.9	15.4	73.0
1984	19.7	25.7%	29.6	11.4	16.0	76.7
1985	20.1	26.3%	28.8	11.5	16.0	76.4
1986	20.8	27.1%	28.3	11.6	16.0	76.7
1987	21.5	27.2%	28.4	11.9	16.3	79.1
1988	22.3	27.0%	30.7	12.6	17.1	82.7
1989	22.5	26.5%	31.3	13.2	17.8	84.8
1990	22.4	26.5%	31.8	13.3	16.9	84.5
1991	22.1	26.2%	31.4	13.4	17.4	84.4
1992	22.4	26.1%	32.6	13.4	17.4	85.8
1993	22.8	26.1%	32.6	13.8	18.2	87.4
1994	23.4	26.3%	33.5	14.1	18.1	89.1
1995	23.8	26.2%	34.0	14.7	18.5	91.0
1996	24.4	26.0%	34.9	15.2	19.5	94.0
1997	24.8	26.2%	35.2	15.7	19.0	94.6
1998	25.3	26.8%	34.8	16.0	19.0	95.0
1999	25.9	26.8%	34.8	16.4	19.6	96.7
2000	26.6	26.9%	34.7	17.2	20.4	98.8
2001	26.3	27.3%	32.7	17.1	20.0	96.2
2002	26.8	27.5%	32.7	17.3	20.8	97.6
2003	26.9	27.5%	32.6	17.3	21.1	97.9
2004	27.8	27.8%	33.5	17.7	21.1	100.1
2005	28.3	28.2%	32.4	17.9	21.6	100.2
2006	28.7	28.9%	32.4	17.7	20.7	99.5
2007	28.9	28.6%	32.4	18.2	21.5	101.0
2008	27.5	27.8%	31.3	18.4	21.7	98.9
2009	26.7	28.3%	28.5	17.9	21.1	94.1
2010	27.1	27.8%	30.5	18.0	21.8	97.5
2011	27.7	27.6%	30.8	18.0	21.4	96.9
2012	26.2	27.7%	30.9	17.4	20.0	94.5
2013	26.8	27.5%	31.4	17.9	21.2	97.2
2014	27.1	27.6%	31.4	18.4	21.6	98.4
		Average annual percentage change				
1973–2014	0.9%		-0.1%	1.6%	0.9%	0.6%
2004–2014	-0.3%		-0.6%	0.4%	0.2%	-0.2%

Source:
U.S. Department of Energy, Energy Information Administration, *Monthly Energy Review,* April 2015, Washington, DC, Table 2.1. (Additional resources: www.eia.doe.gov)

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

In transportation, the alcohol fuels blended into gasoline to make gasohol (10% ethanol or less) are counted under "renewables" and are not in with petroleum. The petroleum category, however, still contains other blending agents 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 2014
(percentage)

Energy	Transportation		Residential		Commercial	
source	1973	2014	1973	2014	1973	2014
Petroleum[a]	95.8	91.5	18.8	4.4	16.8	3.1
Natural gas[b]	4.0	3.5	33.4	24.2	27.8	19.3
Coal	0.0	0.0	0.6	0.0	1.7	0.3
Renewable	0.0	4.7	2.4	4.0	0.1	0.8
Nuclear	0.0	0.0	0.0	0.0	0.0	0.0
Electricity[c]	0.2	0.3	44.8	67.4	53.6	76.5
Total	100.0	100.0	100.0	100.0	100.0	100.0

Energy	Industrial		Electric utilities	
source	1973	2014	1973	2014
Petroleum[a]	27.9	26.0	17.8	0.8
Natural gas[b]	31.8	30.3	19.0	21.7
Coal	12.4	4.8	44.1	42.5
Renewable	3.7	7.4	14.4	13.0
Nuclear	0.0	0.0	4.5	21.6
Electricity[c]	24.2	31.5	0.2	0.4
Total	100.0	100.0	100.0	100.0

Source:
U.S. Department of Energy, Energy Information Administration, *Monthly Energy Review*, April 2015, 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.

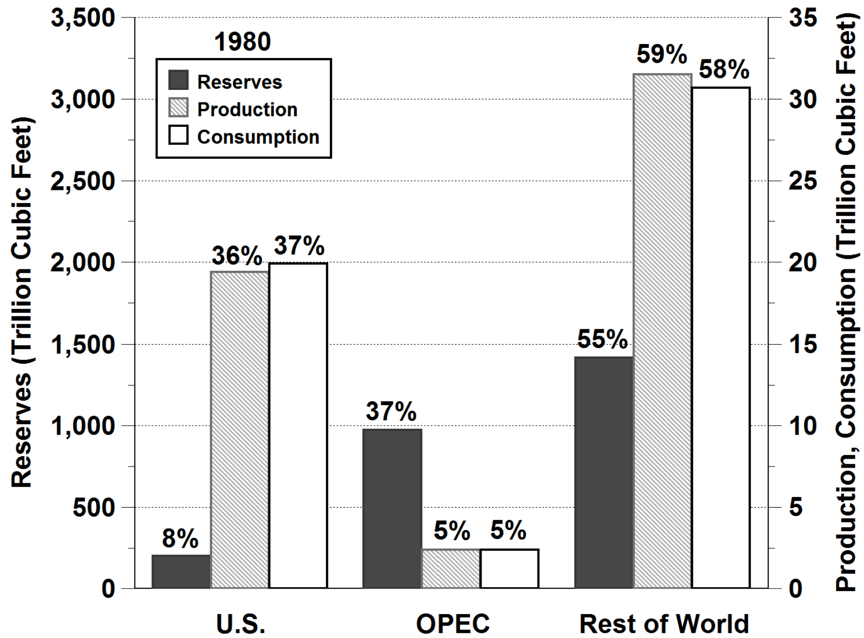
Table 2.3. Distribution of Transportation Energy Consumption by Source, 1950–2014

Year	Petroleum[a]	Natural gas[b]	Coal	Renewables	Electricity[c]	Total (trillion Btu)
1950	78.8%	1.5%	18.4%	0.0%	1.3%	8,492.5
1955	92.1%	2.7%	4.4%	0.0%	0.8%	9,550.2
1960	95.6%	3.4%	0.7%	0.0%	0.3%	10,595.9
1965	95.4%	4.2%	0.1%	0.0%	0.3%	12,432.5
1970	95.1%	4.6%	0.0%	0.0%	0.2%	16,098.2
1975	96.5%	3.3%	0.0%	0.0%	0.2%	18,245.0
1980	96.5%	3.3%	0.0%	0.0%	0.2%	19,696.7
1985	96.9%	2.6%	0.0%	0.2%	0.2%	20,087.9
1986	97.1%	2.4%	0.0%	0.3%	0.2%	20,788.8
1987	97.0%	2.5%	0.0%	0.3%	0.2%	21,468.9
1988	96.6%	2.8%	0.0%	0.3%	0.2%	22,317.7
1989	96.6%	2.9%	0.0%	0.3%	0.2%	22,477.9
1990	96.5%	3.0%	0.0%	0.3%	0.2%	22,419.6
1991	96.6%	2.8%	0.0%	0.3%	0.2%	22,118.0
1992	96.7%	2.7%	0.0%	0.4%	0.2%	22,415.1
1993	96.5%	2.8%	0.0%	0.4%	0.2%	22,711.7
1994	96.3%	3.0%	0.0%	0.4%	0.2%	23,365.1
1995	96.3%	3.0%	0.0%	0.5%	0.2%	23,851.1
1996	96.4%	3.0%	0.0%	0.3%	0.2%	24,439.2
1997	96.2%	3.2%	0.0%	0.4%	0.2%	24,751.3
1998	96.7%	2.6%	0.0%	0.4%	0.2%	25,260.1
1999	96.7%	2.6%	0.0%	0.5%	0.2%	25,949.5
2000	96.7%	2.5%	0.0%	0.5%	0.2%	26,555.3
2001	96.7%	2.5%	0.0%	0.5%	0.2%	26,282.2
2002	96.5%	2.6%	0.0%	0.6%	0.2%	26,845.7
2003	96.5%	2.3%	0.0%	0.9%	0.3%	26,900.2
2004	96.5%	2.2%	0.0%	1.0%	0.3%	27,842.8
2005	96.3%	2.2%	0.0%	1.2%	0.3%	28,280.3
2006	95.9%	2.2%	0.0%	1.7%	0.3%	28,716.7
2007	95.3%	2.3%	0.0%	2.1%	0.3%	28,859.5
2008	94.2%	2.5%	0.0%	3.0%	0.3%	27,486.3
2009	93.5%	2.7%	0.0%	3.5%	0.3%	26,687.1
2010	93.1%	2.7%	0.0%	4.0%	0.3%	27,059.1
2011	92.6%	2.7%	0.0%	4.3%	0.3%	26,712.1
2012	92.3%	3.0%	0.0%	4.4%	0.3%	26,219.3
2013	91.5%	3.4%	0.0%	4.8%	0.3%	26,781.8
2014	91.5%	3.5%	0.0%	4.7%	0.3%	26,781.8

Source:
U.S. Department of Energy, Energy Information Administration, *Monthly Energy Review*, June 2015, Washington, DC, Table 2.5. (Additional resources: www.eia.doe.gov)

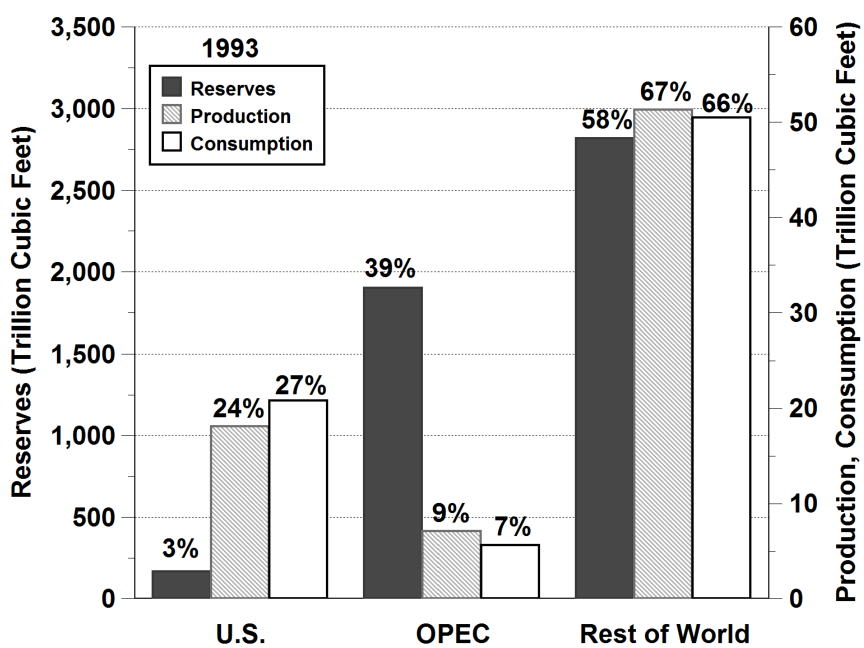
[a] In transportation, the petroleum category contains some blending agents which are not petroleum.
[b] Includes supplemental gaseous fuels. Transportation sector includes pipeline fuel and natural gas vehicle use.
[c] Includes electrical system energy losses.

Figure 2.2. World Natural Gas Reserves, Production, and Consumption, 1980



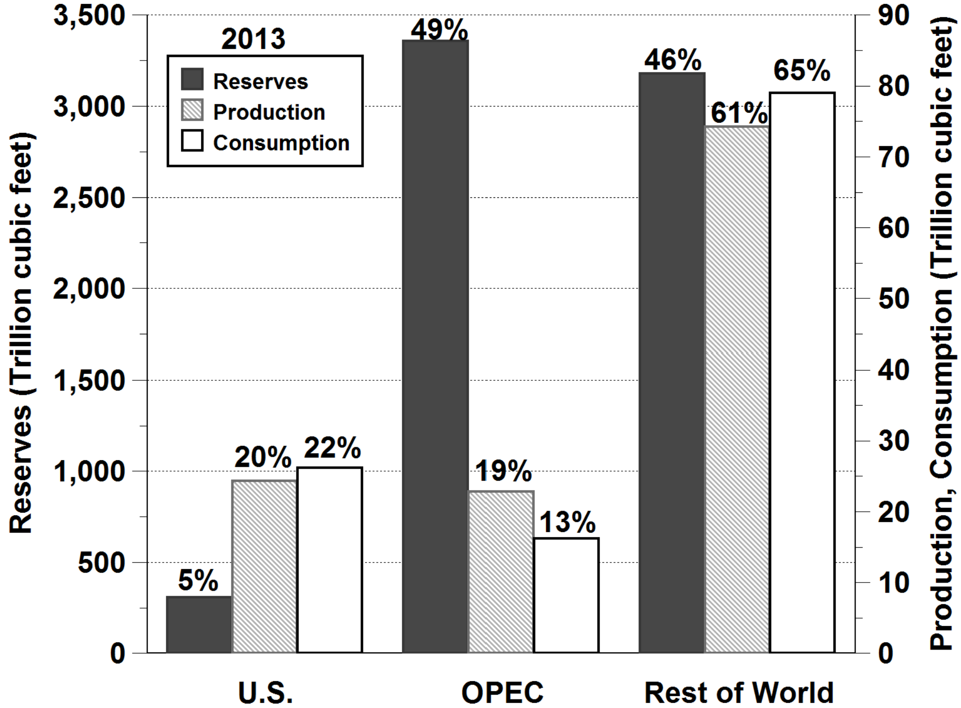
Source:
See Table 2.4.

Figure 2.3. World Natural Gas Reserves, Production, and Consumption, 1993



Source:
See Table 2.4.

Figure 2.4. World Natural Gas Reserves, Production and Consumption, 2013



Source:
See Table 2.4.

Table 2.4
World Natural Gas Reserves, Production, and Consumption, 1980, 1993, and 2013
(trillion cubic feet)

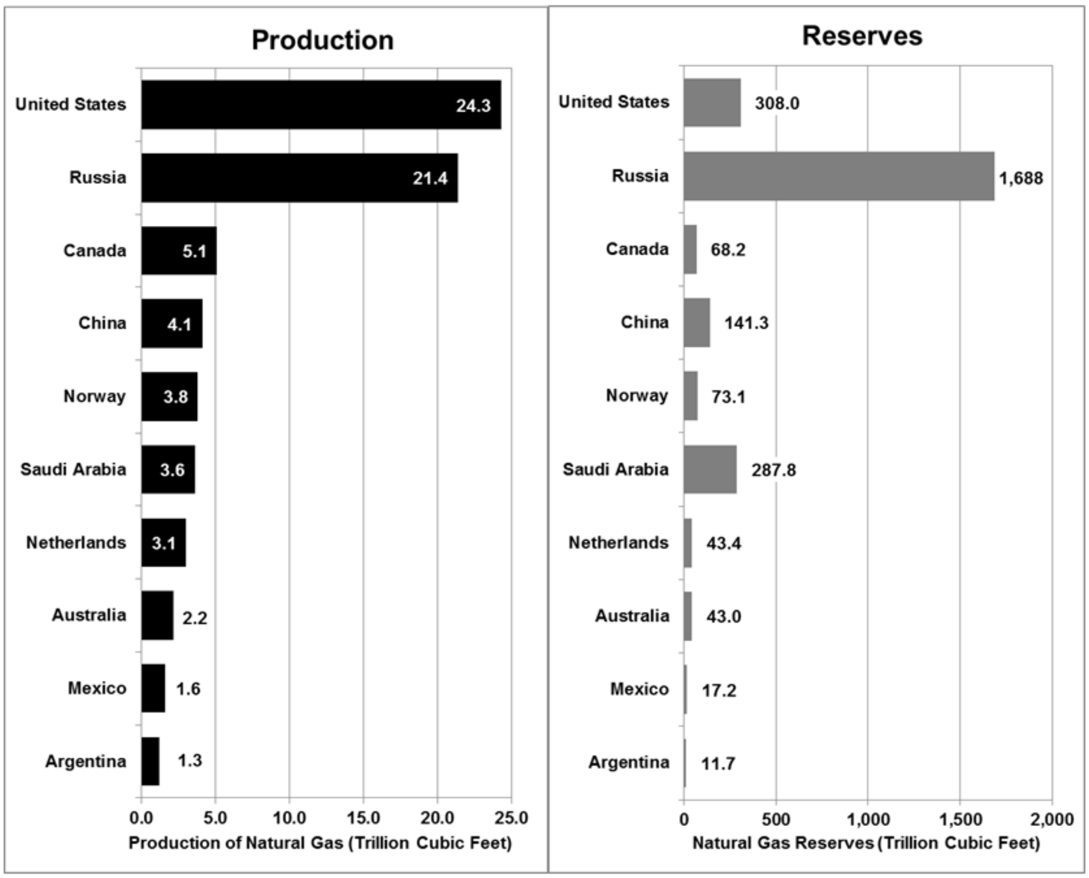
	Natural gas reserves	Reserve share	Natural gas production	Production share	Natural gas consumption	Consumption share
			1980			
United States	201.0	8%	19.4	36%	19.9	38%
OPEC	972.6	37%	2.4	5%	2.4	4%
Rest of world	1,418.4	55%	31.5	59%	30.7	58%
			1993			
United States	165.0	3%	18.1	24%	20.8	27%
OPEC	1,902.7	39%	7.1	9%	5.6	7%
Rest of world	2,816.7	58%	51.3	67%	50.5	66%
			2013			
United States	308.0	5%	24.3	20%	26.2	22%
OPEC	3,358.8	49%	22.8	19%	16.2	13%
Rest of world	3,178.3	46%	74.2	61%	79.0	65%

Note: Production data are dry gas production.

Source:
Energy Information Administration, *International Energy Statistics*, June 2015. (Additional resources: www.eia.doe.gov)

In 2013, the United States and Russia were by far the top natural gas producing countries with more than double that of any other country. Although the United States produced more than Russia, Russia has five times more reserves.

Figure 2.5. Natural Gas Production and Reserves for the Top Ten Natural Gas Producing Countries, 2013



Source:
U.S. Department of Energy, Energy Information Administration, *International Energy Statistics*, May 2015. (Additional resources: www.eia.gov/countries/data.cfm)

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 Energy Information Administration has not released data for any year past 2011.

Table 2.5
Alternative Fuel and Oxygenate Consumption, 2005–2011
(thousand gasoline–equivalent gallons)

	2005	2006	2007	2008	2009	2010	2011
Alternative fuel							
Liquefied petroleum gas	188,171	173,130	152,360	147,784	129,631	126,354	124,457
Compressed natural gas	166,878	172,011	178,585	189,358	199,513	210,007	220,247
Liquefied natural gas	22,409	23,474	24,594	25,554	25,652	26,072	26,242
E85[a]	38,074	44,041	54,091	62,464	71,213	90,323	137,165
Electricity[b]	5,219	5,104	5,037	5,050	4,956	4,847	7,635
Hydrogen	25	41	66	117	140	152	174
Biodiesel	91,649	267,623	367,764	324,329	334,809	270,170	910,968
Other	2	2	2	2	2	0	0
Subtotal	**512,427**	**685,426**	**782,479**	**754,658**	**756,916**	**727,925**	**1,426,888**
Oxygenates							
MTBE[c]	1,654,500	435,000	0	0	0	0	0
Ethanol in gasohol	2,756,663	3,729,168	4,694,304	6,442,781	7,343,133	8,527,431	8,563,841
Total	**4,923,590**	**4,849,594**	**5,476,783**	**7,197,439**	**8,099,342**	**9,255,356**	**9,990,729**

Note: These are the latest data available from the Energy Information Administration.

Source:
U.S. Department of Energy, Energy Information Administration, Alternative Fuel Vehicle Data website, May 2013, www.eia.doe.gov/renewable. (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] 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. The Energy Information Administration has not released data for any year past 2011.

Table 2.6
Ethanol Consumption, 1995–2011
(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
2008	62,464	0	6,442,781	6,505,245
2009	71,213	0	7,343,133	7,414,346
2010	90,323	0	8,527,431	8,617,754
2011	137,165	0	8,563,841	8,701,006
2011 Percentage	1.6%	0.0%	98.4%	100.0%

Note: These are the latest data available from the Energy Information Administration. Gallons of E85 and E95 include the gasoline portion of the blended fuel. Although this estimate for ethanol blend consumption (E85 and E95) is the best available, it is based solely on data from selected fleets (federal and state governments, alternative fuel providers, and transit companies). The ethanol in gasohol column does not include gasoline.

Source:
U.S. Department of Energy, Energy Information Administration, Alternative Fuel Vehicle website data, Washington, DC, May 2013, website: www.eia.doe.gov/renewable/afv/index.cfm. (Additional resources: www.eia.doe.gov)

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 2.7
Domestic Consumption of Transportation Energy by Mode and Fuel Type, 2013[a]
(trillion Btu)

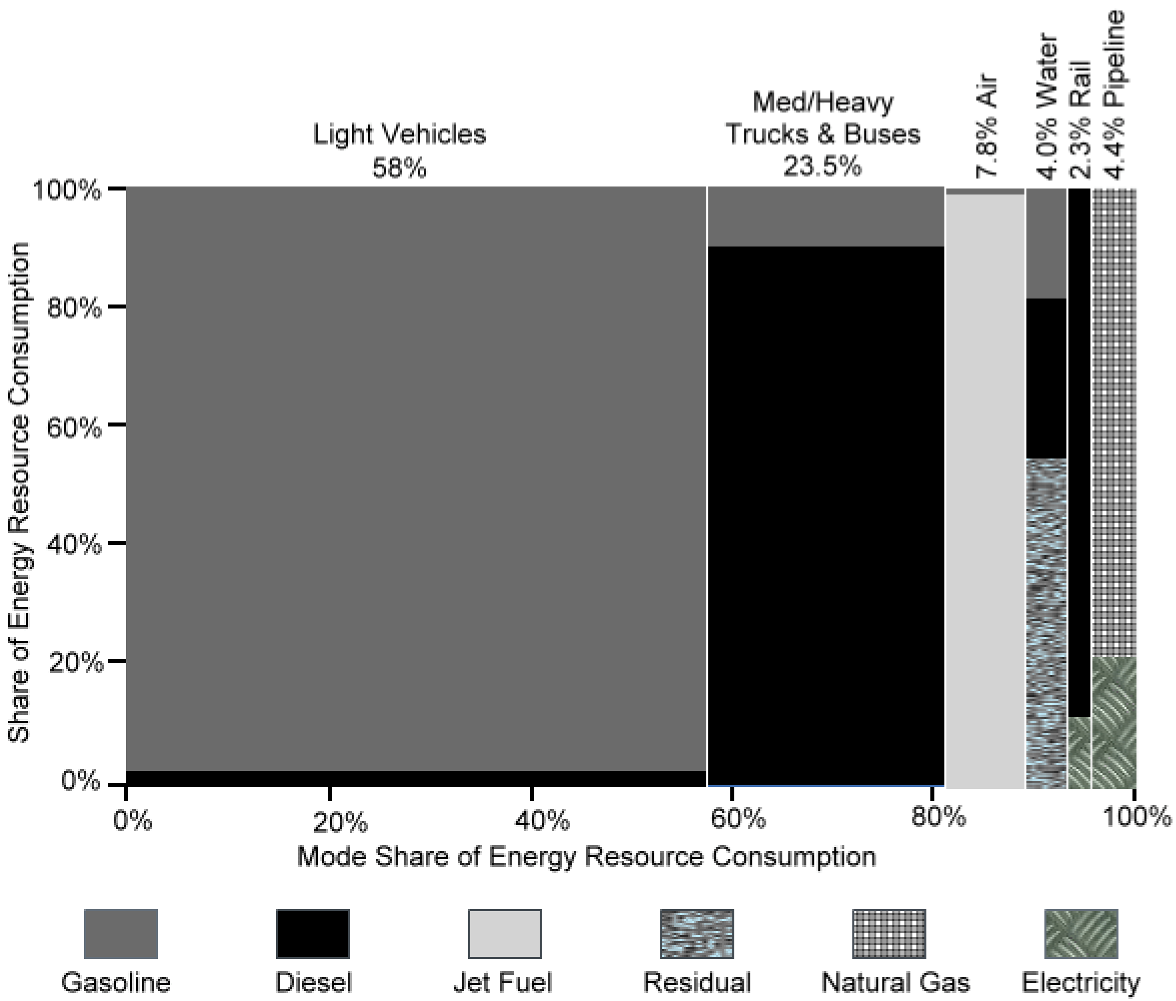
	Gasoline	Diesel fuel	Liquefied petroleum gas	Jet fuel	Residual fuel oil	Natural gas	Electricity	Total[b]
HIGHWAY	**15,335.0**	**5,885.8**	**68.2**	**-**	**-**	**20.3**	**0.7**	**21,309.9**
Light vehicles	**14,730.7**	**403.4**	**47.9**	**-**	**-**	**-**	**-**	**15,182.0**
Cars	7,006.9	39.7						7,046.6
Light trucks[c]	7,665.4	363.7	47.9					8,076.9
Motorcycles	58.5							58.5
Buses	**8.9**	**173.7**	**0.6**	**-**	**-**	**20.3**	**0.7**	**204.1**
Transit	1.6	67.6	0.6			20.3	0.7	90.8
Intercity		32.8						32.8
School	7.3	73.2						80.5
Medium/heavy trucks	595.3	5,308.7	19.8	-	-	-	-	**5,923.8**
Class 3-6 trucks	547.7	743.2	19.6					1,310.5
Class 7-8 trucks	47.6	4,565.5	0.2					4,613.3
NONHIGHWAY	**214.6**	**818.2**	**-**	**2,016.1**	**580.4**	**888.3**	**325.9**	**4,843.5**
Air	**20.9**	**-**	**-**	**2,016.1**	**-**	**-**	**-**	**2,037.0**
General aviation	20.9			182.7				203.6
Domestic air carriers				1,395.5				1,395.5
International air carriers[d]				437.9				437.9
Water	**193.8**	**280.8**	**-**	**-**	**580.4**	**-**	**-**	**1,054.9**
Freight		229.6			580.4			809.9
Recreational	193.8	51.2						245.0
Pipeline	**-**	**-**	**-**	**-**	**-**	**888.3**	**252.5**	**1,140.8**
Rail	**-**	**537.4**	**-**	**-**	**-**	**-**	**73.4**	**610.8**
Freight (Class I)		514.9						514.9
Passenger		22.4					73.4	95.9
Transit							49.0	49.0
Commuter		13.7					18.8	32.5
Intercity		8.7					5.7	14.4
TOTAL HWY & NONHWY[b]	**15,549.6**	**6,704.0**	**68.2**	**2,016.1**	**580.4**	**908.6**	**326.6**	**26,153.4**

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] Totals may not sum due to rounding.
[c] Two-axle, four-tire trucks.
[d] One half of fuel used by domestic carriers in international operation.

The gasoline and diesel used in highway modes accounts for the majority of transportation energy use (81.5%).

Figure 2.6. Domestic Consumption of Transportation Energy Use by Mode and Fuel Type, 2013[a]



Note: Residual fuel oil is heavier oil which can be used in vessel bunkering.

Source:
See Table 2.7 or Appendix A for energy use sources.

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

Nonhighway modes were responsible for 18.5% of all transportation energy use in 2013. See Table 1.16 for transportation energy use in thousand barrels per day.

Table 2.8
Transportation Energy Use by Mode, 2012–2013[a]

	Trillion Btu		Percentage of total based on Btus	
	2012	2013	2012	2013
HIGHWAY	**21,356.1**	**21,309.9**	**81.5%**	**81.5%**
Light vehicles	**15,361.8**	**15,182.0**	**58.6%**	**58.0%**
Cars	7,120.8	7,046.6	27.2%	26.9%
Light trucks[b]	8,179.6	8,076.9	31.2%	30.9%
Motorcycles	61.4	58.5	0.2%	0.2%
Buses	**200.0**	**204.1**	**0.8%**	**0.8%**
Transit	89.7	90.8	0.3%	0.3%
Intercity	32.0	32.8	0.1%	0.1%
School	78.3	80.5	0.3%	0.3%
Medium/heavy trucks	**5,794.3**	**5,923.8**	**22.1%**	**22.7%**
Class 3-6 trucks	1,281.9	1,310.5	4.9%	5.0%
Class 7-8 trucks	4,512.5	4,613.3	17.2%	17.6%
NONHIGHWAY	**4,857.7**	**4,843.5**	**18.5%**	**18.5%**
Air	**2,077.3**	**2,037.0**	**7.9%**	**7.8%**
General aviation	228.8	203.6	0.9%	0.8%
Domestic air carriers	1,409.4	1,395.5	5.4%	5.3%
International air	439.2	437.9	1.7%	1.7%
Water	**1,183.0**	**1,054.9**	**4.5%**	**4.0%**
Freight	938.2	809.9	3.6%	3.1%
Recreational	244.8	245.0	0.9%	0.9%
Pipeline	**999.8**	**1,140.8**	**3.8%**	**4.4%**
Rail	**597.6**	**610.8**	**2.3%**	**2.3%**
Freight (Class I)	504.0	514.9	1.9%	2.0%
Passenger	93.6	95.9	0.4%	0.4%
Transit	47.6	49.0	0.2%	0.2%
Commuter	31.6	32.5	0.1%	0.1%
Intercity	14.4	14.4	0.1%	0.1%
HWY & NONHWY TOTAL	**26,213.8**	**26,153.4**	**100.0%**	**100.0%**
Off-highway	**2,092.6**	**2,132.7**		

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.

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 2.9
Highway Transportation Energy Consumption by Mode, 1970–2013
(trillion Btu)

Year	Cars	Light trucks	Light vehicles subtotal	Motor-cycles	Buses	Class 3-6 trucks	Class 7-8 trucks	Heavy trucks subtotal	Highway subtotal	Total transportation[a]
1970	8,479	1,539	10,018	7	129	333	1,220	1,553	11,707	15,395
1975	9,298	2,384	11,682	14	124	430	1,574	2,003	13,823	17,424
1980	8,800	2,975	11,775	26	143	929	1,757	2,686	14,630	18,940
1981	8,693	2,963	11,656	27	145	1,065	1,659	2,724	14,552	18,741
1982	8,673	2,837	11,510	25	151	1,182	1,525	2,707	14,393	18,237
1983	8,802	2,990	11,792	22	152	1,121	1,649	2,770	14,736	18,368
1984	8,837	3,197	12,034	22	146	1,072	1,801	2,873	15,075	18,962
1985	8,932	3,413	12,345	23	153	986	1,897	2,883	15,404	19,205
1986	9,138	3,629	12,767	23	160	920	2,038	2,958	15,908	20,276
1987	9,157	3,819	12,976	24	164	858	2,203	3,061	16,225	20,771
1988	9,158	4,078	13,236	25	169	860	2,257	3,118	16,548	21,327
1989	9,232	4,156	13,388	26	169	869	2,330	3,199	16,782	21,685
1990	8,688	4,451	13,139	24	167	891	2,442	3,334	16,664	21,581
1991	8,029	4,774	12,803	23	177	895	2,507	3,402	16,405	21,182
1992	8,169	5,117	13,286	24	184	897	2,570	3,468	16,962	21,841
1993	8,368	5,356	13,724	25	183	906	2,671	3,577	17,509	22,322
1994	8,470	5,515	13,985	26	183	936	2,842	3,778	17,972	22,930
1995	8,489	5,695	14,184	25	184	954	2,983	3,937	18,330	23,465
1996	8,634	5,917	14,551	24	186	958	3,088	4,045	18,806	23,974
1997	8,710	6,168	14,878	25	192	945	3,141	4,086	19,181	24,327
1998	8,936	6,304	15,240	26	196	967	3,251	4,218	19,680	24,662
1999	9,134	6,602	15,736	26	203	1,054	3,584	4,638	20,603	25,960
2000	9,100	6,607	15,707	26	209	1,085	3,734	4,819	20,761	26,273
2001	9,161	6,678	15,839	24	196	1,074	3,738	4,813	20,872	25,945
2002	9,391	6,883	16,274	24	192	1,114	3,921	5,035	21,525	26,536
2003	9,255	7,551	16,806	24	190	1,083	3,812	4,895	21,915	26,715
2004	9,331	7,861	17,192	25	194	1,003	3,532	4,535	21,946	27,173
2005	9,579	7,296	16,875	24	196	1,126	3,963	5,088	22,183	27,582
2006	9,296	7,534	16,830	28	199	1,149	4,045	5,193 [b]	22,286	27,760
2007	9,221	7,679	16,900	59	195	1,429	5,031	6,460	23,615	29,223
2008	8,831	7,572	16,404	61	200	1,444	5,083	6,527	23,192	28,592
2009	8,209	7,635	15,843	60	199	1,341	4,720	6,061	22,164	27,107
2010	7,657	7,971	15,628	53	190	1,363	4,797	6,160	22,032	27,185
2011	7,336	8,104	15,440	53	195	1,283	4,517	5,801	21,488	26,600
2012	7,121	8,180	15,300	61	200	1,282	4,512	5,794	21,356	26,214
2013	7,047	8,077	15,124	58	204	1,310	4,613	5,924	21,310	26,153
						Average annual percentage change				
1970-2013	-0.4%	3.9%	1.0%	5.2%	1.1%	3.2%	3.1%	3.2%	1.4%	1.2%
2003-2013	-2.7%	0.7%	-1.0%	9.2%	0.7%	1.9%	1.9%	1.9%	-0.3%	-0.2%

Note: Totals may not add due to rounding.

Source:
See Appendix A for Highway Energy Use.

[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.

[b] Due to changes in the FHWA fuel use methodology, motorcycle, bus, and heavy truck data are not comparable with data before the year 2007. Car and light truck data changed after 2008; see Appendix A for car/light truck shares.

About 19% of transportation energy use is for nonhighway modes. Air travel accounts for about 42% of nonhighway energy use. See Table 1.15 for nonhighway petroleum use in thousand barrels per day.

Table 2.10
Nonhighway Transportation Energy Consumption by Mode, 1970–2013
(trillion Btu)

Year	Air	Water	Pipeline	Rail	Nonhighway subtotal	Total transportation[a]
1970	1,307	836	990	555	3,688	15,395
1975	1,274	927	840	559	3,601	17,424
1976	1,333	1,083	803	581	3,800	18,492
1977	1,350	1,177	786	591	3,904	19,126
1978	1,423	1,382	784	588	4,177	20,097
1979	1,488	1,149	860	607	4,104	19,652
1980	1,434	1,393	896	588	4,310	18,940
1981	1,453	1,270	904	561	4,189	18,741
1982	1,445	1,063	855	481	3,844	18,237
1983	1,440	974	740	478	3,632	18,368
1984	1,609	964	782	532	3,887	18,962
1985	1,677	871	755	498	3,801	19,205
1986	1,823	1,323	735	487	4,368	20,276
1987	1,899	1,378	772	498	4,546	20,771
1988	1,978	1,417	874	511	4,779	21,327
1989	1,981	1,516	890	515	4,903	21,685
1990	2,046	1,442	923	506	4,918	21,581
1991	1,916	1,523	860	478	4,777	21,182
1992	1,945	1,599	846	490	4,879	21,841
1993	1,986	1,437	885	505	4,813	22,322
1994	2,075	1,394	951	539	4,958	22,930
1995	2,141	1,468	967	559	5,135	23,465
1996	2,206	1,411	979	572	5,167	23,974
1997	2,300	1,250	1,022	574	5,146	24,327
1998	2,275	1,232	897	578	4,982	24,662
1999	2,483	1,367	908	599	5,357	25,960
2000	2,554	1,454	904	601	5,512	26,273
2001	2,397	1,186	886	603	5,073	25,945
2002	2,229	1,247	931	605	5,012	26,536
2003	2,260	1,074	850	617	4,800	26,715
2004	2,456	1,299	822	650	5,227	27,173
2005	2,532	1,368	842	657	5,399	27,582
2006	2,511	1,450	842	670	5,473	27,760
2007	2,509	1,559	882	657	5,608	29,223
2008	2,396	1,460	911	634	5,400	28,592
2009	2,127	1,341	934	540	4,943	27,107
2010	2,149	1,485	939	581	5,153	27,185
2011	2,157	1,392	953	609	5,112	26,600
2012	2,077	1,183	1,000	598	4,858	26,214
2013	2,037	1,055	1,141	611	4,843	26,153
			Average annual percentage change			
1970–2013	1.0%	0.5%	0.3%	0.2%	0.6%	1.2%
2003–2013	-1.0%	-0.2%	3.0%	-0.1%	-0.1%	-0.2%

Note: Totals may not add due to rounding.

Source:
See Appendix A for Nonhighway Energy Use.

[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).

The Environmental Protection Agency's NONROAD2008a model estimates fuel use for different types of equipment and off-highway vehicles. Most of these vehicles/equipment use diesel fuel. Recreational equipment, such as off-highway motorcycles, snowmobiles, and ATVs, are mainly fueled by gasoline.

Table 2.11
Off-Highway Transportation-Related Fuel Consumption from the Nonroad Model, 2013
(trillion Btus)

	Gasoline	Diesel	LPG	CNG	Total
Agricultural equipment *Tractors, mowers, combines, balers, and other farm equipment which has utility in its movement.*	8.5	588.0	0.0	0.0	596.6
Airport ground equipment	0.3	15.6	0.3	[a]	16.2
Construction and mining equipment *Pavers, rollers, drill rigs, graders, backhoes, excavators, cranes, mining equipment*	11.3	944.3	1.9	[a]	957.5
Industrial equipment *Forklifts, terminal tractors, sweeper/scrubbers*	6.3	123.7	203.6	15.4	349.1
Logging equipment *Feller/buncher/skidder*	1.8	22.6	[a]	[a]	24.4
Railroad maintenance equipment	0.2	3.7	0.0	[a]	3.8
Recreational equipment *Off-road motorcycles, snowmobiles, all-terrain vehicles, golf carts, specialty vehicles*	183.0	2.1	0.1	[a]	185.2
Total	211.4	1,700.0	205.9	15.4	2,132.7

Source:
Environmental Protection Agency, NONROAD2008a model, www.epa.go/oms/nonrdmdl.htm.

[a] There is no equipment listed for this fuel type.

Mowing equipment consumes nearly half of all the fuel used by lawn and garden equipment. The gasoline used in lawn and garden equipment is 2.0% of total gasoline use.

Table 2.12
Fuel Consumption from Lawn and Garden Equipment, 2013
(million gallons[a])

Equipment	Classification	Gasoline	Diesel	LPG	Total fuel consumption
Mowing equipment					
Front mowers	Commercial	20.3	122.3	0.0	142.6
Lawn & garden tractors	Commercial	240.5	25.3	0.0	265.7
Lawn & garden tractors	Residential	563.9	0.0	0.0	563.9
Lawn mowers	Commercial	160.7	0.0	0.0	160.7
Lawn mowers	Residential	214.0	0.0	0.0	214.0
Rear engine riding mowers	Commercial	17.7	0.0	0.0	17.7
Rear engine riding mowers	Residential	42.1	0.0	0.0	42.1
Total		**1,259.2**	**147.6**	**0.0**	**1,406.7**
Soil and turf equipment					
Commercial turf equipment[b]	Commercial	775.1	19.6	0.0	794.7
Rotary tillers < 6 HP	Commercial	89.1	0.0	0.0	89.1
Rotary tillers < 6 HP	Residential	19.3	0.0	0.0	19.3
Total		**883.5**	**19.6**	**0.0**	**903.1**
Wood cutting equipment					
Chain saws < 6 HP	Commercial	77.7	0.0	0.0	77.7
Chain saws < 6 HP	Residential	18.6	0.0	0.0	18.6
Chippers/stump grinders	Commercial	40.1	166.5	19.3	225.8
Shredders < 6 HP	Commercial	9.6	0.0	0.0	9.6
Total		**146.0**	**166.5**	**19.3**	**331.7**
Blowers and vacuums					
Leafblowers/vacuums	Commercial	212.8	0.0	0.0	212.8
Leafblowers/vacuums	Residential	18.9	0.0	0.0	18.9
Snowblowers	Commercial	36.7	2.2	0.0	38.9
Snowblowers	Residential	19.4	0.0	0.0	19.4
Total		**287.8**	**2.2**	**0.0**	**290.0**
Trimming equipment					
Trimmers/edgers/brush cutter	Commercial	65.6	0.0	0.0	65.6
Trimmers/edgers/brush cutter	Residential	26.9	0.0	0.0	26.9
Other lawn & garden equipment[c]	Commercial	24.2	0.5	0.0	24.6
Other lawn & garden equipment[c]	Residential	20.3	0.0	0.0	20.3
Total		**137.0**	**0.5**	**0.0**	**137.4**
Total all equipment		**2,713.5**	**336.4**	**19.3**	**3,068.9**

Source:
U.S. Environmental Protection Agency, NONROAD2008a Model, www.epa.gov/oms/nonrdmdl.htm.

[a] Numbers may not sum due to rounding.
[b] Includes equipment such as aerators, dethatchers, sod cutters, hydro-seeders, turf utility vehicles, golf course greens mowers, and sand trap groomers.
[c] 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 FHWA no longer publishes separate estimates of gasohol or ethanol used in gasohol. See Table 2.5 for details on oxygenate usage.

Table 2.13
Highway Usage of Gasoline and Diesel, 1973–2013
(billion gallons)

Year	Total gasoline and gasohol	Diesel[a]	Percent diesel	Total highway fuel use
1973	100.6	9.8	8.9%	110.5
1975	99.4	9.6	8.8%	109.0
1980	101.2	13.8	12.0%	115.0
1981	99.6	14.9	13.0%	114.5
1982	98.5	14.9	13.1%	113.4
1983	100.1	16.0	13.8%	116.1
1984	101.4	17.3	14.6%	118.7
1985	103.6	17.8	14.6%	121.3
1986	106.8	18.4	14.7%	125.2
1987	108.7	19.0	14.9%	127.7
1988	109.8	20.1	15.5%	129.9
1989	110.6	21.2	16.1%	131.9
1990	110.2	21.4	16.3%	131.6
1991	107.9	20.7	16.1%	128.6
1992	111.0	22.0	16.5%	132.9
1993	113.7	23.5	17.1%	137.2
1994	115.0	25.1	17.9%	140.1
1995	117.1	26.2	18.3%	143.3
1996	119.5	27.2	18.5%	146.7
1997	120.9	29.4	19.6%	150.3
1998	124.7	30.2	19.5%	154.9
1999	128.7	31.9	19.9%	160.7
2000	128.9	33.4	20.6%	162.3
2001	129.7	33.4	20.5%	163.1
2002	133.0	34.8	20.7%	167.8
2003	134.1	35.5	20.9%	169.6
2004	136.5	37.4	21.5%	173.9
2005	135.2	39.1	22.4%	174.3
2006	134.8	40.1	22.9%	174.9
2007	135.4	40.7	23.1%	176.1
2008	132.2	38.6	22.6%	170.8
2009	132.9	35.3	21.0%	168.1
2010	133.1	36.6	21.6%	169.7
2011	131.5	37.1	22.0%	168.6
2012	130.9	37.4	22.2%	168.3
2013	131.3	38.4	22.6%	169.7
		Average annual percentage change		
1973–2013	0.7%	3.5%		1.1%
2003–2013	-0.2%	0.8%		0.0%

Source:
U.S. Department of Transportation, Federal Highway Administration, *Highway Statistics 2013*, Washington, DC, 2015, Table MF-21 and annual. (Additional resources: www.fhwa.dot.gov)

[a] Consists primarily of diesel fuel, with small quantities of other fuels, such as liquefied petroleum gas and E85.

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 2.14
Passenger Travel and Energy Use, 2013

	Number of vehicles (thousands)	Vehicle-miles (millions)	Passenger-miles (millions)	Load factor (persons/vehicle)	Energy intensities (Btu per vehicle-mile)	Energy intensities (Btu per passenger-mile)	Energy use (trillion Btu)
Cars	**113,676.0**	**1,446,000**	**2,241,300**	**1.5**	**4,873**	**3,144**	**7,046.6**
Personal trucks	**106,018.4**	**1,032,554**	**1,899,899**	**0.0**	**6,446**	**3,503**	**6,655.4**
Motorcycles	**8,405.0**	**20,366**	**23,625**	**1.2**	**2,871**	**2,475**	**58.5**
Demand response[a]	**68.6**	**1,565**	**2,171**	**1.4**	**16,898**	**12,182**	**26.4**
Buses	[b]	[b]	[b]	[b]	[b]	[b]	**204.1**
Transit	71.7	2,425	22,306	9.2	37,442	4,071	90.8
Intercity[c]	[b]	[b]	[b]	[b]	[b]	[b]	32.8
School[c]	720.3	[b]	[b]	[b]	[b]	[b]	80.5
Air	[b]	[b]	[b]	[b]	[b]	[b]	**1,599.1**
Certificated route[d]	[b]	5,512	579,944	105.2	253,190	2,406	1,395.5
General aviation	199.9	[b]	[b]	[b]	[b]	[b]	203.6
Recreational boats	**13,706.6**	[b]	[b]	[b]	[b]	[b]	**245.0**
Rail	**20.2**	**1,452**	**39,053**	**26.9**	**66,008**	**2,455**	**95.9**
Intercity (Amtrak)	0.5	319	6,810	21.3	45,205	2,118	14.4
Transit	12.4	774	20,381	26.3	63,265	2,404	49.0
Commuter	7.3	359	11,862	33.0	90,407	2,737	32.5

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 2.15
Energy Intensities of Highway Passenger Modes, 1970–2013

	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	12,480	31,796	2,472
1975	8,993	4,733	11,879	33,748	2,814
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	37,259	4,262
1995	5,902	3,689	7,208	37,251	4,307
1996	5,874	3,683	7,247	37,452	4,340
1997	5,797	3,646	7,251	38,861	4,434
1998	5,767	3,638	7,260	41,296	4,399
1999	5,821	3,684	7,327	40,578	4,344
2000	5,687	3,611	7,158	41,695	4,531
2001	5,626	3,583	7,080	38,535	4,146
2002	5,662	3,607	7,125	37,548	4,133
2003	5,535	3,525	7,673	37,096	4,213
2004	5,489	3,496	7,653	37,855	4,364
2005	5,607	3,571	7,009	37,430	4,250
2006	5,511	3,510	6,974	39,568	4,316
2007	5,513	3,512	6,904	39,931	4,372
2008	5,466	3,526	6,830	39,906	4,348
2009	5,239	3,380	7,158	39,160	4,242
2010	5,117	3,301	6,919	35,953	4,118
2011	5,032	3,246	6,795	37,718	4,240
2012	4,949	3,193	6,674	37,105	4,030
2013	4,873	3,144	6,557	37,442	4,071
			Average annual percentage change		
1970–2013	-1.5%	-1.0%	-1.5%	0.4%	1.2%
2003–2013	-1.3%	-1.1%	-1.6%	0.1%	-0.3%

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

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[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).

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 Nonhighway Passenger Modes, 1970–2013

	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	4,797	2,505	3,024	2,822
1991	4,602	2,417	3,254	2,770
1992	4,455	2,534	3,155	2,629
1993	4,490	2,565	3,373	2,976
1994	4,407	2,282	3,338	2,682
1995	4,349	2,501	3,340	2,632
1996	4,199	2,690	3,017	2,582
1997	4,173	2,811	2,856	2,724
1998	3,987	2,788	2,823	2,646
1999	4,108	2,943	2,785	2,714
2000	3,960	3,235	2,797	2,551
2001	3,943	3,257	2,803	2,515
2002	3,718	3,212	2,872	2,514
2003	3,614	2,800	2,837	2,545
2004	3,505	2,760	2,750	2,569
2005	3,346	2,709	2,783	2,743
2006	3,250	2,650	2,707	2,527
2007	3,153	2,516	2,577	2,638
2008	3,055	2,398	2,521	2,656
2009	2,901	2,435	2,516	2,811
2010	2,825	2,271	2,520	2,897
2011	2,772	2,214	2,459	2,780
2012	2,633	2,120	2,398	2,823
2013	2,568	2,118	2,404	2,737
		Average annual percentage change[c]		
1970–2013	-3.1%	-1.3%	0.3%	-0.1%
2003–2013	-3.4%	-2.8%	-1.6%	0.7%

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

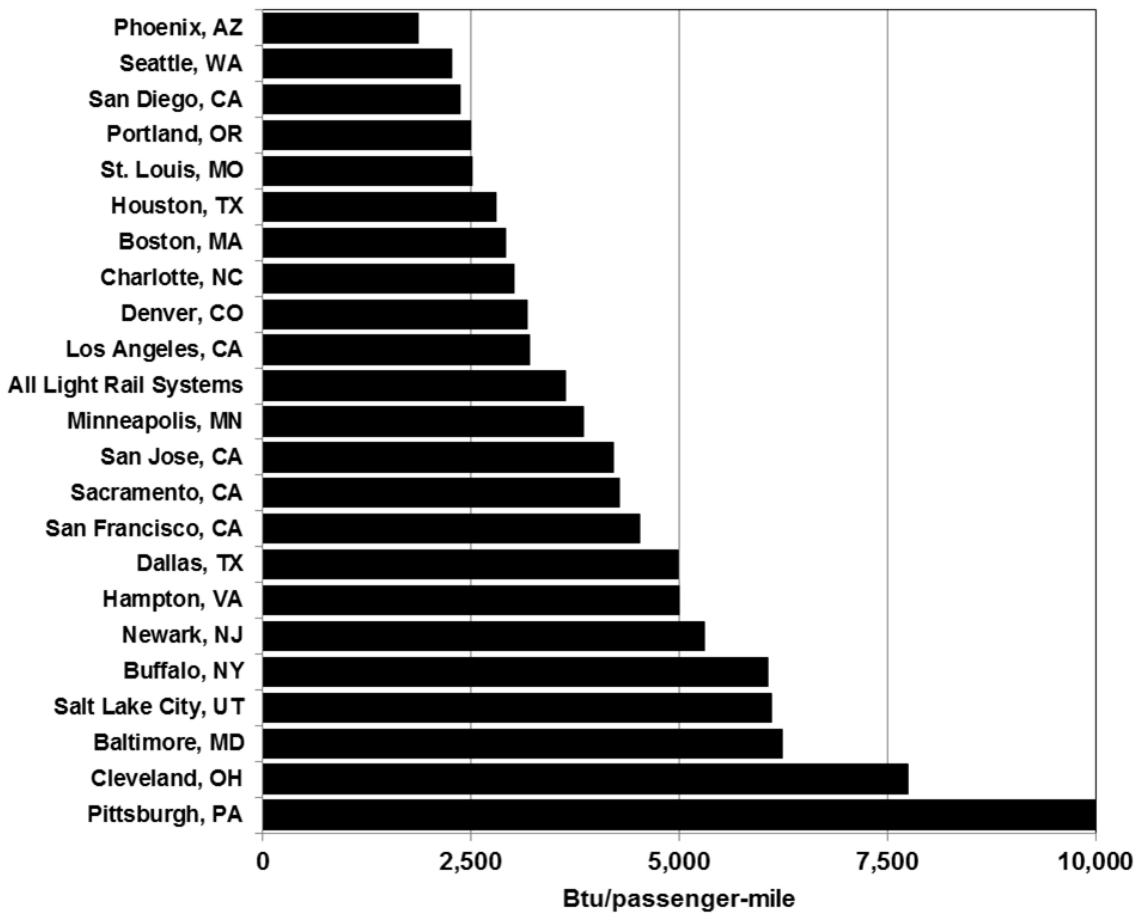
[a] These data differ from the data on Table 2.14 because they include half of international services. These energy intensities may be inflated because all energy use is attributed to passengers–cargo energy use is not taken into account.

[b] Data are not available.

[c] Average annual percentage calculated to earliest year possible.

The energy intensity of light rail systems, measured in Btu per passenger-mile varies greatly. The weighted average of all light rail systems in 2013 is 3,631 Btu/passenger-mile.

Figure 2.7. Energy Intensity of Light Rail Transit Systems[a], 2013



Source:
U.S. Department of Transportation, *National Transit Database*, June 2015. (Additional resources: www.ntdprogram.gov)

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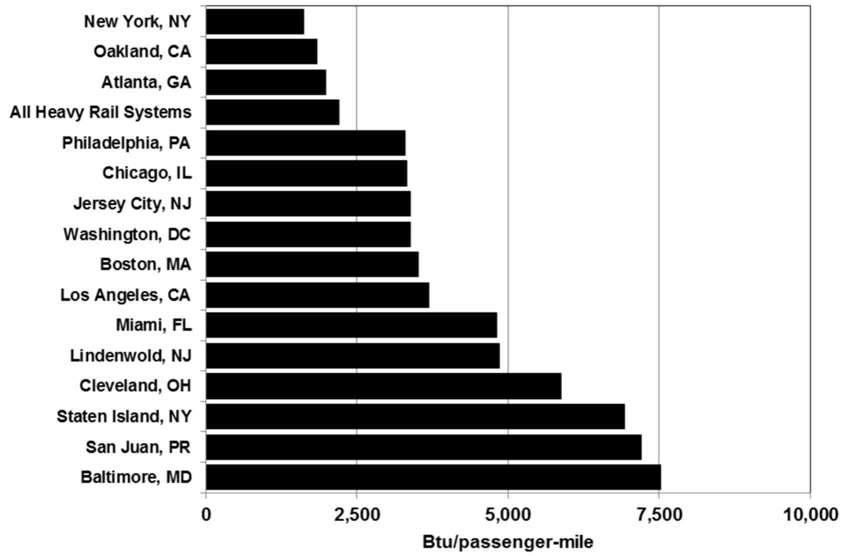
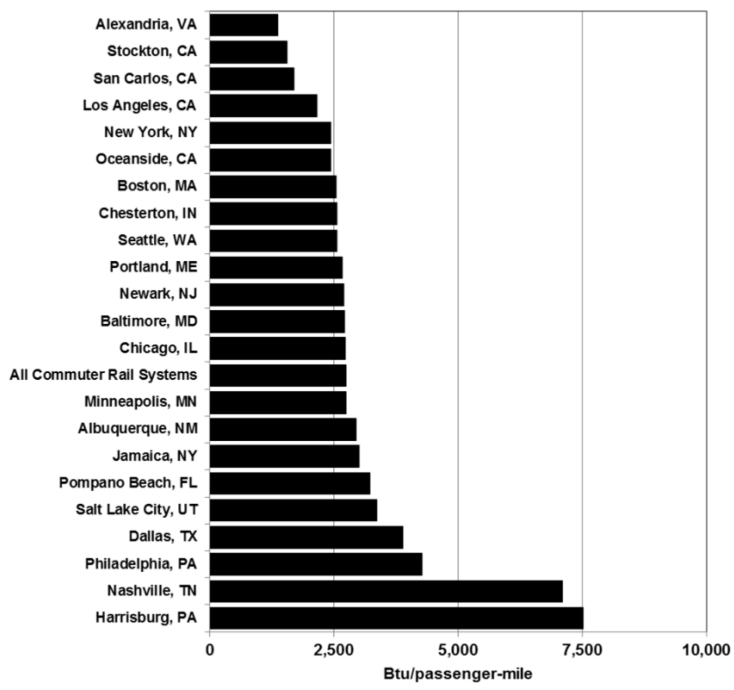
[a] Typically an electric railway with a light volume traffic capacity with power drawn from an overhead electric line.

Figure 2.8. Energy Intensity of Heavy Rail Systems[a], 2013



Source:
U.S. Department of Transportation, *National Transit Database*, June 2015. (Additional resources: www.ntdprogram.gov)

Figure 2.9. Energy Intensity of Commuter Rail Systems[b], 2013



Source:
U.S. Department of Transportation, *National Transit Database*, June 2015. (Additional resources: www.ntdprogram.gov)

[a] An electric railway with the capacity for a heavy volume of traffic.
[b] Electric car or diesel-propelled railway for urban passenger train service between a central city and adjacent suburbs.

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 2.17
Energy Intensities of Freight Modes, 1970–2013

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)	Waterborne commerce on taxable waterways (Btu per ton-mile)
1970	24,960	17,669	691	[a]
1975	24,631	18,739	687	[a]
1976	24,567	18,938	680	[a]
1977	24,669	19,226	669	[a]
1978	24,655	18,928	641	[a]
1979	24,746	19,188	618	[a]
1980	24,758	18,742	597	[a]
1981	25,059	18,629	572	[a]
1982	24,297	18,404	553	[a]
1983	23,853	17,864	525	[a]
1984	23,585	17,795	510	[a]
1985	23,343	17,500	497	[a]
1986	23,352	17,265	486	[a]
1987	22,923	16,790	456	[a]
1988	22,596	16,758	443	[a]
1989	22,411	16,894	437	[a]
1990	22,795	16,619	420	[a]
1991	22,749	15,835	391	[a]
1992	22,609	16,043	393	[a]
1993	22,373	16,056	389	[a]
1994	22,193	16,340	388	[a]
1995	22,097	15,992	372	[a]
1996	22,109	15,747	368	[a]
1997	21,340	15,784	370	266
1998	21,516	15,372	365	256
1999	22,884	15,363	363	266
2000	23,449	14,917	352	270
2001	23,024	15,108	346	253
2002	23,462	15,003	345	253
2003	22,461	15,016	344	251
2004	20,540	15,274	341	241
2005	22,866	15,152	337	241
2006	23,340 [b]	14,990	330	235
2007	21,238	14,846	320	225
2008	21,008	14,573	305	252
2009	21,024	13,907	291	225
2010	21,499	13,733	289	217
2011	21,677	14,043	298	211
2012	21,525	13,800	294	210
2013	21,540	14,607	296	[a]
		Average annual percentage change		
1970–2013	-0.3%	-0.4%	-2.0%	[a]
2003–2013	-0.4%	-0.3%	-1.5%	[a]

Source:
See Appendix A for Freight Mode Energy Intensities.

[a] Data are not available.
[b] Due to changes in the FHWA fuel use methodology, truck data are not comparable with data before the year 2007.

Chapter 3
All Highway Vehicles and Characteristics

Summary Statistics from Tables in this Chapter

Source		
Table 3.2	U.S. share of world car registrations, 2013	15.1%
Table 3.3	U.S. share of world truck & bus registrations, 2013	37.3%
Table 3.4	Number of U.S. cars, 2013 (thousands)	113,676
Table 3.4	Number of U.S. trucks, 2013 (thousands)	132,931
Table 3.7	Vehicle miles traveled, 2013 (million miles)	2,968,771
	Cars	*48.4%*
	Two-axle, four-tire trucks	*41.2%*
	Combination trucks	*5.6%*
	Other single-unit trucks	*3.6%*
	Motorcycles	*0.7%*
	Buses	*0.5%*
Table 3.10	Average age of vehicles, 2014	
	Cars (years)	*11.5*
	Light trucks (years)	*11.5*
	All light vehicles (years)	*11.5*

The top countries producing the world's cars and trucks have changed over the last ten years. In 2013, China was the largest producer of cars and trucks. In 2000, Japan produced the most cars and the United States produced the most trucks (includes light trucks).

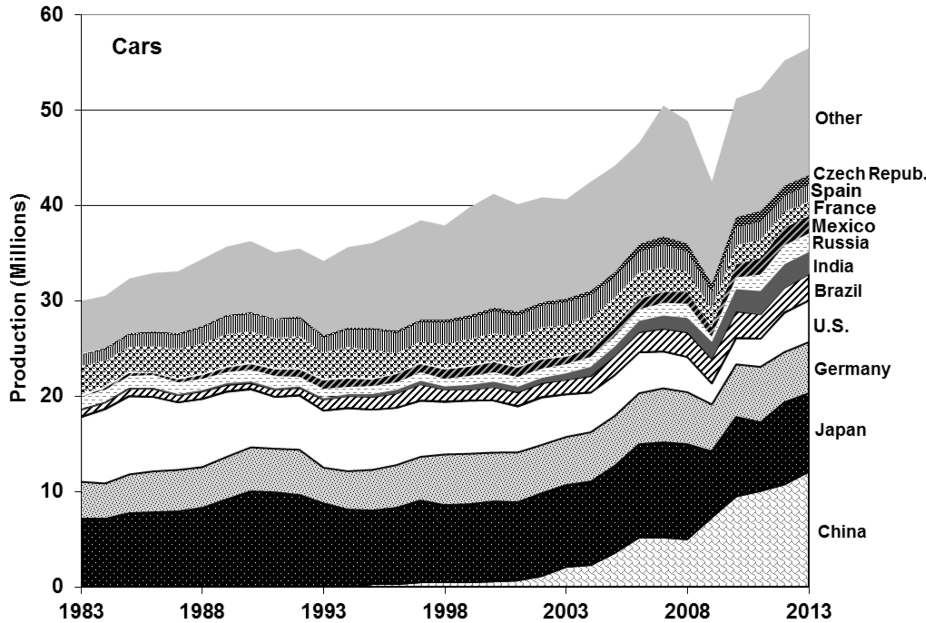
Table 3.1
World Production of Cars and Trucks, 2000 and 2013
(thousands)

Cars	2000	2013	Percent change 2000-2013
China	605	12,059	1,894%
Japan	8,363	8,189	-2%
Germany	5,132	5,440	6%
U.S.	5,542	4,369	-21%
Brazil	1,362	2,723	100%
India	605	2,370	292%
Russia	969	1,920	98%
Mexico	1,130	1,772	57%
Spain	2,366	1,755	-26%
UK	1,641	1,509	-8%
France	2,880	1,461	-49%
Czech Republic	428	1,127	163%
All Other Countries	10,205	11,815	16%
Total world	41,229	56,509	37%
Trucks[a]	2000	2013	Percent change 2000-2013
China	1,464	10,058	587%
U.S.	7,263	6,698	-8%
South Korea	513	1,882	267%
India	283	1,526	438%
Japan	1,781	1,441	-19%
Canada	1,411	1,415	0%
Thailand	315	1,386	341%
All Other Countries	4,685	6,124	31%
Total World	17,717	30,530	72%

Source:
Ward's Communications, Ward's *World Motor Vehicle Data*, 2014 Edition, Southfield, MI, 2014, pp. 275-280 and annual. (Additional resources: www.wardsauto.com)

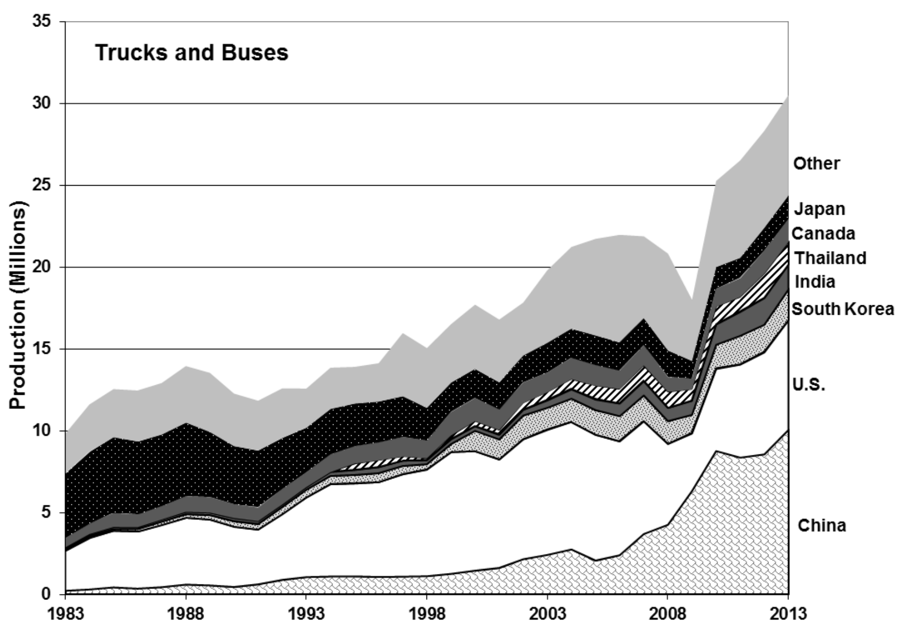
[a] Includes all trucks and buses. In the United States, light trucks, such as pickups, vans, and sport-utility vehicles are included with trucks.

Figure 3.1. World Car Production, 1983–2013[a]



Source:
See Table 3.1.

Figure 3.2. World Truck and Bus Production, 1983–2013[a]



Source:
See Table 3.1.

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[a] The sharp decrease in 2009 coincides with the recession. Note that the scales of the two figures differ.

Use caution comparing historical data because of disconnects in data series. 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 continues to decline. The growth in the World total comes mainly from developing countries, like China, Indonesia, India, and South Korea.

Table 3.2
Car Registrations for Selected Countries, 1960–2013
(thousands)

Country	1960	1970	1980	1990	2000	2005	2010	2012	2013	Average annual percentage change 1990-2013
Argentina	474	1,482	3,112	4,284	5,060	5,340	7,605	8,683	9,462	3.5%
Brazil	[a]	[a]	[a]	12,127	15,393	18,370	25,541	29,566	31,339	4.2%
Canada[b]	4,104	6,602	10,256	12,622	16,832	18,124	20,121	20,652	21,262	2.3%
China	[a]	[a]	351	1,897	3,750	8,900	34,430	52,165	55,930	15.8%
France	4,950	11,860	18,440	23,550	28,060	30,100	31,300	31,600	31,650	1.3%
Germany[c]	4,856	14,376	23,236	35,512	43,772	46,090	42,302	43,431	43,851	0.9%
India	[a]	[a]	[a]	2,300	5,150	7,654	13,300	19,130	21,551	10.2%
Indonesia	[a]	[a]	[a]	1,200	[a]	3,850	8,891	10,432	11,485	10.3%
Japan	457	8,779	23,660	34,924	52,437	57,091	58,347	58,421	60,035	2.4%
Malaysia	[a]	[a]	[a]	1,811	4,213	6,402	9,115	9,833	11,154	8.2%
Pakistan	[a]	[a]	[a]	738	375	411	1,726	1,997	2,159	4.8%
Russia	[a]	[a]	[a]	[a]	20,353	25,285	34,350	38,482	39,320	5.2%[d]
South Korea	[a]	[a]	[a]	2,075	8,084	11,122	13,632	14,577	15,078	9.0%
United Kingdom	5,650	11,802	15,438	22,528	27,185	30,652	31,258	31,482	31,918	1.5%
United States	61,671	89,244	121,601	143,550	127,721	132,909	129,053	120,902	120,214	-0.8%
U.S. percentage of world	62.7%	46.1%	38.0%	32.3%	23.3%	21.5%	17.8%	15.6%	15.1%	
World total	98,305	193,479	320,390	444,900	548,558	617,914	723,567	774,145	796,260	2.6%

Source:
Ward's Communications, *Ward's World Motor Vehicle Data*, *2014 Edition*, Southfield, MI, 2014, pp. 300–303 and annual. (Additional resources: www.wardsauto.com)

[a] Data are not available.
[b] Data from 2000 and later are not comparable to prior data. Canada reclassified autos and trucks prior to 2000.
[c] Data for 1990 and prior include West Germany only. Kraftwagen are included with automobiles.
[d] Data for earliest year available.

The United States totals include SUVs, minivans, and light trucks, many of which are used for personal travel. Thus, countries that only use trucks for freight movement will not be comparable to the United States.

Table 3.3
Truck and Bus Registrations for Selected Countries, 1960–2013
(thousands)

Country	1960	1970	1980	1990	2000	2005	2010	2013	Average annual percentage change 1990-2013
Argentina	392	788	1,217	1,501	1,554	1,730	2,511	3,041	3.1%
Brazil	[a]	[a]	[a]	936	3,917	4,653	6,524	8,356	10.0%
Canada[b]	1,056	1,481	2,955	3,931	739	786	933	1,072	-5.5%
China	[a]	[a]	1,480	4,314	9,650	21,750	43,590	63,580	12.4%
France	1,650	1,850	2,550	4,910	5,733	6,198	6,444	6,550	1.3%
Germany[c]	786	1,228	1,617	2,764	3,534	3,133	2,960	3,163	0.6%
India	[a]	[a]	[a]	2,050	2,390	4,145	9,500	10,948	7.6%
Indonesia	[a]	[a]	[a]	1,391	2,373	2,950	6,938	7,902	7.8%
Japan	896	8,803	14,197	22,773	20,211	16,734	15,512	14,930	-1.8%
Malaysia	[a]	[a]	[a]	616	1,030	1,323	1,138	1,142	2.7%
Pakistan	[a]	[a]	[a]	172	385	414	538	620	5.7%
Russia	[a]	[a]	[a]	7,200	5,041	5,705	6,304	7,000	-0.1%
South Korea	[a]	[a]	[a]	1,320	3,956	4,275	4,310	4,323	5.3%
United Kingdom	1,534	1,769	1,920	3,774	3,361	3,943	4,220	4,365	0.6%
United States	12,186	19,175	34,195	45,106	85,579	104,788	119,179	132,501	4.8%
U.S. percentage of world	42.6%	36.2%	37.7%	32.7%	42.1%	42.6%	38.5%	37.3%	
World total	28,583	52,899	90,592	138,082	203,272	245,798	309,395	355,405	4.2%

Source:
Ward's Communications, *Ward's World Motor Vehicle Data, 2014 Edition*, Southfield, MI, 2014, pp. 300–303 and annual. (Additional resources: www.wardsauto.com)

[a] Data are not available.
[b] Data from 2000 and later are not comparable to prior data. Canada reclassified autos and trucks prior to 2000.
[c] Data for 1990 and prior include West Germany only. Kraftwagen are included with automobiles.

VEHICLES IN USE

Both the Federal Highway Administration (FHWA) and IHS Automotive 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. IHS Automotive data include only those vehicles which are registered on July 1 of the given year.
- The classification of mini-vans, station wagons on truck chassis, and utility vehicles as cars or trucks causes important differences in the two estimates. IHS Automotive data included passenger vans in the car count until 1980; since 1980 all vans have been counted as trucks.
- Starting in 1993, the FHWA reclassified some minivans and sport utility vehicles into the truck category which were previously included with cars. 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. Beginning with 2009, the FHWA discontinued the car/2-axle, 4-tire truck designations on Table VM-1. The data since 2009 come from Tables MV-1 and MV-9.
- The FHWA data include all non-military Federal vehicles, while IHS Automotive 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.
- In 2012 both IHS Automotive and FHWA changed their methodologies for the car/light truck split which created a significant decrease in the number of cars reported and a corresponding increase in the number of light trucks.

In the early 1980's, researchers had to make a conscious choice of which data series to use, since they differed by as much as 11%. In 2005 the two sources differed by less than 1%. Both sources changed their methodologies for the car/light truck split causing significant decreases to the number of cars in 2012.

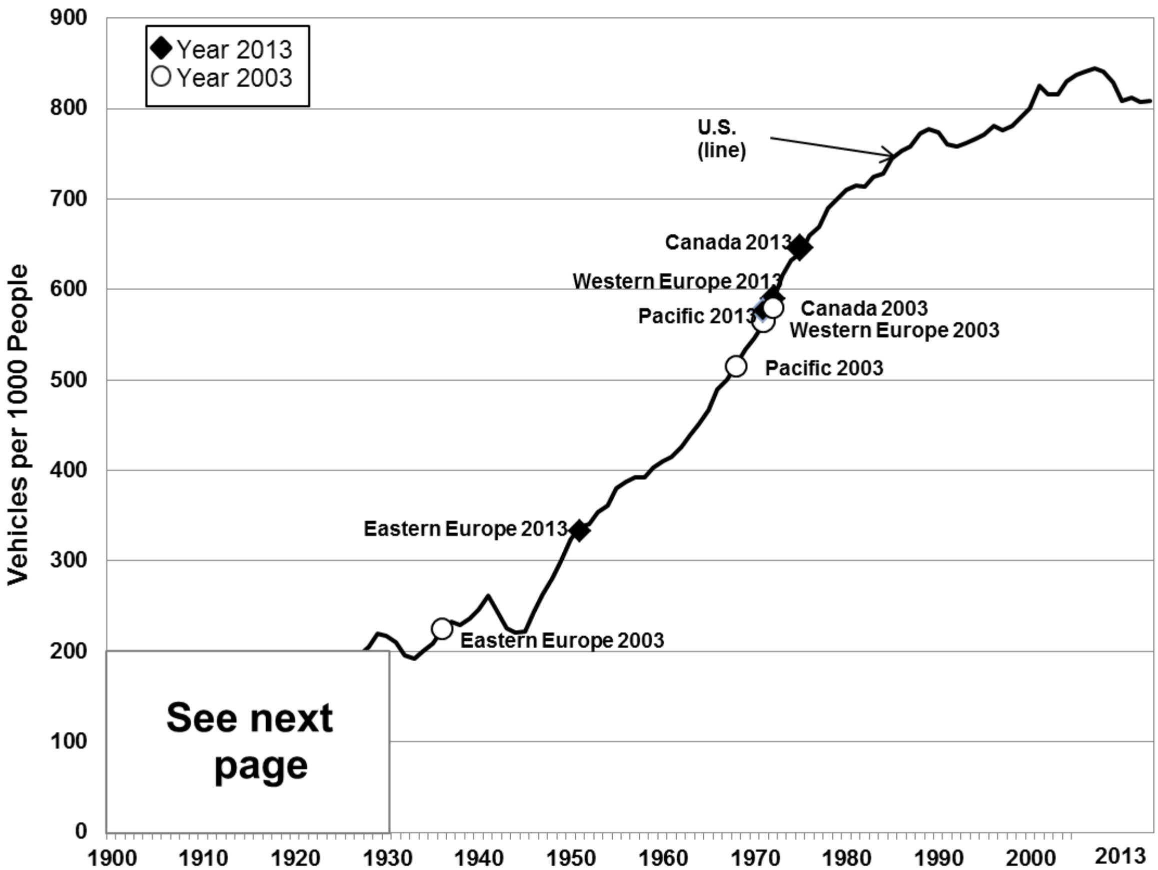
Table 3.4
U.S. Cars and Trucks in Use, 1970–2013
(thousands)

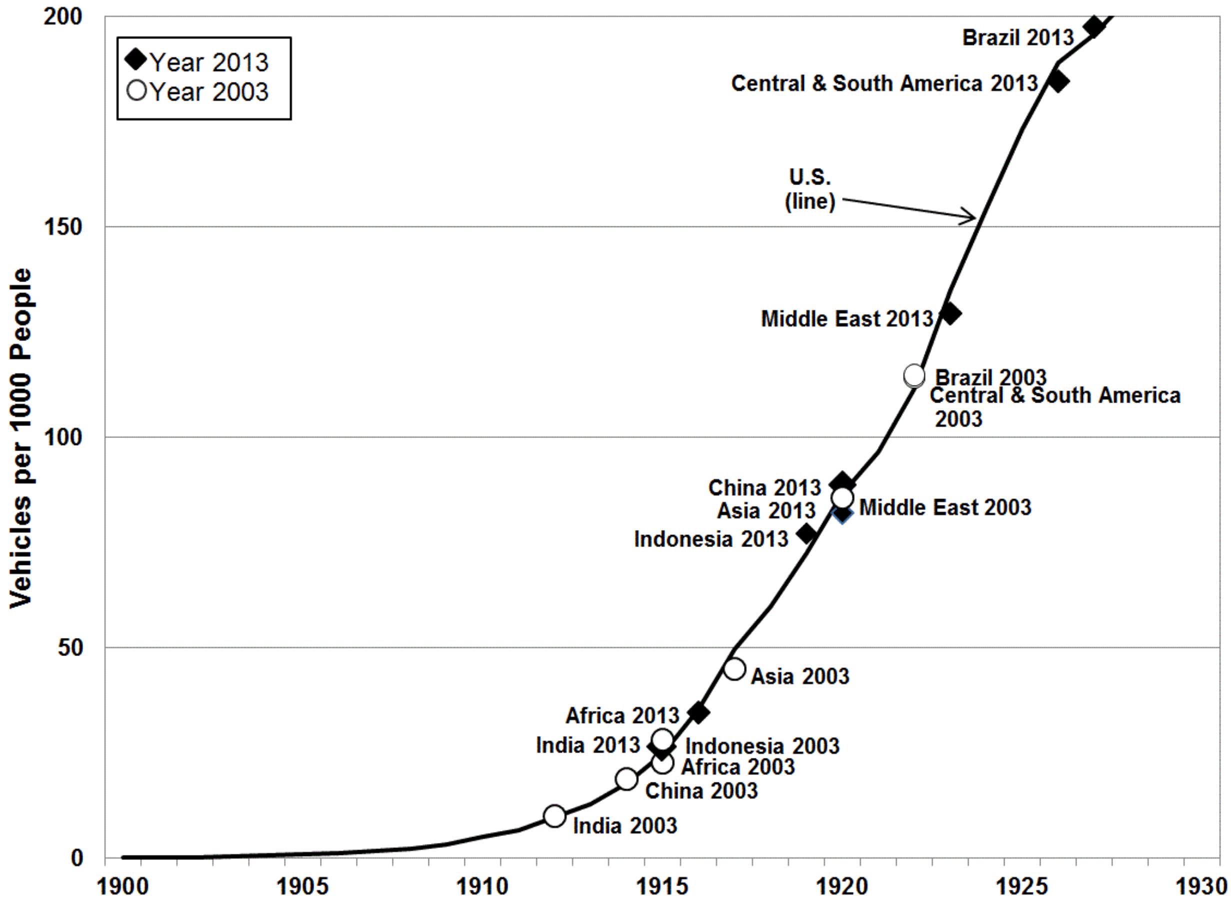
	Cars			Trucks			Total		
Year	FHWA	IHS Automotive	Percentage difference	FHWA	IHS Automotive	Percentage difference	FHWA	IHS Automotive	Percentage difference
1970	89,243	80,448	10.9%	18,797	17,688	6.3%	108,040	98,136	10.1%
1975	106,706	95,241	12.0%	25,781	24,813	3.9%	132,487	120,054	10.4%
1976	110,189	97,818	12.6%	27,876	26,560	5.0%	138,065	124,378	11.0%
1977	112,288	99,904	12.4%	29,314	28,222	3.9%	141,602	128,126	10.5%
1978	116,573	102,957	13.2%	31,336	30,565	2.5%	147,909	133,522	10.8%
1979	118,429	104,677	13.1%	32,914	32,583	1.0%	151,343	137,260	10.3%
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%
2008	137,080	135,882	0.9%	110,242	113,931	-3.2%	247,322	249,813	-1.0%
2009	134,880	132,500	1.8%	110,561	116,472	-5.1%	245,441	248,972	-1.4%
2010	130,892	129,053	1.4%	110,322	119,179	-7.4%	241,214	248,232	-2.8%
2011	125,657	127,577	-1.5%	118,483	121,355	-2.4%	244,140	248,932	-1.9%
2012	111,290	120,902	-8.0%	133,130	130,595	1.9%	244,420	251,497	-2.8%
2013	113,676	120,214	-5.4%	132,931	132,501	0.3%	246,607	252,715	-2.4%

Source:
FHWA - U.S. Department of Transportation, Federal Highway Administration, 1970-2008, *Highway Statistics 2008* and earlier, Washington, DC, 2009, Table VM-1 and annual. 2009-2013 data from Tables MV-1 and MV-9, *Highway Statistics 2013*. (Additional resources: www.fhwa.dot.gov)
IHS Automotive - IHS Automotive, Detroit, Michigan. **FURTHER REPRODUCTION PROHIBITED.**
(Additional resources: https://www.ihs.com/industry/automotive.html)

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 2013. 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, 2003 and 2013. For instance, the graph shows that in 2003, Eastern Europe's vehicles per thousand people was about where the United States was in 1936, but by 2013 it is about where the United States was in 1951. The lower part of the graph (1900-1930) is shown enlarged on the facing page.

Figure 3.3. Vehicles per Thousand People: U.S. (Over Time) Compared to Other Countries (in 2003 and 2013)





Source:
See Tables 3.5 and 3.6.

Though some countries are listed separately in this table, those countries are also included in the regional total. For instance, China is listed separately, but is also included in the Asia, Far East region.

Table 3.5
Vehicles per Thousand People in Selected Countries/Regions, 2003 and 2013

	Vehicles per 1,000 people	
Country/Region	2003	2013
Africa	22.6	34.6
Asia, Far East	45.0	81.9
Asia, Middle East	85.5	129.5
Brazil	114.8	197.5
Canada	580.0	646.1
Central & South America	114.2	184.6
China	18.7	88.6
Europe, East	224.5	332.4
Europe, West	565.7	589.6
India	10.1	26.6
Indonesia	28.1	77.2
Pacific	515.3	576.2
United States	816.1	808.6

Sources:
Population –U.S. Census Bureau, Population Division, International Data Base (IDB) World, June 10, 2015. (Additional resources: www.census.gov/population/international)
Vehicles –Ward's Communications, *Ward's World Motor Vehicle Data 2014*, pp. 300–303. (Additional resources: www.fhwa.dot.gov, www.wardsauto.com)

The number of vehicles per thousand people in the United States has grown tremendously since 1900. After a peak in 2007 at 844.5, the number has declined and in 2013 was 808.6.

Table 3.6
Vehicles per Thousand People in the United States, 1990–2013

Year	U.S. vehicles per 1,000 people	Year	U.S. vehicles per 1,000 people	Year	U.S. vehicles per 1,000 people	Year	U.S. vehicles per 1,000 people	Year	U.S. vehicles per 1,000 people
1900	0.1	1923	134.9	1946	243.1	1969	533.4	1992	758.0
1901	0.2	1924	154.4	1947	262.6	1970	545.4	1993	761.9
1902	0.3	1925	173.3	1948	280.2	1971	562.5	1994	766.9
1903	0.4	1926	189.1	1949	299.6	1972	585.6	1995	771.0
1904	0.7	1927	195.8	1950	323.7	1973	615.2	1996	781.2
1905	0.9	1928	204.9	1951	337.1	1974	632.3	1997	776.0
1906	1.3	1929	219.3	1952	340.6	1975	640.1	1998	781.2
1907	1.7	1930	217.3	1953	353.7	1976	659.5	1999	790.1
1908	2.2	1931	210.4	1954	361.4	1977	669.0	2000	800.3
1909	3.5	1932	195.4	1955	379.8	1978	690.2	2001	825.8
1910	5.1	1933	192.4	1956	387.6	1979	700.4	2002	815.7
1911	6.8	1934	199.9	1957	392.1	1980	710.7	2003	816.1
1912	9.9	1935	208.6	1958	392.2	1981	715.2	2004	829.9
1913	12.9	1936	222.6	1959	402.8	1982	714.0	2005	837.3
1914	17.8	1937	233.3	1960	410.4	1983	724.3	2006	840.7
1915	24.8	1938	229.7	1961	415.1	1984	728.2	2007	844.5
1916	35.5	1939	236.9	1962	426.1	1985	744.5	2008	841.6
1917	49.6	1940	245.6	1963	438.8	1986	753.3	2009	828.7
1918	59.7	1941	261.6	1964	451.6	1987	758.6	2010	808.4
1919	72.5	1942	244.7	1965	466.9	1988	772.9	2011	812.7
1920	86.8	1943	225.9	1966	489.3	1989	777.0	2012	808.0
1921	96.7	1944	220.2	1967	500.7	1990	773.4	2013	808.6
1922	111.5	1945	221.8	1968	516.5	1991	760.2		

Sources:
Population – U.S. Census Bureau, Population Division, International Data Base (IDB) World, June 9, 2015. (Additional resources: www.census.gov/ipc/www/idb/)
Vehicles – (2013) U.S.: U.S. Department of Transportation, Federal Highway Administration, *Highway Statistics 2013,* Washington, DC, 2015.

Total vehicle-miles traveled increased slightly from 2012 to 2013. 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 30.1% more travel in 2013 than in 1970, and cars account for 34.2% less travel in that time period.

Table 3.7
Shares of Highway Vehicle-Miles Traveled by Vehicle Type, 1970–2013

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%	33.7%	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%	2,890,412
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 [a]
2007	53.7%	0.7%	35.7%	3.8%	5.9%	0.2%	3,117,292
2008	52.8%	0.7%	36.2%	4.1%	6.0%	0.2%	3,063,059
2009	53.0%	0.7%	36.1%	4.1%	5.7%	0.5%	2,956,816
2010	50.4%	0.6%	38.8%	3.7%	5.9%	0.5%	2,967,310
2011	49.4%	0.6%	40.4%	3.5%	5.6%	0.5%	2,950,443
2012	48.4%	0.7%	41.3%	3.6%	5.5%	0.5%	2,969,753
2013	48.4%	0.7%	41.2%	3.6%	5.6%	0.5%	2,988,351
			Average annual percentage change				
1970–2013							2.3%
2003–2013							0.3%

Source:
U.S. Department of Transportation, Federal Highway Administration, *Highway Statistics 2013*, Washington, DC, 2015, Table VM-1 and annual. (Additional resources: www.fhwa.dot.gov). 2009-2013 cars and 2-axle 4-tire trucks – see Appendix A for car/light truck shares.

[a] Due to FHWA methodology changes, data from 2007-on are not comparable with previous data.

In 1970 only 2.9% of the car population was 15 years old or older; by 2013 that number rose to nearly 20%.

Table 3.8
Cars in Operation by Age, 1970, 2001, and 2013

	1970			2001			2013		
Age (years)	Vehicles (thousands)	Percentage[a]	Cumulative percentage[a]	Vehicles (thousands)	Percentage[a]	Cumulative percentage[a]	Vehicles (thousands)	Percentage[a]	Cumulative percentage[a]
Under 1[b]	6,288	7.8%	7.8%	6,183	4.8%	4.8%	9,287	7.1%	7.1%
1	9,299	11.6%	19.4%	8,882	6.9%	11.7%	7,700	5.9%	13.1%
2	8,816	11.0%	30.3%	8,093	6.3%	18.0%	5,957	4.6%	17.6%
3	7,878	9.8%	40.1%	7,555	5.9%	23.9%	6,159	4.7%	22.4%
4	8,538	10.6%	50.8%	7,860	6.1%	30.0%	5,484	4.2%	26.6%
5	8,506	10.6%	61.3%	7,337	5.7%	35.7%	7,226	5.6%	32.1%
6	7,116	8.8%	70.2%	8,555	6.6%	42.3%	7,896	6.1%	38.2%
7	6,268	7.8%	78.0%	7,471	5.8%	48.1%	7,706	5.9%	44.1%
8	5,058	6.3%	84.3%	7,420	5.8%	53.9%	7,843	6.0%	50.2%
9	3,267	4.1%	88.3%	6,807	5.3%	59.2%	6,924	5.3%	55.5%
10	2,776	3.5%	91.8%	6,810	5.3%	64.5%	7,237	5.6%	61.1%
11	1,692	2.1%	93.9%	6,692	5.2%	69.7%	7,167	5.5%	66.6%
12	799	1.0%	94.9%	6,742	5.2%	74.9%	6,660	5.1%	71.7%
13	996	1.2%	96.1%	6,189	4.8%	79.7%	6,889	5.3%	77.0%
14	794	1.0%	97.1%	5,345	4.2%	83.9%	5,487	4.2%	81.2%
15 and older	2,336	2.9%	100.0%	20,773	16.1%	100.0%	24,457	18.8%	100.0%
Subtotal	**80,427**	**100.0%**		**128,714**	**100.0%**		**130,078**		
Age not given	**22**			**0**			**0**		
Total	**80,449**			**128,714**			**130,078**		

Source:
IHS Automotive, Detroit, MI. **FURTHER REPRODUCTION PROHIBITED.**

[a] Percentages may not sum to totals due to rounding.

[b] 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. For 2013, cars sold prior to December 31, 2013 which were model year 2013, 2014 or 2015 were included.

The number of trucks in the United States has grown significantly since 1970, some of it due to the use of light trucks (pickups, vans, sport utility vehicles) as personal passenger vehicles. Those light trucks, as well as medium and heavy trucks, are included in the data. In 1970 about 15% of trucks were age 15 or older; by 2013, that increased to 20.8%.

Table 3.9
Trucks in Operation by Age, 1970, 2001, and 2013

	1970			2001			2013		
Age (years)	Vehicles (thousands)	Percentage[a]	Cumulative percentage[a]	Vehicles (thousands)	Percentage[a]	Cumulative percentage[a]	Vehicles (thousands)	Percentage[a]	Cumulative percentage[a]
Under 1[b]	1,262	7.1%	7.1%	6,213	7.1%	7.1%	8,097	6.5%	6.5%
1	1,881	10.6%	17.8%	7,958	9.0%	16.1%	6,391	5.1%	11.6%
2	1,536	8.7%	26.5%	7,522	8.6%	24.7%	6,417	5.2%	16.8%
3	1,428	8.1%	34.6%	6,398	7.3%	31.9%	4,972	4.0%	20.8%
4	1,483	8.4%	43.0%	6,109	6.9%	38.9%	3,991	3.2%	24.0%
5	1,339	7.6%	50.5%	5,122	5.8%	44.7%	6,927	5.6%	29.5%
6	1,154	6.5%	57.1%	5,574	6.3%	51.0%	7,587	6.1%	35.6%
7	975	5.5%	62.6%	5,042	5.7%	56.8%	7,580	6.1%	41.7%
8	826	4.7%	67.3%	4,148	4.7%	61.5%	7,585	6.1%	47.8%
9	621	3.5%	70.8%	3,395	3.9%	65.3%	7,978	6.4%	54.2%
10	658	3.7%	74.5%	3,221	3.7%	69.0%	7,201	5.8%	60.0%
11	583	3.3%	77.8%	3,039	3.5%	72.5%	6,850	5.5%	65.5%
12	383	2.2%	80.0%	3,345	3.8%	76.3%	6,163	4.9%	70.4%
13	417	2.4%	82.3%	3,112	3.5%	79.8%	5,673	4.6%	75.0%
14	414	2.3%	84.7%	2,544	2.9%	82.7%	5,217	4.2%	79.2%
15 and older	2,710	15.3%	100.0%	15,227	17.3%	100.0%	25,917	20.8%	100.0%
Subtotal	**17,670**	**100.0%**		**87,969**	**100.0%**		**124,545**		
Age note given	**15**			**0**			**0**		
Total	**17,685**			**87,969**			**124,545**		

Source:
IHS Automotive, Detroit, MI. **FURTHER REPRODUCTION PROHIBITED.**

[a] Percentages may not sum to totals due to rounding.
[b] 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.

The average age of cars and light trucks has grown to a record level in 2014—11.5 years. Light trucks, which include pickups, vans, and sport utility vehicles, previously had a lower average age than cars. In 2014, however, there is no difference in their ages.

Table 3.10
U.S. Average Vehicle Age, 1995–2014

	Passenger cars	Light trucks	All light vehicles
1995	8.4	8.3	8.4
1996	8.5	8.3	8.5
1997	8.7	8.5	8.6
1998	8.9	8.5	8.8
1999	9.1	8.5	8.8
2000	9.1	8.4	8.9
2001	9.3	8.4	8.9 [a]
2002	9.8	9.4	9.6
2003	9.9	9.0	9.7
2004	10.0	9.5	9.8
2005	10.1	9.5	9.8
2006	10.2	9.5	9.9
2007	10.3	9.6	10.0
2008	10.4	9.8	10.1
2009	10.5	10.1	10.3
2010	10.8	10.5	10.6
2011	11.1	10.8	10.9
2012	11.3	11.1	11.2
2013	11.4	11.3	11.4
2014	11.5	11.5	11.5

Source:
IHS Automotive, Detroit, MI. **FURTHER REPRODUCTION PROHIBITED**. (Additional resources: https://www.ihs.com/industry/automotive.html)

[a] In 2013, IHS Automotive published a data series showing vehicle age from 2002-2013. These data did not match the previous data published by IHS Automotive. The data prior to 2002 came from earlier IHS Automotive news releases and is not comparable to the revised data.

Table 3.11
New Retail Vehicle Sales, 1970–2014
(thousands)

Calendar Year	Cars	Light Trucks[a]	Subtotal Light Vehicles	Heavy Trucks	Total Vehicle Sales
1970	8,399	1,457	9,856	334	10,191
1971	10,242	1,673	11,915	340	12,255
1972	10,941	2,097	13,038	438	13,475
1973	11,424	2,512	13,936	497	14,433
1974	8,853	2,163	11,016	424	11,440
1975	8,624	2,053	10,677	298	10,975
1976	10,110	2,719	12,829	324	13,153
1977	11,183	3,109	14,292	376	14,668
1978	11,314	3,474	14,788	441	15,229
1979	10,673	2,845	13,518	391	13,909
1980	8,949	1,960	10,909	265	11,174
1981	8,489	1,746	10,235	235	10,470
1982	7,956	2,063	10,019	183	10,202
1983	9,148	2,521	11,669	189	11,858
1984	10,324	3,255	13,579	277	13,856
1985	10,979	3,688	14,667	285	14,952
1986	11,404	4,594	15,998	265	16,263
1987	10,192	4,610	14,802	287	15,089
1988	10,547	4,800	15,347	334	15,681
1989	9,779	4,610	14,389	312	14,700
1990	9,303	4,548	13,851	277	14,129
1991	8,185	4,122	12,307	221	12,528
1992	8,213	4,629	12,842	249	13,091
1993	8,518	5,351	13,869	303	14,172
1994	8,991	6,033	15,024	353	15,376
1995	8,620	6,053	14,673	388	15,061
1996	8,479	6,519	14,998	359	15,356
1997	8,217	6,797	15,014	376	15,391
1998	8,085	7,299	15,384	424	15,808
1999	8,638	8,073	16,711	521	17,232
2000	8,778	8,386	17,164	462	17,626
2001	8,352	8,598	16,950	350	17,300
2002	8,042	8,633	16,675	322	16,998
2003	7,556	8,938	16,494	328	16,822
2004	7,483	9,254	16,737	432	17,168
2005	7,660	9,114	16,774	497	17,271
2006	7,762	8,574	16,336	545	16,880
2007	7,562	8,305	15,867	371	16,238
2008	6,769	6,246	13,015	298	13,314
2009	5,402	4,834	10,236	200	10,435
2010	5,636	5,758	11,394	218	11,611
2011	6,090	6,449	12,539	306	12,845
2012	7,244	6,975	14,219	346	14,565
2013	7,585	7,693	15,278	352	15,630
2014	7,688	8,484	16,171	407	16,578
			Average annual percentage change		
1970–2014	-0.2%	4.1%	1.1%	0.5%	1.1%
2004–2014	0.3%	-0.9%	-0.3%	-0.6%	-0.3%

Source:
1970-2014: Ward's Communications, www.wardsauto.com.

[a] Includes light trucks of 10,000 lb. gross vehicle weight and less.

Using current registration data and a scrappage model by Greenspan and Cohen, [1996 paper: www.federalreserve.gov/pubs/feds/1996/199640/199640pap.pdf], ORNL calculated car scrappage rates for 1970, 1980, and 1990. These data are fitted model values which assume constant economic conditions. Using 1977-2002 data, the Federal Highway Administration completed a separate survivability study in 2006.

Table 3.12
Car Scrappage and Survival Rates
1970, 1980, and 1990 Model Years

Vehicle age[a] (years)	1970 model year		1980 model year		1990 model year		2002
	Survival rate[b]	Scrappage rate[c]	Survival rate[b]	Scrappage rate[c]	Survival rate[b]	Scrappage rate[c]	Survival rate
4	99.0	1.0	100.0	0.0	100.0	0.0	95.9
5	94.1	5.0	96.3	3.7	100.0	0.0	94.1
6	88.4	6.1	91.3	5.1	99.4	0.6	91.9
7	82.0	7.2	85.7	6.1	96.3	3.2	89.2
8	75.2	8.3	79.7	7.1	92.7	3.7	86.0
9	68.1	9.5	73.3	8.1	88.7	4.3	82.5
10	60.9	10.6	66.6	9.0	84.4	4.9	78.7
11	53.8	11.7	60.0	10.0	79.8	5.5	71.7
12	46.9	12.8	53.3	11.0	75.0	6.1	61.3
13	40.3	14.0	46.9	12.0	70.0	6.7	50.9
14	34.2	15.1	40.8	13.0	64.9	7.3	41.4
15	28.7	16.2	35.1	14.0	59.7	7.9	33.1
16	23.7	17.4	29.8	15.0	54.6	8.6	26.0
17	19.3	18.5	25.0	16.1	49.5	9.3	20.3
18	15.5	19.6	20.8	17.1	44.6	9.9	15.7
19	12.3	20.8	17.0	18.1	39.9	10.6	12.0
20	9.6	21.9	13.8	19.1	35.4	11.3	9.2
21	7.4	23.0	11.0	20.1	31.1	12.0	7.0
22	5.6	24.2	8.7	21.2	27.2	12.7	5.3
23	4.2	25.3	6.7	22.2	23.5	13.5	4.0
24	3.1	26.4	5.2	23.2	20.2	14.2	3.0
25	2.2	27.5	3.9	24.2	17.1	15.0	2.3
26	1.6	28.6	2.9	25.3	14.5	15.7	[d]
27	1.1	29.7	2.2	26.3	12.1	16.5	[d]
28	0.8	30.8	1.6	27.3	10.0	17.2	[d]
29	0.5	31.9	1.1	28.4	8.2	18.0	[d]
30	0.4	33.0	0.8	29.4	6.6	18.8	[d]
Median lifetime	11.5 years		12.5 years		16.9 years		152,137 Lifetime miles

Sources:
Schmoyer, Richard L., unpublished study on scrappage rates, Oak Ridge National Laboratory, Oak Ridge, TN, 2001.
U.S. Department of Transportation, National Highway Traffic Safety Administration, *Vehicle Survivability and Travel Mileage Schedules*, January 2006.

[a] It was assumed that scrappage for vehicles less than 4 years old is 0.
[b] The percentage of automobiles which will be in use at the end of the year.
[c] The percentage of automobiles which will be retired from use during the year.
[d] Data are not available.

Using current registration data and a scrappage model by Greenspan and Cohen [1996 paper: www.federalreserve.gov/pubs/feds/1996/199640/199640pap.pdf], ORNL calculated light truck scrappage rates for 1970, 1980, and 1990. These data are fitted model values which assume constant economic conditions. Using 1977-2002 data, the Federal Highway Administration completed a separate survivability study in 2006.

Table 3.13
Light Truck[a] Scrappage and Survival Rates
1970, 1980, and 1990 Model Years

Vehicle age[b] (years)	1970 model year		1980 model year		1990 model year		2002
	Survival rate[c]	Scrappage rate[d]	Survival rate[c]	Scrappage rate[d]	Survival rate[c]	Scrappage rate[d]	Survival rate[c]
4	99.7	0.3	99.1	0.9	99.3	0.7	91.9
5	97.5	2.2	96.6	2.5	96.9	2.4	89.1
6	94.9	2.7	93.7	3.1	94.1	3.0	85.9
7	91.8	3.2	90.2	3.7	90.7	3.6	82.3
8	88.3	3.8	86.3	4.3	86.9	4.2	78.3
9	84.4	4.4	82.0	5.0	82.7	4.8	74.0
10	80.2	5.0	77.3	5.7	78.2	5.5	69.6
11	75.7	5.6	72.4	6.4	73.4	6.1	65.0
12	70.9	6.3	67.3	7.1	68.4	6.8	60.4
13	66.0	6.9	62.1	7.8	63.3	7.5	55.2
14	61.0	7.6	56.8	8.5	58.0	8.2	50.1
15	55.9	8.3	51.5	9.3	52.8	9.0	45.2
16	50.8	9.0	46.3	10.1	47.7	9.7	40.6
17	45.9	9.8	41.3	10.8	42.7	10.5	36.3
18	41.1	10.5	36.5	11.6	37.9	11.3	32.4
19	36.4	11.3	32.0	12.4	33.3	12.1	28.7
20	32.1	12.0	27.7	13.3	29.0	12.9	25.4
21	28.0	12.8	23.8	14.1	25.0	13.7	22.4
22	24.2	13.6	20.3	14.9	21.4	14.5	19.8
23	20.7	14.4	17.1	15.8	18.1	15.4	17.4
24	17.5	15.2	14.2	16.7	15.2	16.2	15.2
25	14.7	16.1	11.7	17.5	12.6	17.1	13.3
26	12.2	16.9	9.6	18.4	10.3	18.0	11.7
27	10.1	17.8	7.7	19.3	8.4	18.8	10.2
28	8.2	18.6	6.2	20.2	6.7	19.7	8.9
29	6.6	19.5	4.9	21.1	5.3	20.6	7.7
30	5.2	20.4	3.8	22.1	4.2	21.5	6.7
Median lifetime	16.2 years		15.3 years		15.5 years		179,954 Lifetime miles

Sources:
Schmoyer, Richard L., unpublished study on scrappage rates, Oak Ridge National Laboratory, Oak Ridge, TN, 2001.
U.S. Department of Transportation, National Highway Traffic Safety Administration, *Vehicle Survivability and Travel Mileage Schedules*, January 2006.

[a] Light trucks are trucks less than 10,000 lbs. gross vehicle weight.
[b] It was assumed that scrappage for vehicles less than 4 years old is 0.
[c] The percentage of light trucks which will be in use during the year.
[d] The percentage of light trucks which will be retired from use at the end of the year.

Using current registration data and a scrappage model by Greenspan and Cohen [1996 paper: www.federalreserve.gov/pubs/feds/1996/199640/199640pap.pdf], ORNL calculated heavy truck (trucks over 26,000 lbs. gross vehicle weight) scrappage rates. The expected median lifetime for a 1990 model year heavy truck is 29 years. These data are fitted model values which assume constant economic conditions.

Table 3.14
Heavy Truck[a] Scrappage and Survival Rates
1970, 1980, and 1990 Model Years

Vehicle age[b] (years)	1970 model year		1980 model year		1990 model year	
	Survival rate[c]	Scrappage rate[d]	Survival rate[c]	Scrappage rate[d]	Survival rate[c]	Scrappage rate[d]
4	98.8	1.2	98.5	1.5	99.4	0.6
5	97.2	1.6	96.7	1.9	98.6	0.8
6	95.3	1.9	94.5	2.3	97.6	1.0
7	93.2	2.3	92.0	2.7	96.5	1.2
8	90.7	2.6	89.1	3.1	95.2	1.3
9	88.1	3.0	86.0	3.5	93.8	1.5
10	85.2	3.3	82.7	3.9	92.2	1.7
11	82.1	3.6	79.1	4.3	90.5	1.9
12	78.8	4.0	75.4	4.7	88.6	2.0
13	75.4	4.3	71.6	5.1	86.7	2.2
14	71.9	4.7	67.7	5.5	84.6	2.4
15	68.3	5.0	63.7	5.9	82.4	2.6
16	64.6	5.3	59.7	6.3	80.2	2.7
17	61.0	5.7	55.7	6.7	77.9	2.9
18	57.3	6.0	51.8	7.1	75.5	3.1
19	53.7	6.3	47.9	7.4	73.0	3.3
20	50.1	6.7	44.2	7.8	70.5	3.4
21	46.6	7.0	40.6	8.2	68.0	3.6
22	43.2	7.3	37.1	8.6	65.4	3.8
23	39.9	7.6	33.7	9.0	62.8	3.9
24	36.7	8.0	30.6	9.4	60.3	4.1
25	33.7	8.3	27.6	9.7	57.7	4.3
26	30.8	8.6	24.8	10.1	55.1	4.5
27	28.0	8.9	22.2	10.5	52.6	4.6
28	25.4	9.3	19.8	10.9	50.0	4.8
29	23.0	9.6	17.6	11.2	47.6	5.0
30	20.7	9.9	15.5	11.6	45.1	5.1
Median lifetime	20.0 years		18.5 years		28.0 years	

Source:
Schmoyer, Richard L., unpublished study on scrappage rates, Oak Ridge National Laboratory, Oak Ridge, TN, 2001.

[a] Heavy trucks are trucks over 26,000 lbs. gross vehicle weight.
[b] It was assumed that scrappage for vehicles less than 4 years old is 0.
[c] The percentage of heavy trucks which will be in use at the end of the year.
[d] The percentage of heavy trucks which will be retired from use during the year.

Chapter 4
Light Vehicles and Characteristics

Summary Statistics from Tables in this Chapter

Source		
Table 4.1	Cars, 2013	
	Registrations (thousands)	*113,676*
	Vehicle miles (billion miles)	*1,446.0*
	Fuel economy (miles per gallon)	*25.2*
Table 4.2	Two-axle, four-tire trucks, 2013	
	Registrations (thousands)	*120,523*
	Vehicle miles (billion miles)	*1,231.8*
	Fuel economy (miles per gallon)	*18.8*
Table 4.6	Light truck share of total light vehicle sales	
	1970 calendar year	*14.8%*
	2014 calendar year	*52.5%*
Table 4.11	Car production share, 2014 model year	61.3%
	Car	*51.3%*
	Car SUV	*10.0%*
Table 4.11	Light truck production share, 2014 model year	*38.7%*
	Pickup	*11.5%*
	Van	*3.9%*
	Truck SUV	*23.3%*
Tables 4.20	Corporate average fuel economy	(mpg)
and 4.21	*Car standard, MY 2014*	*34.2*
	Car fuel economy, MY 2014	*36.4*
	Light truck standard, MY 2014 (unreformed)	*26.2*
	Light truck fuel economy, MY 2014	*26.3*
Table 4.27	Average fuel economy loss from 50 to 70 mph	24.5%

The data in this table from 1985–on DO NOT include minivans, pickups, or sport utility vehicles. Much of the data for 2009-on were estimated; the FHWA no longer publishes travel and fuel data for cars. A methodology change for the number of cars registered affected the series in 2012.

Table 4.1
Summary Statistics for Cars, 1970–2013

Year	Registrations[a] (thousands)	Vehicle travel (billion miles)	Miles (per vehicle)	Fuel use (million gallons)	Fuel economy[b] (miles per gallon)
1970	89,244	916.7	10,272	67,820	13.5
1975	106,706	1,034.0	9,690	74,140	13.9
1980	121,601	1,111.6	9,141	69,981	15.9
1981	123,098	1,133.3	9,207	69,112	16.4
1982	123,702	1,161.7	9,391	69,116	16.8
1983	126,444	1,195.1	9,451	70,322	17.0
1984	128,158	1,227.0	9,574	70,663	17.4
1985[c]	127,885	1,246.8	9,749	71,518	17.4
1986	130,004	1,270.2	9,770	73,174	17.4
1987	131,482	1,316.0	10,009	73,308	18.0
1988	133,836	1,370.3	10,238	73,345	18.7
1989	134,559	1,401.2	10,413	73,913	19.0
1990	133,700	1,408.3	10,533	69,568	20.2
1991	128,300	1,358.2	10,586	64,318	21.1
1992	126,581	1,371.6	10,836	65,436	21.0
1993	127,327	1,374.7	10,797	67,047	20.5
1994	127,883	1,406.1	10,995	67,874	20.7
1995	128,387	1,438.3	11,203	68,072	21.1
1996	129,728	1,469.9	11,330	69,221	21.2
1997	129,749	1,502.6	11,580	69,892	21.5
1998	131,839	1,549.6	11,754	71,695	21.6
1999	132,432	1,569.1	11,848	73,283	21.4
2000	133,621	1,600.3	11,976	73,065	21.9
2001	137,633	1,628.3	11,831	73,559	22.1
2002	135,921	1,658.5	12,202	75,471	22.0
2003	135,670	1,672.1	12,325	74,590	22.4
2004	136,431	1,699.9	12,460	75,402	22.5
2005	136,568	1,708.4	12,510	77,418	22.1
2006	135,400	1,690.5	12,485	75,009	22.5
2007	135,933	1,672.5	12,304	74,377	22.5
2008	137,080	1,615.9	11,788	71,497	22.6 [d]
2009	134,880	1,566.8	11,616	66,587	23.5
2010	130,892	1,496.4	11,432	62,245	24.0
2011	125,657	1,457.8	11,601	59,646	24.4
2012	111,290	1,438.8	12,928	57,899	24.9
2013	113,676	1,446.0	12,720	57,290	25.2
			Average annual percentage change		
1970–2013	0.6%	1.1%	0.5%	-0.4%	1.5%
2003–2013	-1.8%	-1.4%	0.3%	-2.6%	1.2%

Source:
1970-2008: U.S. Department of Transportation, Federal Highway Administration, *Highway Statistics 2009*, Washington, DC, 2011, Table VM-1 and annual. 2009-on: See Appendix A for Car/Light Truck Shares. (Additional resources: www.fhwa.dot.gov)

[a] This number differs from IHS Automotive's estimates of "number of cars in use." See Table 3.4.
[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.
[d] Due to FHWA methodology changes, data from 2009-on are not comparable with previous data.

Much of the data for 2009-on were estimated; the FHWA no longer publishes travel and fuel use data for two-axle, four tire trucks. A methodology change for the number of registrations affected the data series in 2012.

Table 4.2
Summary Statistics for Two-Axle, Four-Tire Trucks, 1970–2013

Year	Registrations (thousands)	Vehicle travel (billion miles)	Miles (per vehicle)	Fuel use (million gallons)	Fuel economy (miles per gallon)
1970	14,211	123.3	8,675	12,313	10.0
1975	20,418	200.7	9,830	19,081	10.5
1980	27,876	290.9	10,437	23,796	12.2
1981	28,928	296.3	10,244	23,697	12.5
1982	29,792	306.1	10,276	22,702	13.5
1983	31,214	327.6	10,497	23,945	13.7
1984	32,106	358.0	11,151	25,604	14.0
1985[a]	37,214	391.0	10,506	27,363	14.3
1986	39,382	423.9	10,764	29,074	14.6
1987	41,107	456.9	11,114	30,598	14.9
1988	43,805	502.2	11,465	32,653	15.4
1989	45,945	536.5	11,676	33,271	16.1
1990	48,275	574.6	11,902	35,611	16.1
1991	53,033	649.4	12,245	38,217	17.0
1992	57,091	706.9	12,381	40,929	17.3
1993	59,994	745.8	12,430	42,851	17.4
1994	62,904	764.6	12,156	44,112	17.3
1995	65,738	790.0	12,018	45,605	17.3
1996	69,134	816.5	11,811	47,354	17.2
1997	70,224	850.7	12,115	49,389	17.2
1998	71,330	868.3	12,173	50,462	17.2
1999	75,356	901.0	11,957	52,859	17.0
2000	79,085	923.1	11,672	52,939	17.4
2001	84,188	943.2	11,204	53,522	17.6
2002	85,011	966.0	11,364	55,220	17.5
2003	87,187	984.1	11,287	60,758	16.2
2004	91,845	1,027.2	11,184	63,417	16.2
2005	95,337	1,041.1	10,920	58,869	17.7
2006	99,125	1,082.5	10,920	60,685	17.8
2007	101,470	1,112.3	10,962	61,836	18.0
2008	101,235	1,108.6	10,951	61,199	18.1 [b]
2009	100,154	1,066.5	10,649	61,824	17.3
2010	102,702	1,152.1	11,218	64,687	17.8
2011	105,571	1,192.7	11,298	65,786	18.1
2012	120,847	1,225.6	10,142	66,395	18.5
2013	120,523	1,231.8	10,220	65,555	18.8
			Average annual percentage change		
1970–2013	5.1%	5.5%	0.4%	4.0%	1.5%
2003–2013	3.3%	2.3%	-1.0%	0.8%	1.5%

Source:
1970-2008: U.S. Department of Transportation, Federal Highway Administration, *Highway Statistics 2009*, Washington, DC, 2011, Table MV-9. Previous years Table VM-1. 2009-on: See Appendix A for Car/Light Truck Shares. (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.

[b] Due to FHWA methodology changes, data from 2009-on are not comparable with previous data.

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

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

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.

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 (8,501-10,000 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%

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

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.

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

Car sales in 2009 and 2010 were below 6 million but increased to more than 7.6 million by 2014. In 1980, the Big 3 (Chrysler, Ford and General Motors) held 73.8% of the market; by 2014, that had dropped to 31.1%.

Table 4.5
New Retail Car Sales in the United States, 1970–2014

Calendar year	Domestic[a]	Import[b]	Total[c]	Percentage imports	Percentage Big 3 sales[d]	Percentage diesel
	(thousands)					
1970	7,119	1,280	8,399	15.2%	[e]	0.07%
1975	7,053	1,571	8,624	18.2%	[e]	0.31%
1980	6,580	2,369	8,949	26.5%	73.8%	4.32%
1985	8,205	2,775	10,979	25.3%	72.9%	0.83%
1990	6,919	2,384	9,303	25.6%	65.7%	0.08%
1991	6,162	2,023	8,185	24.7%	64.2%	0.10%
1992	6,286	1,927	8,213	23.5%	65.8%	0.06%
1993	6,742	1,776	8,518	20.9%	67.3%	0.04%
1994	7,255	1,735	8,991	19.3%	65.9%	0.04%
1995	7,114	1,506	8,620	17.5%	65.3%	0.03%
1996	7,206	1,272	8,479	15.0%	64.1%	0.09%
1997	6,862	1,355	8,217	16.5%	62.2%	0.09%
1998	6,705	1,380	8,085	17.1%	59.7%	0.14%
1999	6,919	1,719	8,638	19.9%	58.3%	0.16%
2000	6,762	2,016	8,778	23.0%	55.0%	0.26%
2001	6,254	2,098	8,352	25.1%	51.4%	0.18%
2002	5,817	2,226	8,042	27.7%	48.4%	0.39%
2003	5,473	2,083	7,556	27.6%	47.1%	0.52%
2004	5,333	2,149	7,483	28.7%	44.9%	0.40%
2005	5,473	2,187	7,660	28.5%	43.1%	0.63%
2006	5,417	2,345	7,762	30.2%	40.5%	0.82%
2007	5,197	2,365	7,562	31.3%	36.9%	0.10%
2008	4,491	2,278	6,769	33.7%	34.2%	0.11%
2009	3,558	1,843	5,402	34.1%	31.3%	2.93%
2010	3,791	1,844	5,636	32.7%	31.7%	2.69%
2011	4,143	1,947	6,090	32.0%	33.3%	1.47%
2012	5,119	2,125	7,244	29.3%	31.6%	2.69%
2013	5,433	2,153	7,585	28.4%	32.4%	2.45%
2014	5,589	2,098	7,688	27.3%	31.1%	2.42%
	Average annual percentage change					
1970–2014	-0.5%	1.1%	-0.2%			
2004–2014	0.5%	-0.2%	0.3%			

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*. 1998–2010: Ward's Communication, *Ward's Automotive Yearbook*, Detroit, MI, 2009, p. 249. 2011-2014: Ward's Communications, www.wardsauto.com.

Diesel data - Ward's Communications, *Ward's Automotive Yearbook*, Detroit, MI, 2009, p. 31, and Ward's Communications, www.wardsauto.com.

[a] Any vehicle built in North America regardless of manufacturer.

[b] Any vehicle built outside of North America regardless of manufacturer. Does not include import tourist deliveries.

[c] Sums may not add to totals due to rounding.

[d] Big 3 includes Chrysler, Ford and General Motors.

[e] 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 from 2001 to 2007 and again in 2011, 2013 and 2014.

Table 4.6
New Retail Sales of Trucks 10,000 Pounds GVW and Less in the United States, 1970–2014

		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	1,457	4.5%	Not available	[f]	14.8%	80.5%
1975	2,053	10.0%	Not available	[f]	20.9%	82.8%
1980	1,960	24.4%	Not available	4.0%	17.5%	78.6%
1985	3,688	22.6%	78.2%	4.0%	25.1%	77.7%
1986	4,594	21.3%	76.9%	3.7%	28.7%	93.4%
1987	4,610	20.0%	78.3%	2.3%	31.1%	92.2%
1988	4,800	14.8%	81.6%	2.3%	31.3%	91.5%
1989	4,610	13.9%	81.9%	2.9%	32.0%	91.0%
1990	4,548	13.5%	80.9%	2.3%	32.8%	93.8%
1991	4,122	13.1%	79.4%	3.2%	33.5%	94.4%
1992	4,629	8.8%	83.1%	2.5%	36.0%	94.4%
1993	5,351	7.1%	83.4%	2.3%	38.6%	94.2%
1994	6,033	6.8%	82.9%	2.5%	40.2%	94.0%
1995	6,053	6.6%	83.4%	3.8%	41.3%	93.2%
1996	6,519	6.7%	83.8%	3.1%	43.5%	93.4%
1997	6,797	8.5%	81.9%	2.7%	45.3%	93.4%
1998	7,299	9.0%	80.5%	2.6%	47.4%	92.6%
1999	8,073	9.6%	78.0%	2.9%	48.3%	92.0%
2000	8,386	10.2%	76.1%	3.4%	48.9%	92.8%
2001	8,598	11.4%	75.3%	2.9%	50.7%	94.3%
2002	8,633	12.4%	74.7%	2.7%	51.8%	94.9%
2003	8,938	13.7%	72.4%	2.9%	54.2%	95.0%
2004	9,254	13.5%	70.1%	2.8%	55.3%	94.3%
2005	9,114	13.3%	68.2%	2.7%	54.3%	93.1%
2006	8,574	15.7%	63.9%	2.8%	52.5%	92.3%
2007	8,305	16.7%	61.9%	3.2%	52.3%	93.3%
2008	6,246	17.6%	61.2%	3.4%	48.0%	92.9%
2009	4,834	18.3%	57.8%	4.2%	47.2%	93.0%
2010	5,758	15.6%	57.6%	4.9%	50.5%	93.8%
2011	6,449	15.2%	59.4%	5.4%	51.4%	92.8%
2012	6,975	15.2%	57.7%	5.5%	49.1%	92.5%
2013	7,693	16.1%	57.3%	5.3%	50.4%	92.7%
2014	8,484	16.0%	57.6%	5.4%	52.5%	92.7%
Average annual percentage change						
1970–2014	4.1%					
2004–2014	-0.9%					

Source:
Ward's Communications, *Ward's Automotive Yearbook*, Detroit, MI, 2014, and updates at www.wardsauto.com. (Additional resources: 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.
[d] Based on model year factory installations.
[e] Light-duty vehicles include cars and light trucks.
[f] Indicates less than 1 percent.

The production-weighted fuel economy of cars increased dramatically from 1975 (13.5 mpg) to 1985 (23.0 mpg), but rose only 0.5 mpg from 1985 to 2005. Since 2005, fuel economy rose 5.2 mpg—from 23.5 mpg in 2005 to 28.7 mpg in 2014. The fuel economy values have been adjusted to provide the best estimate of real world performance.

Table 4.7
Production, Production Shares, and Production-Weighted Fuel Economies of New Domestic and Import Cars, Model Years 1975-2014[a]

	Car			Car SUV		
Model year	Production (thousands)	Production share (%)[b]	Fuel economy (mpg)	Production (thousands)	Production share (%)[b]	Fuel economy (mpg)
1975	8,237	99.9%	13.5	10	0.1%	11.1
1980	9,443	100.0%	20.0	0	0.0%	14.6
1985	10,791	99.2%	23.0	88	0.8%	20.1
1986	11,015	99.5%	23.7	59	0.5%	18.9
1987	10,731	99.1%	23.8	95	0.9%	19.4
1988	10,736	99.0%	24.1	109	1.0%	19.2
1989	10,018	98.9%	23.7	108	1.1%	19.1
1990	8,810	99.3%	23.3	65	0.7%	18.8
1991	8,524	97.4%	23.4	224	2.6%	18.2
1992	8,108	97.1%	23.1	243	2.9%	17.8
1993	8,456	94.7%	23.5	473	5.3%	17.0
1994	8,415	96.2%	23.3	332	3.8%	18.0
1995	9,396	97.7%	23.4	220	2.3%	17.8
1996	7,890	96.5%	23.3	287	3.5%	18.4
1997	8,334	95.8%	23.4	361	4.2%	19.2
1998	7,971	94.6%	23.4	454	5.4%	18.2
1999	8,376	94.5%	23.0	488	5.5%	18.5
2000	9,125	93.7%	22.9	617	6.3%	17.9
2001	8,405	91.9%	23.0	743	8.1%	18.8
2002	8,301	93.2%	23.1	603	6.8%	19.3
2003	7,921	93.2%	23.3	575	6.8%	19.9
2004	7,537	92.2%	23.1	639	7.8%	20.0
2005	8,027	90.8%	23.5	813	9.2%	20.2
2006	7,993	91.4%	23.3	751	8.6%	20.5
2007	8,082	89.8%	24.1	919	10.2%	20.6
2008	7,319	88.8%	24.3	924	11.2%	21.2
2009	5,636	90.3%	25.3	608	9.7%	22.0
2010	6,055	86.9%	26.2	915	13.1%	23.0
2011	5,728	82.6%	26.0	1,207	17.4%	23.6
2012	7,379	85.3%	27.8	1,269	14.7%	23.4
2013	7,907	84.3%	28.3	1,470	15.7%	24.5
2014	[c]	83.7%	28.7	[c]	16.3%	24.3

Note: See Table 4.10 for all cars (car + car SUV).

Source:
U.S. Environmental Protection Agency, *Light-Duty Automotive Technology, Carbon Dioxide Emissions, and Fuel Economy Trends: 1975 Through 2014*, October 2014. (Additional resources: www.epa.gov/fueleconomy/fetrends/1975-2014/420r14023a.pdf)

[a] The fuel economy data on this table are adjusted to provide the best estimate of real world performance. See section 10 of the source document for details on adjustment methodology.
[b] Production share is based on total of cars plus car SUVs. Percentages may not sum to totals due to rounding.
[c] Data are not available.

A new vehicle classification was created to match the Corporate Average Fuel Economy (CAFE) methodology. Under CAFE, small, two-wheel drive sport utility vehicles will be held to the same standards as cars. The Environmental Protection Agency has defined these vehicles as "car SUVs." The vehicles below make up this category.

Table 4.8
Definition of Car Sport Utility Vehicles in Model Year 2014

BYD Motors E6	Hyundai Santa Fe Sport 2WD
Dodge Journey	Hyundai Tucson 2WD
Jeep Cherokee FWD	Kia Sorento 2WD
Jeep Compass FWD	Kia Sorento 4WD
Jeep Patriot FWD	Kia Sportage 2WD
Ford Edge FWD	Mazda CX-5 2WD
Ford Escape FWD	Mercedes-Benz GLK 350
Buick Encore	Mitsubishi Outlander 2WD
Cadillac SRX 2WD	Mitsubishi Outlander Sport 2WD
Cadillac SRX AWD	Nissan Murano FWD
Chevrolet Captiva AWD	Nissan Rogue FWD
Chevrolet Captiva FWD	Nissan Rogue Select
Chevrolet Equinox AWD	Nissan XTERRA 2WD
Chevrolet Equinox FWD	Lexus RX 350
GMC Terrain AWD	Lexus RX 450h
GMC Terrain FWD	Toyota FJ Cruiser 2WD
Acura MDX 2WD	Toyota RAV4
Acura RDX 2WD	Toyota RAV4 EV
Honda CR-V 2WD	Toyota Venza
Honda Crosstour 2WD	VW Tiguan
Honda Crosstour 4WD	Volvo XC60 FWD
Hyundai Santa Fe 2WD	Volvo XC70 FWD

Note: 2WD = Two-wheel drive. 4WD = Four-wheel drive. FWD = Front-wheel drive.

Source:
U.S. Environmental Protection Agency, *Light-Duty Automotive Technology, Carbon Dioxide Emissions, and Fuel Economy Trends: 1975 Through 2014*, October 2014. (Additional resources: www.epa.gov/fueleconomy/fetrends/1975-2014/420r14023a.pdf)

Production of sport utility vehicles (SUVs) has grown substantially since 1975. The production-weighted fuel economy of SUVs was more than 21 mpg in 2014. Over 60% of all light trucks produced in 2014 were SUVs.

Table 4.9
Production, Production Shares, and Production-Weighted Fuel Economies of New Domestic and Import Light Trucks, Model Years 1975-2014[a]

	Pickup			Van			Truck SUV		
Model Year	Production (Thousands)	Share (%)[b]	Fuel Economy (mpg)	Production (Thousands)	Share (%)[b]	Fuel Economy (mpg)	Production (Thousands)	Share (%)[b]	Fuel Economy (mpg)
1975	1,343	67.9%	11.9	457	23.1%	11.1	177	9.0%	11.0
1980	1,437	77.1%	16.5	242	13.0%	14.1	184	9.9%	13.2
1981	1,440	79.1%	17.9	245	13.5%	14.8	136	7.5%	14.3
1982	1,441	75.8%	18.5	311	16.4%	14.7	150	7.9%	14.7
1983	1,628	71.8%	18.9	383	16.9%	15.1	256	11.3%	15.8
1984	2,043	62.1%	18.3	676	20.6%	16.1	570	17.3%	16.2
1985	2,078	58.0%	18.2	855	23.9%	16.5	648	18.1%	16.5
1986	2,532	59.0%	18.9	1,044	24.3%	17.5	714	16.6%	17.0
1987	2,147	53.2%	19.0	1,114	27.6%	17.7	779	19.3%	17.3
1988	2,459	55.3%	18.1	1,133	25.5%	17.9	859	19.3%	17.0
1989	2,232	51.6%	17.8	1,278	29.5%	17.8	818	18.9%	16.6
1990	1,835	49.1%	17.4	1,262	33.7%	17.8	643	17.2%	16.4
1991	1,920	50.2%	18.2	1,034	27.0%	17.9	871	22.8%	16.7
1992	1,840	48.1%	17.5	1,221	31.9%	17.9	761	19.9%	16.2
1993	2,002	46.8%	17.6	1,441	33.7%	18.2	838	19.6%	16.3
1994	2,669	49.6%	17.4	1,418	26.4%	17.8	1,291	24.0%	16.0
1995	2,271	41.1%	16.9	1,662	30.1%	18.1	1,596	28.9%	16.0
1996	1,955	39.4%	17.1	1,409	28.4%	18.3	1,603	32.3%	16.2
1997	2,408	41.8%	16.8	1,265	22.0%	18.2	2,089	36.3%	16.1
1998	2,415	40.0%	17.0	1,489	24.7%	18.7	2,127	35.3%	16.2
1999	2,544	40.1%	16.3	1,463	23.0%	18.3	2,342	36.9%	16.1
2000	2,612	38.2%	16.7	1,691	24.8%	18.6	2,526	37.0%	16.0
2001	2,519	39.0%	16.0	1,232	19.1%	18.0	2,707	41.9%	16.4
2002	2,380	33.0%	15.8	1,243	17.2%	18.7	3,588	49.8%	16.3
2003	2,474	34.0%	16.1	1,232	16.9%	19.0	3,571	49.1%	16.4
2004	2,505	33.3%	15.7	953	12.7%	19.2	4,075	54.1%	16.5
2005	2,300	32.6%	15.8	1,481	21.0%	19.3	3,272	46.4%	16.7
2006	2,188	34.4%	16.1	1,166	18.3%	19.5	3,006	47.3%	17.2
2007	2,113	33.7%	16.2	847	13.5%	19.5	3,314	52.8%	17.7
2008	1,794	31.7%	16.5	790	14.0%	19.8	3,072	54.3%	18.2
2009	989	32.2%	16.9	368	12.0%	20.1	1,713	55.8%	19.3
2010	1,276	30.8%	16.9	559	13.5%	20.1	2,305	55.7%	19.7
2011	1,479	29.2%	17.2	521	10.3%	21.0	3,069	60.6%	19.8
2012	1,357	28.3%	17.2	661	13.8%	21.4	2,773	57.9%	20.0
2013	1,577	28.8%	17.4	571	10.4%	21.1	3,321	60.7%	20.9
2014	[c]	29.7%	18.0	[c]	10.1%	21.2	[c]	60.2%	21.2

Note: Includes light trucks of 8,500 lbs. or less. See Table 4.10 for all light trucks (pickup + van + truck SUV).

Source:
U.S. Environmental Protection Agency, *Light-Duty Automotive Technology, Carbon Dioxide Emissions, and Fuel Economy Trends: 1975 Through 2014*, October 2014. (Additional resources: www.epa.gov/fueleconomy/fetrends/1975-2014/420r14023a.pdf)

[a] The fuel economy data on this table are adjusted to provide the best estimate of real world performance. See section 10 of the source document for details on adjustment methodology.

[b] Production share is based on the total of pickups, plus vans and truck SUVs. Percentages may not sum to totals due to rounding.

[c] Data are not available.

The average fuel economy of cars more than doubled from 1975 to 2014 while the average fuel economy of light trucks grew by 73% in that same time period. This was not steady annual growth, but growth in the 1970's and early 1980's followed by a long period with little improvement. Growth resumed around 2008-2009.

Table 4.10
Production and Production-Weighted Fuel Economies of New Domestic and Import Cars, Light Trucks and Light Vehicles, Model Years 1975-2014[a]

	All Cars		All Light Trucks		All Light Vehicles	
Model Year	Production (Thousands)	Fuel Economy (mpg)	Production (Thousands)	Fuel Economy (mpg)	Production (Thousands)	Fuel Economy (mpg)
1975	8,247	13.5	1,977	11.6	10,224	13.1
1980	9,444	20.0	1,863	15.8	11,307	19.2
1981	8,734	21.4	1,821	17.1	10,555	20.5
1982	7,832	22.2	1,901	17.4	9,733	21.1
1983	8,035	22.1	2,267	17.7	10,302	21.0
1984	10,730	22.4	3,289	17.4	14,019	21.0
1985	10,879	23.0	3,581	17.5	14,460	21.3
1986	11,074	23.7	4,291	18.2	15,365	21.8
1987	10,826	23.8	4,039	18.3	14,865	22.0
1988	10,845	24.1	4,450	17.8	15,295	21.9
1989	10,126	23.6	4,327	17.6	14,453	21.4
1990	8,875	23.3	3,740	17.4	12,615	21.2
1991	8,748	23.3	3,825	17.8	12,573	21.3
1992	8,350	22.9	3,822	17.3	12,172	20.8
1993	8,929	23.0	4,281	17.5	13,210	20.9
1994	8,747	23.0	5,378	17.2	14,125	20.4
1995	9,616	23.3	5,529	17.0	15,145	20.5
1996	8,177	23.1	4,967	17.2	13,144	20.4
1997	8,695	23.2	5,762	16.8	14,457	20.2
1998	8,425	23.0	6,030	17.1	14,455	20.1
1999	8,865	22.7	6,350	16.6	15,215	19.7
2000	9,742	22.5	6,829	16.8	16,571	19.8
2001	9,148	22.6	6,458	16.5	15,606	19.6
2002	8,904	22.8	7,211	16.5	16,115	19.5
2003	8,496	23.0	7,277	16.7	15,773	19.6
2004	8,176	22.9	7,533	16.5	15,709	19.3
2005	8,839	23.1	7,053	16.9	15,892	19.9
2006	8,744	23.0	6,360	17.2	15,104	20.1
2007	9,001	23.7	6,275	17.4	15,276	20.6
2008	8,243	23.9	5,656	17.8	13,899	21.0
2009	6,244	25.0	3,071	18.5	9,315	22.4
2010	6,969	25.7	4,141	18.8	11,110	22.6
2011	6,934	25.6	5,069	19.1	12,003	22.4
2012	8,648	27.0	4,791	19.3	13,438	23.6
2013	9,377	27.6	5,469	19.8	14,846	24.1
2014	[b]	27.9	[b]	20.1	[b]	24.2

Source:
U.S. Environmental Protection Agency, *Light-Duty Automotive Technology, Carbon Dioxide Emissions, and Fuel Economy Trends: 1975 Through 2014*, October 2014. (Additional resources: www.epa.gov/fueleconomy/fetrends/1975-2014/420r14023a.pdf)

[a] The fuel economy data on this table are adjusted to provide the best estimate of real world performance. See section 10 of the source document for details on adjustment methodology.
[b] Data are not available, but 61.3% of all light vehicles were cars and 38.7% were light trucks in 2014.

Back in 1975 only 19.3% of new light vehicles produced were light trucks. Because of the boom in production of minivans, sport utility vehicles, and pick-up trucks, that number rose to over 40% from 1998 to 2008. Cars began to make a comeback to account for more than 60% from 2012-2014.

Table 4.11
Light Vehicle Production Shares[a], Model Years 1975–2014

Model Year	Car	Car SUV	Pickup	Van	Truck SUV	Total Light Vehicles Produced (thousands)	Production Share: Cars	Production Share: Light Trucks
1975	80.6%	0.1%	13.1%	4.5%	1.7%	10,224	80.7%	19.3%
1980	83.5%	0.0%	12.7%	2.1%	1.6%	11,306	83.5%	16.5%
1981	82.7%	0.0%	13.6%	2.3%	1.3%	10,554	82.8%	17.3%
1982	80.3%	0.1%	14.8%	3.2%	1.5%	9,732	80.5%	19.5%
1983	77.7%	0.3%	15.8%	3.7%	2.5%	10,302	78.0%	22.0%
1984	76.1%	0.4%	14.6%	4.8%	4.1%	14,020	76.5%	23.5%
1985	74.6%	0.6%	14.4%	5.9%	4.5%	14,460	75.2%	24.8%
1986	71.7%	0.4%	16.5%	6.8%	4.6%	15,365	72.1%	27.9%
1987	72.2%	0.6%	14.4%	7.5%	5.2%	14,865	72.8%	27.2%
1988	70.2%	0.7%	16.1%	7.4%	5.6%	15,295	70.9%	29.1%
1989	69.3%	0.7%	15.4%	8.8%	5.7%	14,453	70.1%	29.9%
1990	69.8%	0.5%	14.5%	10.0%	5.1%	12,615	70.4%	29.6%
1991	67.8%	1.8%	15.3%	8.2%	6.9%	12,573	69.6%	30.4%
1992	66.6%	2.0%	15.1%	10.0%	6.2%	12,172	68.6%	31.4%
1993	64.0%	3.6%	15.2%	10.9%	6.3%	13,211	67.6%	32.4%
1994	59.6%	2.3%	18.9%	10.0%	9.1%	14,125	61.9%	38.1%
1995	62.0%	1.5%	15.0%	11.0%	10.5%	15,145	63.5%	36.5%
1996	60.0%	2.2%	14.9%	10.7%	12.2%	13,144	62.2%	37.8%
1997	57.6%	2.5%	16.7%	8.8%	14.5%	14,458	60.1%	39.9%
1998	55.1%	3.1%	16.7%	10.3%	14.7%	14,456	58.3%	41.7%
1999	55.1%	3.2%	16.7%	9.6%	15.4%	15,215	58.3%	41.7%
2000	55.1%	3.7%	15.8%	10.2%	15.2%	16,571	58.8%	41.2%
2001	53.9%	4.8%	16.1%	7.9%	17.3%	15,605	58.6%	41.4%
2002	51.5%	3.7%	14.8%	7.7%	22.3%	16,115	55.3%	44.7%
2003	50.2%	3.6%	15.7%	7.8%	22.6%	15,773	53.9%	46.1%
2004	48.0%	4.1%	15.9%	6.1%	25.9%	15,709	52.0%	48.0%
2005	50.5%	5.1%	14.5%	9.3%	20.6%	15,892	55.6%	44.4%
2006	52.9%	5.0%	14.5%	7.7%	19.9%	15,104	57.9%	42.1%
2007	52.9%	6.0%	13.8%	5.5%	21.7%	15,276	58.9%	41.1%
2008	52.7%	6.6%	12.9%	5.7%	22.1%	13,898	59.3%	40.7%
2009	60.5%	6.5%	10.6%	4.0%	18.4%	9,316	67.0%	33.0%
2010	54.5%	8.2%	11.5%	5.0%	20.8%	11,110	62.7%	37.3%
2011	47.7%	10.1%	12.3%	4.3%	25.6%	12,003	57.8%	42.2%
2012	54.9%	9.4%	10.1%	4.9%	20.6%	13,438	64.4%	35.6%
2013	53.3%	9.9%	10.6%	3.8%	22.4%	14,846	63.2%	36.8%
2014	51.3%	10.0%	11.5%	3.9%	23.3%	[b]	61.3%	38.7%

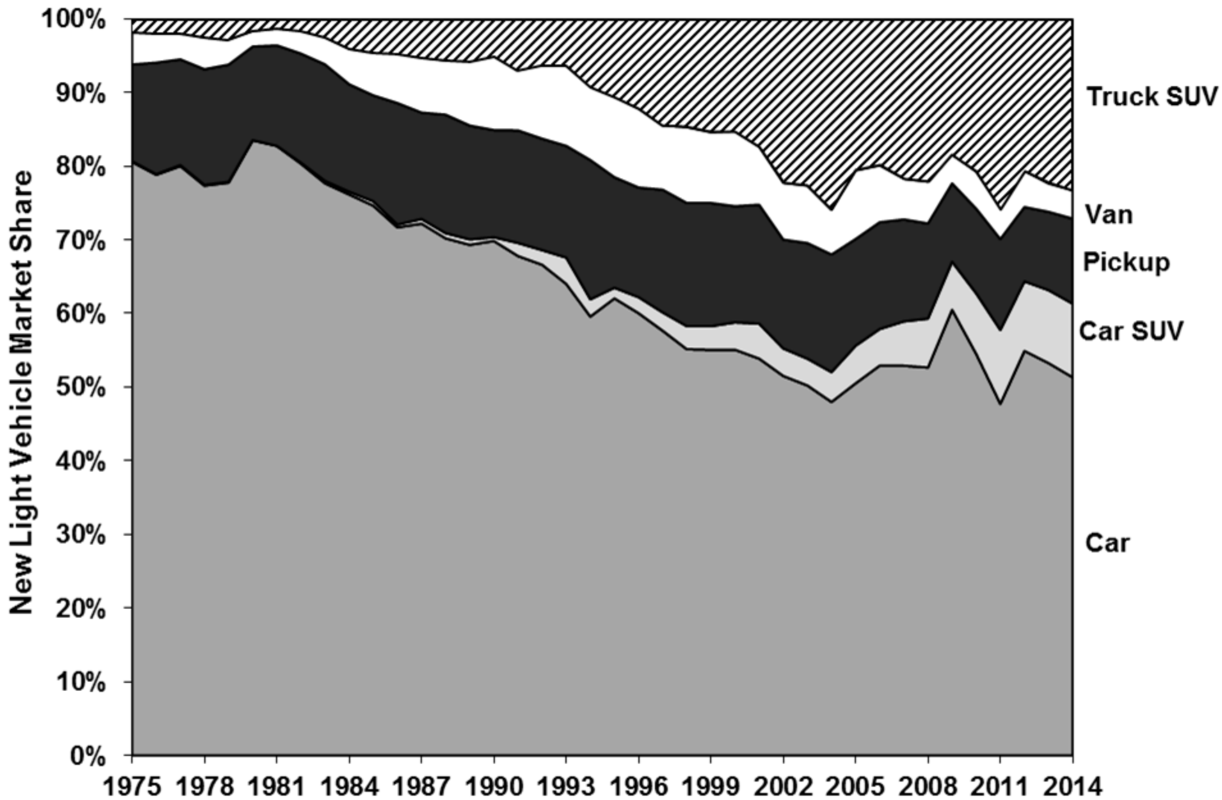
Note: Includes light trucks of 8,500 lbs. or less.

Source:
U.S. Environmental Protection Agency, *Light-Duty Automotive Technology, Carbon Dioxide Emissions, and Fuel Economy Trends: 1975 Through 2014*, October 2014. (Additional resources: www.epa.gov/fueleconomy/fetrends/1975-2014/420r14023a.pdf)

[a] Percentages may not sum to totals due to rounding.
[b] Data are not available.

The effects of the Japanese earthquake/tsunami in 2011 are apparent in the large decline in car production for that year. Light trucks were gaining market share from the early 1980s until 2004, mainly due to increases in the market share of sport utility vehicles (SUVs) and pickup trucks. A new category of SUVs has been added to the vehicle classification—car SUVs. The car SUVs are two-wheel drive SUVs that will be counted as cars in the Corporate Average Fuel Economy Standards for model years 2011-on. A listing of the makes/models of car SUVs is in Table 4.8.

Figure 4.1. Light Vehicle Production Shares, Model Years 1975–2014



Source:
See Table 4.11.

The production-weighted average engine displacement of cars in 1975 was 4.73 liters, but had declined to 2.44 liters by 2014. Car SUVs also experienced a decline in engine displacement. For a list of car SUVs, see Table 4.8.

Table 4.12
Production-Weighted Engine Size of New Domestic and Import Cars
Model Years 1975-2014
(liters[a])

Model Year	Car	Car SUV
1975	4.73	4.29
1976	4.70	4.32
1977	4.57	4.28
1978	4.12	4.30
1979	3.91	3.03
1980	3.08	4.59
1981	2.98	5.21
1982	2.87	2.60
1983	2.98	2.67
1984	2.93	2.94
1985	2.90	2.80
1986	2.74	2.78
1987	2.65	2.93
1988	2.63	3.26
1989	2.67	3.70
1990	2.67	3.42
1991	2.66	3.52
1992	2.78	3.44
1993	2.73	3.91
1994	2.75	3.42
1995	2.74	3.51
1996	2.71	3.52
1997	2.68	3.11
1998	2.68	3.58
1999	2.72	3.45
2000	2.71	3.47
2001	2.70	3.17
2002	2.71	3.00
2003	2.71	2.97
2004	2.76	3.13
2005	2.72	3.05
2006	2.82	3.01
2007	2.71	3.04
2008	2.70	2.93
2009	2.54	2.87
2010	2.56	2.81
2011	2.61	2.72
2012	2.42	2.74
2013	2.39	2.65
2014	2.44	2.57
Annual average percentage change		
1975–2014	-1.7%	-1.3%
2004–2014	-1.2%	-2.0%

Source:
U.S. Environmental Protection Agency, *Light-Duty Automotive Technology, Carbon Dioxide Emissions, and Fuel Economy Trends: 1975 Through 2014*, October 2014. (Additional resources: www.epa.gov/fueleconomy/fetrends/1975-2014/420r4023a.pdf)

[a] 1 liter = 61.02 cubic inches.

The engine size of truck sport utility vehicles (SUVs) declined an average of 2.0% per year from 2004 to 2014.

Table 4.13
Production-Weighted Engine Size of New Domestic and Import Light Trucks, Model Years 1975-2014
(liters[a])

Model Year	Pickup	Van	Truck SUV
1975	5.02	5.20	5.44
1976	5.18	5.30	5.55
1977	5.12	5.44	5.52
1978	5.02	5.40	5.61
1979	4.70	5.28	5.52
1980	3.86	4.72	4.83
1981	3.88	4.66	4.75
1982	3.74	4.70	5.00
1983	3.47	4.82	4.35
1984	3.53	4.08	3.79
1985	3.63	3.87	3.63
1986	3.38	3.73	3.44
1987	3.31	3.70	3.48
1988	3.76	3.75	3.63
1989	3.86	3.69	3.99
1990	4.04	3.69	3.85
1991	3.80	3.60	3.82
1992	4.01	3.64	3.85
1993	4.00	3.57	4.00
1994	4.06	3.70	4.01
1995	4.20	3.79	4.01
1996	4.12	3.61	4.24
1997	4.33	3.61	4.19
1998	4.13	3.56	4.14
1999	4.38	3.65	4.14
2000	4.18	3.55	4.15
2001	4.41	3.75	3.92
2002	4.45	3.57	4.01
2003	4.33	3.59	4.05
2004	4.61	3.58	4.13
2005	4.65	3.53	4.00
2006	4.55	3.54	3.87
2007	4.69	3.59	3.94
2008	4.69	3.60	3.76
2009	4.70	3.53	3.46
2010	4.80	3.51	3.48
2011	4.63	3.47	3.56
2012	4.69	3.44	3.51
2013	4.62	3.43	3.35
2014	4.81	3.53	3.37
	Annual average percentage change		
1975–2014	-0.1%	-1.0%	-1.2%
2004–2014	0.4%	-0.1%	-2.0%

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

Source:
U.S. Environmental Protection Agency, *Light-Duty Automotive Technology, Carbon Dioxide Emissions, and Fuel Economy Trends: 1975 Through 2014*, October 2014. (Additional resources: www.epa.gov/fueleconomy/fetrends/1975-2014/420r14023a.pdf)

[a] 1 liter = 61.02 cubic inches.

The production-weighted average curb weight of cars declined about 500 lbs. from 1975 to 2014, while car SUVs declined by 115 lbs.

Table 4.14
Production-Weighted Curb Weight of New Domestic and Import Cars, Model Years 1975–2014
(pounds)

Model Year	Car	Car SUV
1975	4,058	4,000
1976	4,059	3,986
1977	3,944	4,000
1978	3,588	4,000
1979	3,485	3,271
1980	3,101	4,000
1981	3,076	4,000
1982	3,054	2,630
1983	3,112	3,124
1984	3,099	3,487
1985	3,093	3,469
1986	3,041	3,479
1987	3,031	3,492
1988	3,047	3,495
1989	3,099	3,497
1990	3,176	3,518
1991	3,154	3,733
1992	3,240	3,713
1993	3,207	3,848
1994	3,250	3,735
1995	3,263	3,763
1996	3,282	3,710
1997	3,274	3,549
1998	3,306	3,824
1999	3,365	3,831
2000	3,369	3,870
2001	3,380	3,765
2002	3,391	3,747
2003	3,417	3,716
2004	3,462	3,854
2005	3,463	3,848
2006	3,534	3,876
2007	3,507	3,935
2008	3,527	3,902
2009	3,464	3,846
2010	3,474	3,949
2011	3,559	3,890
2012	3,448	3,913
2013	3,467	3,966
2014	3,510	3,885
Annual average percentage change		
1975–2014	-0.4%	-0.1%
2004–2014	0.1%	0.1%

Source:
U.S. Environmental Protection Agency, *Light-Duty Automotive Technology, Carbon Dioxide Emissions, and Fuel Economy Trends: 1975 Through 2014*, October 2014. (Additional resources: www.epa.gov/fueleconomy/fetrends/1975-2014/420r14023a.pdf)

The average light vehicle in 2013 contained more than 2,000 pounds of steel, most of it conventional steel. High and medium strength steel, however, made up more than 16% of the vehicle. The use of aluminum grew from 1995 to 2013, while the use of iron castings declined.

Table 4.15
Average Material Consumption for a Domestic Light Vehicle[a], Model Years 1995, 2000, and 2013

	1995		2000		2013	
Material	Pounds	Percentage	Pounds	Percentage	Pounds	Percentage
Regular steel	1,630.0	44.1%	1,655.0	42.4%	1,361.0	34.1%
High and medium strength steel	324.0	8.8%	408.0	10.5%	649.0	16.3%
Stainless steel	51.0	1.4%	62.0	1.6%	74.0	1.9%
Other steels	46.0	1.2%	26.0	0.7%	32.0	0.8%
Iron castings	466.0	12.6%	432.0	11.1%	283.0	7.1%
Aluminum	231.0	6.3%	268.0	6.9%	379.0	9.5%
Magnesium castings	4.0	0.1%	8.0	0.2%	11.0	0.3%
Copper and brass	50.0	1.4%	52.0	1.3%	73.0	1.8%
Lead	33.0	0.9%	36.0	0.9%	36.0	0.9%
Zinc castings	19.0	0.5%	13.0	0.3%	8.0	0.2%
Powder metal parts	29.0	0.8%	36.0	0.9%	45.0	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%	336.0	8.4%
Rubber	149.0	4.0%	166.0	4.3%	203.0	5.1%
Coatings	23.0	0.6%	25.0	0.6%	32.0	0.8%
Textiles	42.0	1.1%	44.0	1.1%	50.0	1.3%
Fluids and lubricants	192.0	5.2%	207.0	5.3%	222.0	5.6%
Glass	97.0	2.6%	103.0	2.6%	96.0	2.4%
Other materials	64.0	1.7%	71.0	1.8%	93.0	2.3%
Total	3,694.0	100.0%	3,902.0	100.0%	3,988.0	100.0%

Source:
Ward's Communications, *Ward's Motor Vehicle Facts and Figures, 2014*, Detroit, MI, 2014, p. 52 and updates.

[a] Percentages may not sum to totals due to rounding.

The number of franchised dealerships which sell new light-duty vehicles (cars and light trucks) has declined 43% since 1970. This decline, along with increasing light vehicle sales, caused the average number of vehicles sold per dealer to be at an all-time high of 866 vehicles per dealer.

Table 4.16
New Light Vehicle Dealerships and Sales, 1970–2013

Calendar year	Number of franchised new light vehicle dealerships[a]	New light vehicle sales (thousands)	Light vehicle sales per dealer
1970	30,800	9,856	320
1975	29,600	10,677	361
1976	29,300	12,829	438
1977	29,100	14,292	491
1978	29,000	14,788	510
1979	28,500	13,518	474
1980	27,900	10,909	391
1981	26,350	10,235	388
1982	25,700	10,019	390
1983	24,725	11,669	472
1984	24,725	13,579	549
1985	24,725	14,667	593
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	12,307	509
1992	23,500	12,842	546
1993	22,950	13,869	604
1994	22,850	15,024	657
1995	22,800	14,673	644
1996	22,750	14,998	659
1997	22,700	15,014	661
1998	22,600	15,384	681
1999	22,400	16,711	746
2000	22,250	17,164	771
2001	22,150	16,950	765
2002	21,800	16,675	765
2003	21,725	16,494	759
2004	21,650	16,737	773
2005	21,640	16,774	775
2006	21,495	16,336	760
2007	21,200	15,867	748
2008	20,770	13,015	627
2009	20,010	10,236	512
2010	18,460	11,394	617
2011	17,700	12,539	708
2012	17,540	14,218	811
2013	17,635	15,278	866
	Average annual percentage change		
1970–2013	-1.3%	1.0%	2.3%
2003–2013	-2.1%	-0.8%	1.3%

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

[a] As of the beginning of the year.

In 2010 the number of conventional refueling stations fell below 160,000 for the first time in the series history and continued to decline through 2013. The number of vehicles fueling at those stations fell in 2009 for the first time in several years but began rising slowly in 2011. In 2013, there were 0.61 fueling stations per thousand vehicles or 1.65 thousand vehicles per station.

Table 4.17
Conventional Refueling Stations, 1993-2013

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	213,299	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
2008	161,068	249,813	0.64	1.55
2009	162,350	248,972	0.65	1.53
2010	159,006	248,231	0.64	1.56
2011	157,393	248,932	0.63	1.58
2012	156,065	251,497	0.62	1.61
2013	152,995	252,715	0.61	1.65

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.

Sources:
Conventional refueling stations: National Petroleum News Survey, 2013.
Conventional vehicles: IHS Automotive, Detroit, MI, **FURTHER REPRODUCTION PROHIBITED**.

The National Highway Traffic Safety Administration and the Environmental Protection Agency issued joint rulemaking to establish a new National Program to regulate fuel economy and greenhouse gas emissions for model year 2012-2025 cars and light trucks.

Table 4.18
Fuel Economy and Carbon Dioxide Emissions Standards, MY 2012-2025

Year	Cars	Light trucks	Combined cars and light trucks
		Average required fuel economy (miles per gallon)	
2012	33.3	25.4	29.7
2013	34.2	26.0	30.5
2014	34.9	26.6	31.3
2015	36.2	27.5	32.6
2016	37.8	28.8	34.1
2017	40.1	29.4	35.4
2018	41.6	30.0	36.5
2019	43.1	30.6	37.7
2020	44.8	31.2	38.9
2021	46.8	33.3	41.0
2022	49.0	34.9	43.0
2023	51.2	36.6	45.1
2024	53.6	38.5	47.4
2025	56.2	40.3	49.7
		Average projected emissions compliance levels under the footprint-based carbon dioxide standards (grams per mile)	
2012	263	346	295
2013	256	337	286
2014	247	326	276
2015	236	312	263
2016	225	298	250
2017	212	295	243
2018	202	285	232
2019	191	277	222
2020	182	269	213
2021	172	249	199
2022	164	237	190
2023	157	225	180
2024	150	214	171
2025	143	203	163

Note: The required fuel economy, along with projections of CO_2 emissions, shown here use a model year 2008 baseline. The presented rates of increase in stringency for NHTSA CAFE standards are lower than the Environmental Protection Agency (EPA) rates of increase in stringency for greenhouse gas (GHG) standards. One major difference is that NHTSA's standards, unlike EPA's, do not reflect the inclusion of air conditioning system refrigerant and leakage improvements, but EPA's standards would allow consideration of such improvements which reduce GHGs but generally do not affect fuel economy. The 2025 EPA GHG standard of 163 grams/mile would be equivalent to 54.5 mpg, if the vehicles were to meet this level all through fuel economy improvements. The agencies expect, however, that a portion of these improvements will be made through reductions in air conditioning leakage, which would not contribute to fuel economy.

Source:
Federal Register, Vol. 77, No. 199, October 15, 2012. (Additional resources: www.nhtsa.dot.gov/fuel-economy)

The target levels for the fuel economy and carbon dioxide emission standards for vehicles manufactured in model years 2012-on are assigned based on a vehicle's "footprint." 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.

Table 4.19
Fuel Economy and Carbon Dioxide Targets for Model Year 2025

Vehicle type	Example models	Example model footprint (square feet)	CO_2 emissions target (grams per mile)	Fuel economy target (miles per gallon)
Example Passenger Cars				
Compact car	Honda Fit	40	131	61.1
Midsize car	Ford Fusion	46	147	54.9
Fullsize car	Chrysler 300	53	170	48.0
Example Light-Duty Trucks				
Small SUV	4WD Ford Escape	44	170	47.5
Midsize crossover	Nissan Murano	49	188	43.4
Minivan	Toyota Sienna	55	209	39.2
Large pickup truck	Chevy Silverado	67	252	33.0

Note: Examples use model year 2012 vehicle specifications. The fuel economy from this table will not match the fuel economy listed on the window sticker of a new vehicle. Window sticker fuel economy is calculated by a different methodology than the Corporate Average Fuel Economy.

Source:
Federal Register, Vol. 77, No. 199, October 15, 2012. (Additional resources: www.nhtsa.gov/fuel-economy)

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 changed the CAFE standards beginning in the 2011 model year (MY). Some two-wheel drive sport utility vehicles are classified as cars under the final standards for MY 2011-2021.

Table 4.20
Car Corporate Average Fuel Economy (CAFE) Standards versus Sales-Weighted Fuel Economy Estimates, 1978–2014[a]
(miles per gallon)

	Cars				CAFE estimates
Model	CAFE	CAFE estimates[c]			Cars and light
year[b]	standards	Domestic	Import	Combined	trucks combined
1978	18.0	18.7	27.3	19.9	19.9
1980	20.0	22.6	29.6	24.3	23.1
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[d]	31.2	31.8	31.5	27.1
2009	27.5[d]	32.1	33.8	32.9	29.0
2010	27.5[d]	33.1	35.2	33.9	29.3
2011	30.2[e]	32.7	33.7	33.1	29.0
2012	33.0[e]	34.8	36.5	35.4	30.8
2013	33.5[e]	36.0	36.6	36.2	31.1
2014	34.2	36.7	36.0	36.4	31.5

Source:
U.S. Department of Transportation, NHTSA, "Summary of Fuel Economy Performance," Washington, DC, December 2014. (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.
[d] Unreformed standards, which were an option from 2008-2010. See Table 4.18 for reformed standards.
[e] Projected required average fuel economy standards value based on pre-model year reports.

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 changed the CAFE standards beginning in the 2011 model year (MY). Some two-wheel drive sport utility vehicles are classified as cars under the final standards for MY 2011-2021.

Table 4.21
Light Truck Corporate Average Fuel Economy (CAFE) Standards versus Sales-Weighted Fuel Economy Estimates, 1978–2014[a]
(miles per gallon)

	Light trucks[b]				CAFE estimates
Model	CAFE	CAFE estimates[d]			Cars and light
year[c]	standards	Domestic	Import	Combined	trucks combined
1978	[e]	[f]	[f]	[f]	19.9
1980	[e]	16.8	24.3	18.5	23.1
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	22.4[g]	[f]	[f]	23.6	27.1
2009	23.0[g]	[f]	[f]	24.8	29.0
2010	23.4[g]	[f]	[f]	25.2	29.3
2011	24.3[h]	[f]	[f]	24.7	29.0
2012	25.3[h]	[f]	[f]	25.0	30.8
2013	25.8[h]	[f]	[f]	25.6	31.1
2014	26.2	[f]	[f]	26.3	31.5

Source:
U.S. Department of Transportation, NHTSA, "Summary of Fuel Economy Performance," Washington, DC, December 2014. (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, which were an option from 2008-2010. See Table 4.18 for reformed standards.

[h] Projected required average fuel economy standards value based on pre-model year reports.

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 in the year in which the money was collected, which may not be the same year in which it was assessed. A manufacturer can also use CAFE credits to offset fines. Fines for recent model years are still being collected.

Table 4.22
Corporate Average Fuel Economy (CAFE) Fines Collected, 1983-2012[a]

Model year	Current dollars	2012 constant dollars[b]
1983	$57,970	$133,630
1984	$5,958,020	$13,165,791
1985	$15,564,540	$33,211,199
1986	$29,871,815	$62,576,546
1987	$31,260,530	$63,179,843
1988	$43,470,545	$84,366,664
1989	$48,549,420	$89,892,383
1990	$48,308,615	$84,861,271
1991	$42,243,030	$71,209,591
1992	$38,286,565	$62,654,067
1993	$28,688,380	$45,582,560
1994	$31,498,570	$48,798,129
1995	$40,787,498	$61,447,276
1996	$19,301,930	$28,244,789
1997	$36,211,850	$51,800,769
1998	$21,739,774	$30,621,605
1999	$27,516,451	$37,920,840
2000	$51,067,038	$68,087,605
2001	$35,507,412	$46,032,121
2002	$20,041,533	$25,577,630
2003	$15,225,419	$18,998,179
2004	$30,411,986	$36,963,523
2005	$25,057,126	$29,457,069
2006	$40,933,954	$46,618,007
2007	$37,385,941	$41,398,210
2008	$11,619,696	$12,390,968
2009	$9,148,425	$9,790,495
2010	$23,803,412	$25,062,922
2011	$40,013,270	$40,841,325
2012	$14,962,382	$14,962,382

Source:
U.S. Department of Transportation, National Highway Traffic Safety Administration, Office of Vehicle Safety Compliance, Washington, DC, April 2014 and updates, 2015. (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. 10-05), "Gas Guzzler Tax." (Additional resources: www.irs.ustreas.gov)

Consumers who purchased these 2014 model year vehicles paid the Gas Guzzler tax.

Table 4.24
List of Model Year 2014 Cars with Gas Guzzler Taxes[a]

Make	Model(s)	Size class	Unadjusted combined city/highway fuel economy	Adjusted combined city/highway fuel economy
Aston Martin	DB9	Minicompact Cars	19	15
Aston Martin	Rapide S	Subcompact Cars	19	15
Aston Martin	V8 Vantage	Two Seaters	19	15
Aston Martin	V8 Vantage	Two Seaters	21	16
Aston Martin	V8 Vantage S	Two Seaters	19	15
Aston Martin	V8 Vantage S	Two Seaters	21	16
Aston Martin	Vanquish	Minicompact Cars	19	15
Audi	A8L	Large Cars	19	16
Audi	R8	Two Seaters	17	14
Audi	R8	Two Seaters	19	16
Audi	R8	Two Seaters	21	17
Audi	R8 Spyder	Two Seaters	17	14
Audi	R8 Spyder	Two Seaters	19	16
Audi	R8 Spyder	Two Seaters	21	17
Bentley	Continental GT	Compact Cars	19	15
Bentley	Continental GT Speed Convertible	Subcompact Cars	18	15
Bentley	Continental GTC	Subcompact Cars	18	15
Bentley	Continental GTC	Subcompact Cars	22	17
Bentley	Flying Spur	Midsize Cars	18	15
Bentley	Mulsanne	Midsize Cars	16	13
BMW	760Li	Large Cars	19	15
BMW	M5	Midsize Cars	21	16
BMW	M5	Midsize Cars	22	17
BMW	M6 Convertible	Subcompact Cars	21	16
BMW	M6 Convertible	Subcompact Cars	22	17
BMW	M6 Coupe	Subcompact Cars	21	16
BMW	M6 Coupe	Subcompact Cars	22	17
BMW	M6 Gran Coupe	Compact Cars	21	16
BMW	M6 Gran Coupe	Compact Cars	22	17
Bugatti	Veyron	Two Seaters	12	10
FCA	300 SRT8	Large Cars	22	17
FCA	Challenger SRT8	Midsize Cars	22	17
FCA	Charger SRT8	Large Cars	22	17
FCA	Viper	Two Seaters	18	15
Ferrari	458 Italia	Two Seaters	18	14
Ferrari	458 Italia	Two Seaters	19	15
Ferrari	458 Speciale	Two Seaters	18	14
Ferrari	458 Speciale	Two Seaters	19	15
Ferrari	458 Spider	Two Seaters	18	14
Ferrari	458 Spider	Two Seaters	19	15
Ferrari	F12	Two Seaters	17	13
Ferrari	Ferrari California	Minicompact Cars	20	15
Ferrari	Ferrari California	Minicompact Cars	20	16
Ferrari	FF	Midsize Cars	16	13
Ferrari	FF	Midsize Cars	17	13
Ferrari	LaFerrari	Two Seaters	18	14

Table 4.24 (Continued)
List of Model Year 2014 Cars with Gas Guzzler Taxes[a]

Make	Model(s)	Size class	Unadjusted combined city/highway fuel economy	Adjusted combined city/highway fuel economy
General Motors	Camaro	Compact Cars	18	14
General Motors	Camaro	Compact Cars	19	15
General Motors	Camaro	Compact Cars	20	16
General Motors	Chevrolet SS	Large Cars	21	17
General Motors	CTS	Midsize Cars	18	14
General Motors	CTS	Midsize Cars	20	16
General Motors	CTS V	Midsize Cars	18	14
General Motors	CTS V	Midsize Cars	20	16
General Motors	CTS Wagon	Small Station Wagons	18	14
General Motors	CTS Wagon	Small Station Wagons	20	16
General Motors	XTS Hearse	Special Purpose Vehicle 2WD	22	17
General Motors	XTS Limo	Special Purpose Vehicle 2WD	22	17
Lamborghini	Aventador Coupe	Two Seaters	16	13
Lamborghini	Aventador Roadster	Two Seaters	14	12
Lamborghini	Aventador Veneno Coupe	Two Seaters	16	13
Lamborghini	Gallardo Coupe	Two Seaters	17	15
Lamborghini	Gallardo Coupe	Two Seaters	19	16
Lamborghini	Gallardo Spyder	Two Seaters	16	14
Lamborghini	Gallardo Spyder	Two Seaters	19	16
Maserati	Granturismo	Subcompact Cars	20	16
Maserati	Granturismo Convertible	Subcompact Cars	20	15
Maserati	Quattroporte GTS	Large Cars	21	16
Mercedes-Benz	C 63 AMG	Compact Cars	20	15
Mercedes-Benz	C 63 AMG Coupe	Subcompact Cars	20	15
Mercedes-Benz	CL 600	Compact Cars	18	14
Mercedes-Benz	CL 65 AMG	Compact Cars	18	14
Mercedes-Benz	SL 65 AMG	Two Seaters	21	17
Mercedes-Benz	SLS AMG Black Series Coupe	Two Seaters	18	14
Mercedes-Benz	SLS AMG Coupe	Two Seaters	19	15
Mercedes-Benz	SLS AMG GT Coupe	Two Seaters	19	15
Mercedes-Benz	SLS AMG GT Roadster	Two Seaters	19	15
Mercedes-Benz	SLS AMG Roadster	Two Seaters	19	15
Porsche	911 GT3	Two Seaters	22	17
Rolls-Royce	Ghost	Large Cars	19	15
Rolls-Royce	Ghost EWB	Large Cars	19	15
Rolls-Royce	Phantom	Large Cars	17	14
Rolls-Royce	Phantom Coupe	Compact Cars	17	14
Rolls-Royce	Phantom Drophead Coupe	Compact Cars	17	14
Rolls-Royce	Phantom EWB	Large Cars	17	14
Rolls-Royce	Wraith	Midsize Cars	19	15
Roush	Roush Stage 3 Mustang	Subcompact Cars	21	17

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

[a] Tax is based on unadjusted combined fuel economy; adjusted combined fuel economy is used on window stickers.

The IRS collected $61.3 million in 2013 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. It is worthy to note that total revenue from fines paid by consumers to purchase gas-guzzling vehicles greatly exceeds the overall fines paid by manufacturers whose vehicles fail to meet CAFE standards (see Table 4.20).

Table 4.25
Tax Receipts from the Sale of Gas Guzzlers, 1980–2013
(thousands)

Model year	Current dollars	2013 constant dollars[a]
1980	740	2,092
1981	780	1,999
1982	1,720	4,152
1983	4,020	9,402
1984	8,820	19,776
1985	39,790	86,146
1986	147,660	313,854
1987	145,900	299,194
1988	116,780	229,964
1989	109,640	205,979
1990	103,200	183,942
1991	118,400	202,512
1992	144,200	239,433
1993	111,600	179,917
1994	64,100	100,759
1995	73,500	112,351
1996	52,600	78,098
1997	48,200	69,960
1998	47,700	68,172
1999	68,300	95,504
2000	70,800	95,780
2001	78,200	102,864
2002	79,700	103,206
2003	126,700	160,411
2004	140,800	173,639
2005	163,800	195,383
2006	201,700	233,073
2007	178,700	200,777
2008	172,428	186,566
2009	99,300	107,826
2010	85,226	91,050
2011	68,905	71,361
2012	73,500	74,577
2013	61,300	61,300

Source:
Ward's Communications, Detroit, MI, 2015. Original data source: Internal Revenue Service. (Additional resources: www.epa.gov/fueleconomy/guzzler)

[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 steady-state vehicle speed and fuel economy.

Table 4.26
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]
					(miles per gallon)					
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, July 16, 2009, www.transportation.anl.gov/modeling_simulation/PSAT/. (Additional resources: www.transportation.anl.gov)

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

The latest study of vehicle fuel economy by speed indicated higher fuel economy around 40 miles per hour, as did the 1973 and 1984 studies. Engineers at Oak Ridge National Laboratory believe that the lowest speed in the vehicle's highest gear is where the best fuel economy is typically obtained. That speed will be different for individual vehicles.

Table 4.27
Fuel Economy by Speed, 1973, 1984, 1997, and 2012 Studies
(miles per gallon)

Speed (miles per hour)	1973[a] (13 vehicles)	1984[b] (15 vehicles)	1997[c] (9 vehicles)	2012[d] (74 vehicles)
15	[e]	21.1	24.4	[e]
20	[e]	25.5	27.9	[e]
25	[e]	30.0	30.5	[e]
30	21.1	31.8	31.7	[e]
35	21.1	33.6	31.2	[e]
40	21.1	33.6	31.0	33.2
45	20.3	33.5	31.6	[e]
50	19.5	31.9	32.4	31.9
55	18.5	30.3	32.4	[e]
60	17.5	27.6	31.4	27.9
65	16.2	24.9	29.2	[e]
70	14.9	22.5	26.8	24.1
75	[e]	20.0	24.8	[e]
80	[e]	[e]	[e]	20.5
		Fuel economy loss		
50–60 mph	10.3%	13.5%	3.1%	12.5%
60–70 mph	14.9%	18.5%	14.6%	13.6%
50–70 mph	23.6%	29.5%	17.3%	24.5%

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.

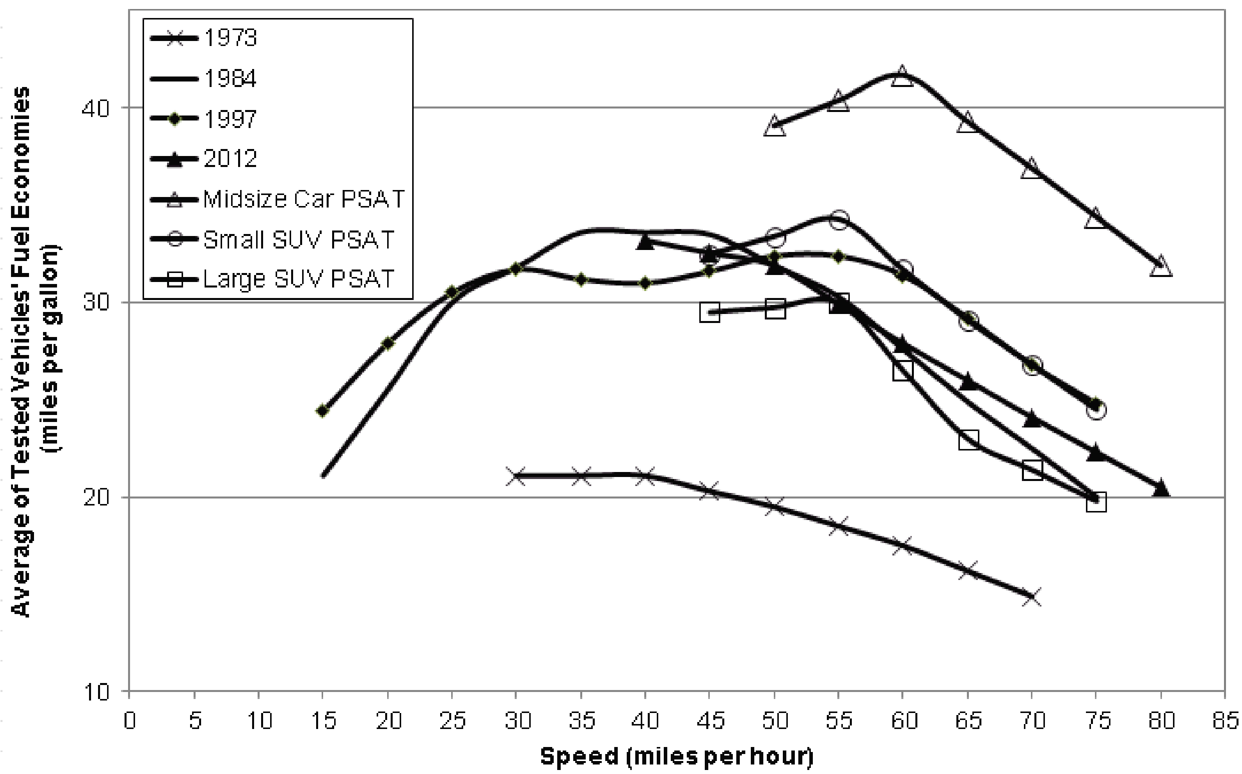
1984 - U.S. Department of Transportation, Federal Highway Administration, *Fuel Consumption and Emission Values for Traffic Models*, Washington, DC, May 1985.

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-RD-99-068, U.S. Department of Transportation, Federal Highway Administration, Washington, DC, March 1999.

2012 - U.S. Department of Energy and U.S. Environmental Protection Agency, Fuel Economy Guide website: www.fueleconomy.gov. The Green Car Congress, "ORNL researchers quantify the effect of increasing highway speed on fuel economy." February 8, 2013.

[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 as shown in Table 4.28.
[d] Model years 2003-2012 cars and light trucks.
[e] Data are not available.

Figure 4.2. Fuel Economy by Speed, 1973, 1984, 1997, and 2012 Studies



Source:
See Tables 4.26 and 4.27.

This table shows the driving cycles for 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 4.28
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 website, 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, and 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

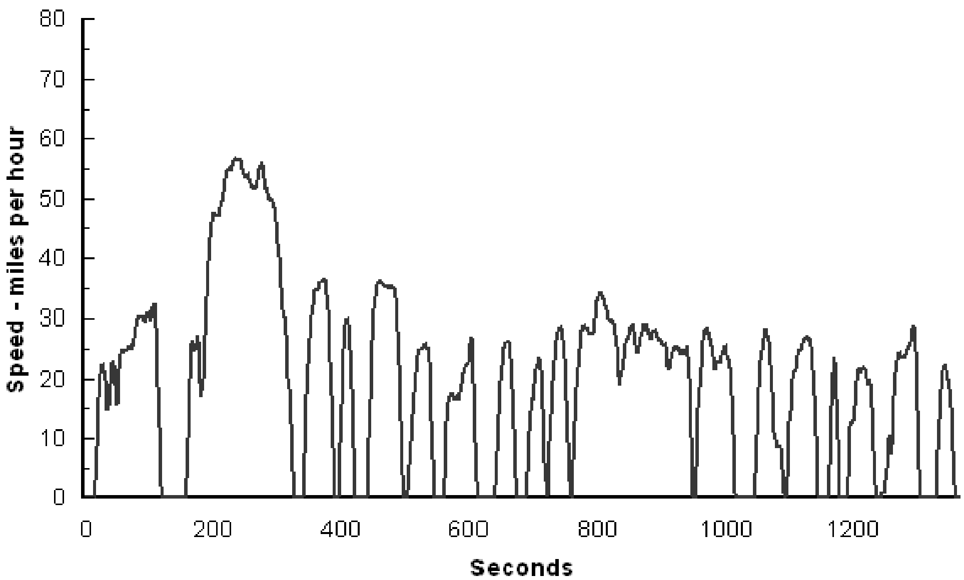
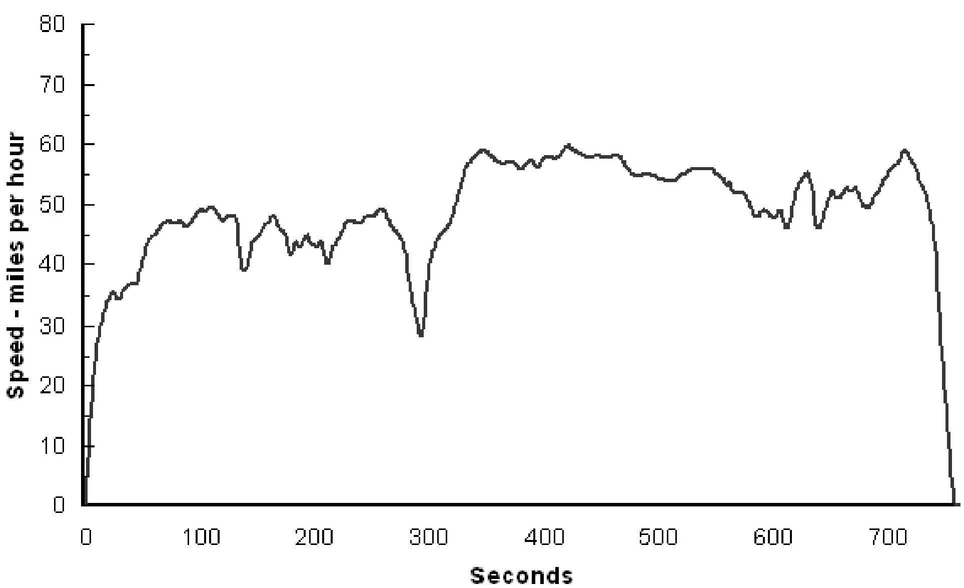


Figure 4.4. Highway Driving Cycle

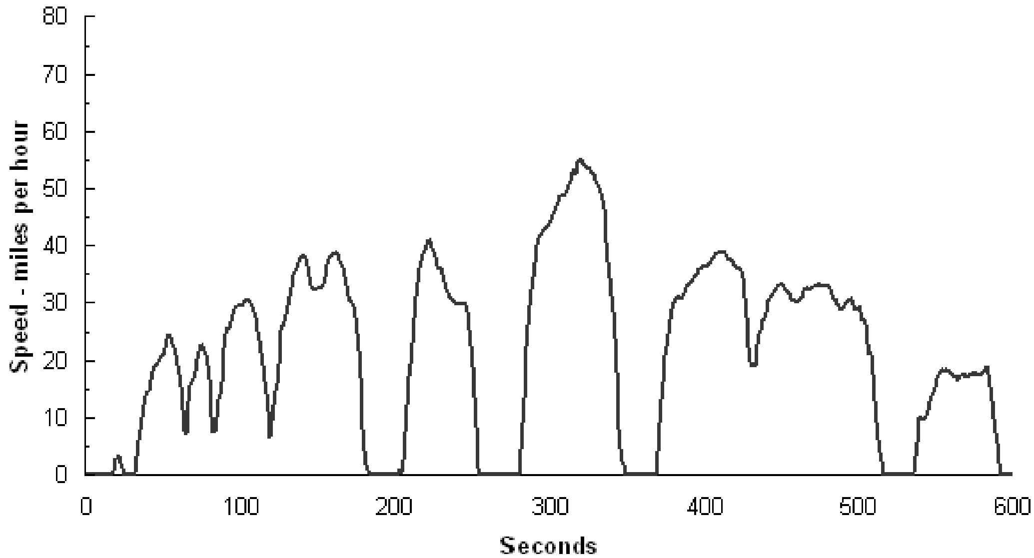


Source:

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.

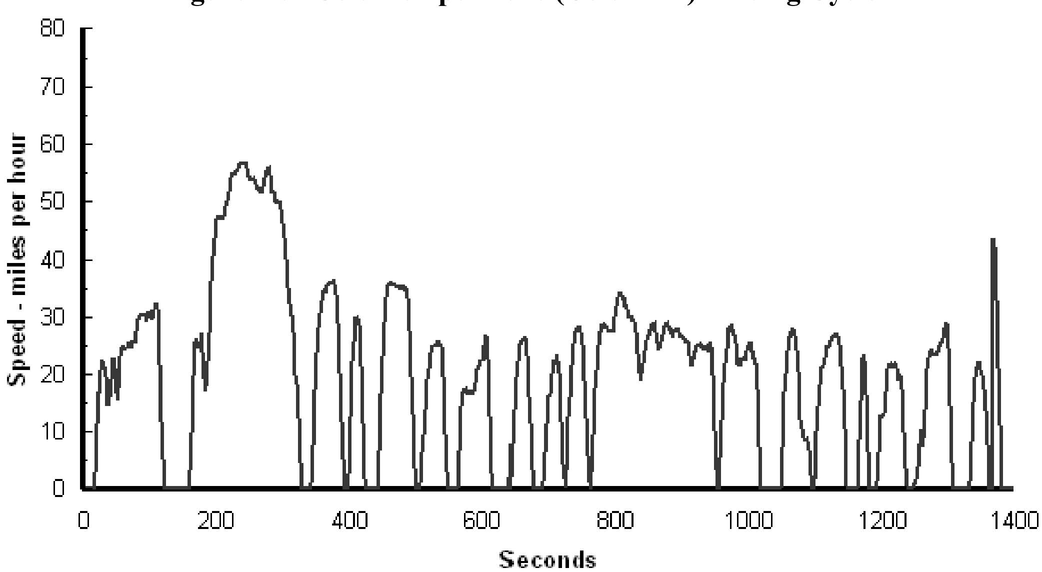
Beginning with the 2008 model year, these cycles influence the new vehicle fuel economy ratings.

Figure 4.5. Air Conditioning (SC03) Driving Cycle



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

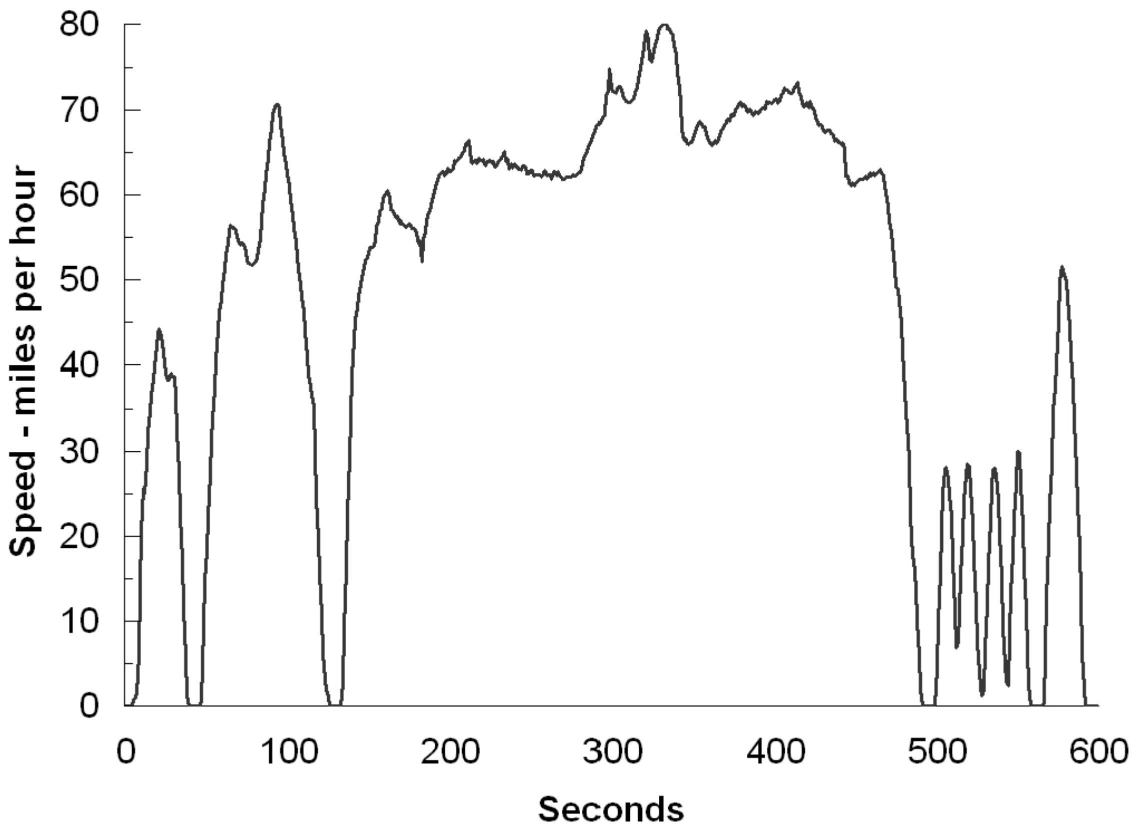
Figure 4.6. Cold Temperature (Cold FTP) Driving Cycle



Source:
U.S. Department of Energy and Environmental Protection Agency, Fuel Economy website, 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 website, 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

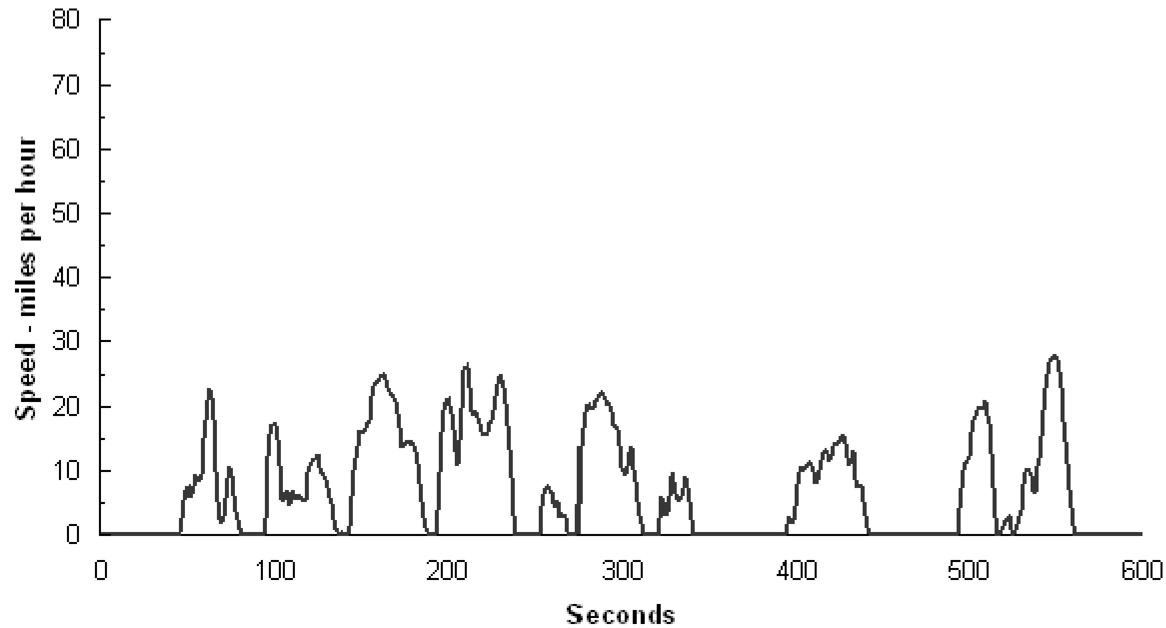
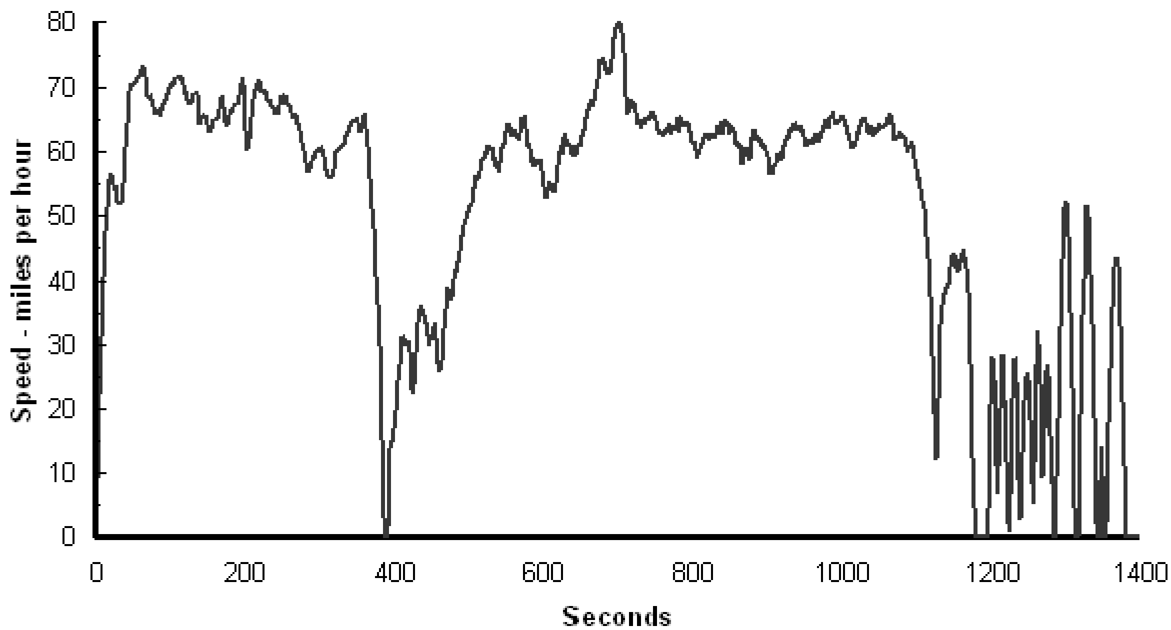


Figure 4.9. Representative Number Five Driving Cycle



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

Testing cycles to determine vehicle fuel economy and emissions vary by country and therefore it is difficult to make a direct comparison. Statistics on the driving cycles from Europe, Japan and the U.S. are listed in below. In addition, Table 4.30 displays the cycle results of these countries by vehicle type. Note that the differences in these cycle results vary with each individual vehicle tested.

Table 4.29
Comparison of U.S., European, and Japanese Driving Cycles Attributes

	Time (seconds)	Average speed (mph)	Maximum speed (mph)	Maximum acceleration (mph/s)
Japanese JC08 test cycle	631	14.8	43.5	1.8
New European Driving Cycle (NEDC)	1,181	20.9	74.6	2.4
U.S. EPA city cycle (LA4)[a]	1,375	19.5	56.7	3.3
U.S. EPA highway cycle	766	48.2	59.9	3.3
U.S. Corporate Average Fuel Economy (CAFE) cycle	[a]	32.4[b]	59.9	3.3

Note: China uses the NEDC. India uses a modified version of the NEDC called The Modified Indian Driving Cycle which accounts for lower maximum speeds that better represent driving conditions in India.

Source:
The International Council on Clean Transportation, *Passenger Vehicle Greenhouse Gas and Fuel Economy Standards: A Global Update*, July 2009.

Table 4.30
Example of Differing Results Using the U.S., European, and Japanese Driving Cycles

	Miles per gallon			Percentage difference from	
Vehicle type	CAFE cycle	NEDC	JC08 cycle	CAFE to NEDC	CAFE to JC08
Small car	34.8	32.4	27.6	-7%	-21%
Large car	26.6	24.7	21.5	-7%	-19%
Minivan	23.9	20.5	17.2	-14%	-28%
Sport-utility vehicle	20.2	17.6	14.6	-13%	-28%
Pickup	18.8	15.9	13.5	-15%	-28%

Note: Simulation results for identical gasoline vehicles (i.e., results for the same small car on each of the three cycles).

Source:
The International Council on Clean Transportation, *Passenger Vehicle Greenhouse Gas and Fuel Economy Standards: A Global Update*, July 2009.

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[a] Data are not available.

[b] 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 vehicles (also called paratransit or dial-a-ride) are widely used by transit agencies. The vehicles do not operate over a fixed route or on a fixed schedule. The vehicle may be dispatched to pick up several passengers at different pick-up points before taking them to their respective destinations and may even be interrupted en route to these destinations to pick up other passengers. Demand response service is provided primarily by vans. 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 4.31
Summary Statistics on Demand Response Vehicles, 1994–2013

Year	Number of agencies	Number of active vehicles	Vehicle-miles (millions)	Average miles per vehicle	Passenger-miles (millions)	Average load factor	Energy use (trillion Btu)
1994	5,214	28,729	463.7	16.14	577	[a]	9.5
1995	5,214	29,352	506.5	17.26	607	1.41	9.2
1996	5,214	30,804	548.3	17.80	656	1.21	9.9
1997	5,214	32,509	585.3	18.00	754	1.36	9.8
1998	5,214	29,646	670.9	22.63	735	1.21	10.4
1999	5,252	31,884	718.4	22.53	813	1.34	10.6
2000	5,252	33,080	758.9	22.94	839	1.30	10.8
2001	5,251	34,661	789.3	22.77	855	1.28	11.3
2002	5,251	34,699	802.6	23.13	853	1.24	11.6
2003	5,346	35,954	864.0	24.03	930	1.27	12.9
2004	5,960	37,078	889.5	23.99	962	1.25	13.3
2005	5,960	41,958	978.3	23.32	1,058	1.25	14.8
2006	5,960	43,509	1,013.0	23.28	1,078	1.24	15.5 [b]
2007	7,300	64,865	1,471.4	22.68	1,502	1.18	24.7
2008	7,200	65,799	1,495.2	22.72	1,412	1.09	24.7
2009	6,700	68,957	1,529.2	22.18	1,477	1.12	23.1
2010	6,741	68,621	1,693.6	24.68	1,494	1.03	22.8
2011	6,600	65,336	1,611.8	24.67	1,580	1.13	24.1
2012	6,511	68,632	1,618.1	23.58	1,756	1.24	24.8
2013	6,270	68,559	1,565.1	22.83	2,171	1.59	26.4

Note: See Glossary for a detailed definition of demand response.

Source:
American Public Transportation Association, *2015 Public Transportation Fact Book,* Washington, DC, June 2015. (Additional resources: www.apta.com)

[a] Data are not available.
[b] 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	Class 3-8 single-unit trucks, 2013	
	Registration (thousands)	*8,126*
	Vehicle miles (millions)	*106,582*
	Fuel economy (miles per gallon)	*7.3*
Table 5.2	Class 7-8 combination trucks, 2013	
	Registration (thousands)	*2,471*
	Vehicle miles (millions)	*163,436*
	Fuel economy (miles per gallon)	*5.8*
Table 5.14	Freight Shipments, 2012 Commodity Flow Survey	
Table 5.14	*Value (billion dollars)*	*13,852*
Table 5.15	*Tons (millions)*	*11,299*
Table 5.16	*Ton-miles (billions)*	*2,970*
Table 5.18	Transit buses in operation, 2013	*71,699*

Class 3-8 single-unit trucks include trucks over 10,000 lbs. gross vehicle weight with the cab/engine and cargo space together as one unit. Most of these trucks would be used for business or for individuals with heavy hauling or towing needs. Very heavy single-units, such as concrete mixers and dump trucks, are also in this category. The data series was recently changed by the FHWA back to 2007.

Table 5.1
Summary Statistics for Class 3-8 Single-Unit Trucks, 1970–2013

Year	Registrations (thousands)	Vehicle travel (million miles)	Average annual miles per vehicle	Fuel use (million gallons)	Fuel economy (miles per gallon)
1970	3,681	27,081	7,357	3,968	6.8
1975	4,232	34,606	8,177	5,420	6.4
1980	4,374	39,813	9,102	6,923	5.8
1981	4,455	39,568	8,882	6,867	5.8
1982	4,325	40,658	9,401	6,803	6.0
1983	4,204	42,546	10,120	6,965	6.1
1984	4,061	44,419	10,938	7,240	6.1
1985	4,593	45,441	9,894	7,399	6.1
1986	4,313	45,637	10,581	7,386	6.2
1987	4,188	48,022	11,467	7,523	6.4
1988	4,470	49,434	11,059	7,701	6.4
1989	4,519	50,870	11,257	7,779	6.5
1990	4,487	51,901	11,567	8,357	6.2
1991	4,481	52,898	11,805	8,172	6.5
1992	4,370	53,874	12,328	8,237	6.5
1993	4,408	56,772	12,879	8,488	6.7
1994	4,906	61,284	12,492	9,032	6.8
1995	5,024	62,705	12,481	9,216	6.8
1996	5,266	64,072	12,167	9,409	6.8
1997	5,293	66,893	12,638	9,576	7.0
1998	5,414	67,894	12,540	9,741	7.0
1999	5,763	70,304	12,199	9,372	7.5
2000	5,926	70,500	11,897	9,563	7.4
2001	5,704	72,448	12,701	9,667	7.5
2002	5,651	75,866	13,425	10,321	7.4
2003	5,849	77,757	13,294	8,881	8.8
2004	6,161	78,441	12,732	8,959	8.8
2005	6,395	78,496	12,275	9,501	8.3
2006	6,649	80,344	12,084	9,852	8.2 [a]
2007	8,117	119,979	14,781	16,314	7.3
2008	8,228	126,855	15,417	17,144	7.4
2009	8,356	120,207	14,386	16,253	7.4
2010	8,217	110,738	13,477	15,097	7.3
2011	7,819	103,803	13,276	14,214	7.3
2012	8,190	105,605	12,894	14,376	7.3
2013	8,126	106,582	13,116	14,502	7.3
			Average annual percentage change		
1970–2013	1.9%	3.2%	1.4%	3.1%	0.2%
2003–2013	3.3%	3.2%	-0.1%	5.0%	-1.9%

Source:
U. S. Department of Transportation, Federal Highway Administration, *Highway Statistics 2013*, Washington, DC, 2015, Table VM-1 and annual. (Additional resources: www.fhwa.dot.gov)

[a] Due to FHWA methodology changes, data from 2007-on are not comparable with previous data.

Class 7-8 combination trucks include all trucks designed to be used in combination with one or more trailers with a gross vehicle weight rating over 26,000 lbs. 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. The data series was recently changed by the FHWA back to 2007.

Table 5.2
Summary Statistics for Class 7-8 Combination Trucks, 1970–2013

Year	Registrations (thousands)	Vehicle travel[a] (million miles)	Average annual miles per vehicle	Fuel use (million gallons)	Fuel economy (miles per gallon)
1970	905	35,134	38,822	7,348	4.8
1975	1,131	46,724	41,312	9,177	5.1
1980	1,417	68,678	48,467	13,037	5.3
1981	1,261	69,134	54,825	13,509	5.1
1982	1,265	70,765	55,941	13,583	5.2
1983	1,304	73,586	56,431	13,796	5.3
1984	1,340	77,377	57,744	14,188	5.5
1985	1,403	78,063	55,640	14,005	5.6
1986	1,408	81,038	57,555	14,475	5.6
1987	1,530	85,495	55,879	14,990	5.7
1988	1,667	88,551	53,120	15,224	5.8
1989	1,707	91,879	53,825	15,733	5.8
1990	1,709	94,341	55,202	16,133	5.8
1991	1,691	96,645	57,153	16,809	5.7
1992	1,675	99,510	59,409	17,216	5.8
1993	1,680	103,116	61,379	17,748	5.8
1994	1,681	108,932	64,802	18,653	5.8
1995	1,696	115,451	68,073	19,777	5.8
1996	1,747	118,899	68,059	20,192	5.9
1997	1,790	124,584	69,600	20,302	6.1
1998	1,831	128,159	69,994	21,100	6.1
1999	2,029	132,384	65,246	24,537	5.4
2000	2,097	135,020	64,387	25,666	5.3
2001	2,154	136,584	63,409	25,512	5.4
2002	2,277	138,737	60,930	26,480	5.2
2003	1,908	140,160	73,459	23,815	5.9
2004	2,010	142,370	70,831	24,191	5.9
2005	2,087	144,028	69,012	27,689	5.2
2006	2,170	142,169	65,516	28,107	5.1 [b]
2007	2,635	184,199	69,905	30,904	6.0
2008	2,585	183,826	71,113	30,561	6.0
2009	2,617	168,100	64,234	28,050	6.0
2010	2,553	175,789	68,856	29,927	5.9
2011	2,452	163,791	66,809	28,181	5.8
2012	2,469	163,602	66,262	27,975	5.8
2013	2,471	168,436	68,165	28,795	5.8
			Average annual percentage change		
1970–2013	2.4%	3.7%	1.3%	3.2%	0.4%
2003–2013	2.6%	1.9%	-0.7%	1.9%	-0.2%

Source:
U. S. Department of Transportation, Federal Highway Administration, *Highway Statistics 2013*, Washington, DC, 2015, Table VM-1 and annual. (Additional resources: www.fhwa.dot.gov)

[a] The Federal Highway Administration changed the combination truck travel methodology in 1993.
[b] Due to FHWA methodology changes, data from 2007-on are not comparable with previous data.

Truck sales rose in 2010 for the first time since the sales peak in 2004 and have continued to rise since then. Trucks under 10,000 lbs. continue to dominate truck sales.

Table 5.3
New Retail Truck Sales by Gross Vehicle Weight, 1970–2014[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
2008	4,358	1,888	135	36	40	39	49	133	6,680
2009	3,528	1,306	112	20	24	22	39	95	5,145
2010	4,245	1,513	161	12	31	29	38	107	6,137
2011	4,714	1,735	195	10	42	41	41	171	6,951
2012	5,164	1,811	223	9	55	40	47	195	7,544
2013	5,615	2,077	254	12	60	47	48	185	8,298
2014	6,209	2,275	264	13	67	52	54	220	9,154
Average annual percentage change									
1970–1985	5.7%	7.9%	4.1%	[c]	-15.1%	-6.6%	6.8%	2.8%	5.5%
1986–2014	2.2%	2.3%	11.7%	7.2%[d]	9.0%	0.5%	-2.2%	2.4%	2.3%
2004–2014	-0.4%	-2.0%	9.5%	-12.1%	6.4%	-2.9%	-3.2%	0.8%	-0.7%

Source:
Ward's Communication's, *Motor Vehicle Facts and Figures 2014*, Southfield, MI, 2014, p. 22, and annual; 2015: Ward's Communications, www.wardsauto.com. (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.
[d] 1987-2014.

The Vehicle Inventory and Use Survey (VIUS) was discontinued, thus the 2002 VIUS data remain the latest available.

The United States Department of Transportation, the United States Department of Energy, and the United States Department of Agriculture are funding a planning study in 2015-16 to design and scope a new VIUS, possibly utilizing new forms of survey technologies.

There is an opportunity to provide input on how VIUS data have been used; which survey elements are essential to your future data and policy needs; and, elements which should be added or deleted. To review the questions from the 2002 survey prior to providing input, go to www.census.gov/svsd/www/vius/questionnaires.html.

*To give input towards a new VIUS data collection, email VIUS@dot.gov***.**

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.

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	85,174,777	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

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

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)

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
	Typical trip miles or range of operation[a]			
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[b]	**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%
Total[b]	**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)

[a] The respondent was asked to choose the category which best described the trips made by the vehicle.
[b] Percentages may not sum to totals due to rounding.

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

Truck fleet size	Primary refueling facility				Total[a]
	Gas station	Truck stop	Own facility	Other's facility	
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)

[a] Percentages may not sum to totals due to rounding.

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

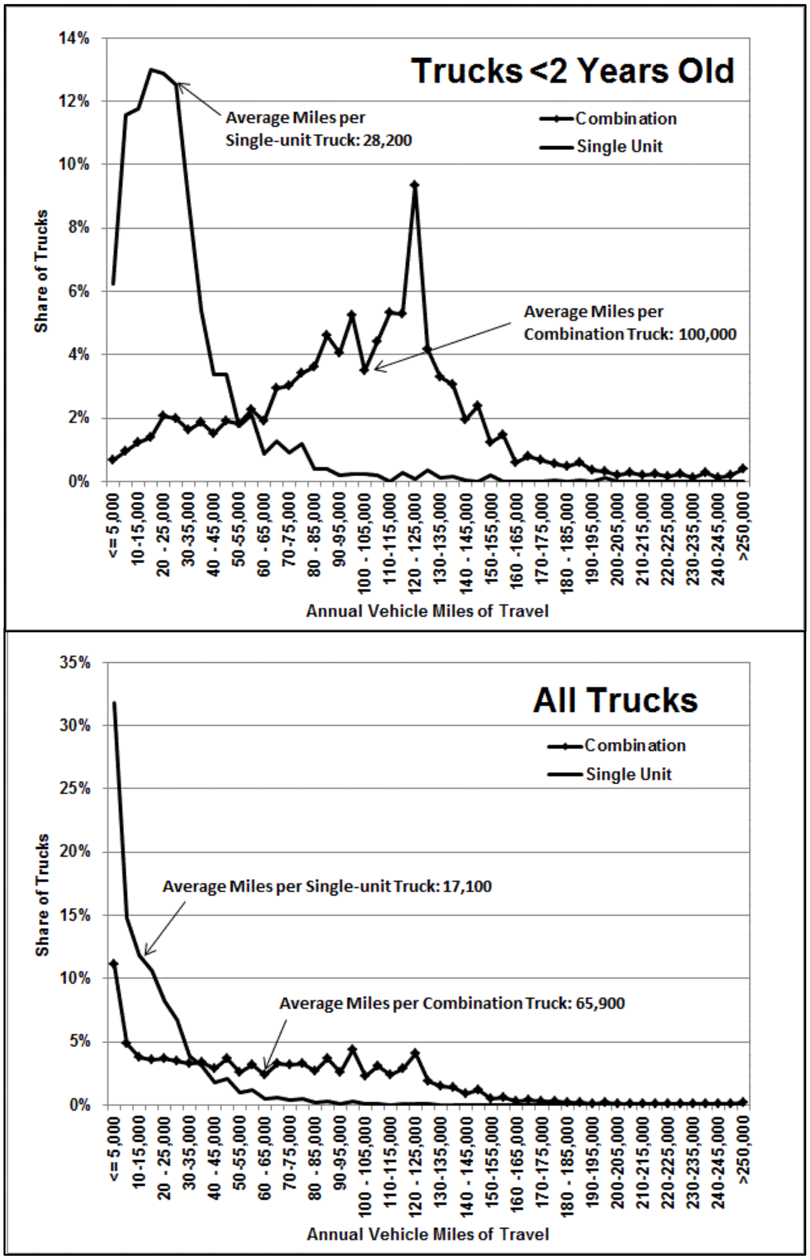
Major use	Gas station	Truck stop	Own facility	Others facility	Other	All[a]
Personal	98.6%	0.6%	0.7%	0.1%	0.1%	100.0%
Other services	96.0%	1.4%	1.6%	0.9%	0.1%	100.0%
All	93.9%	1.8%	3.7%	0.5%	0.0%	100.0%
Information services	92.3%	0.4%	7.2%	0.1%	0.0%	100.0%
Retail trade	86.6%	3.5%	8.6%	1.2%	0.0%	100.0%
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)

[a] Percentages may not sum to totals due to rounding.

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 all trucks and trucks two years old or less. 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. 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. by Vehicle-Miles Traveled



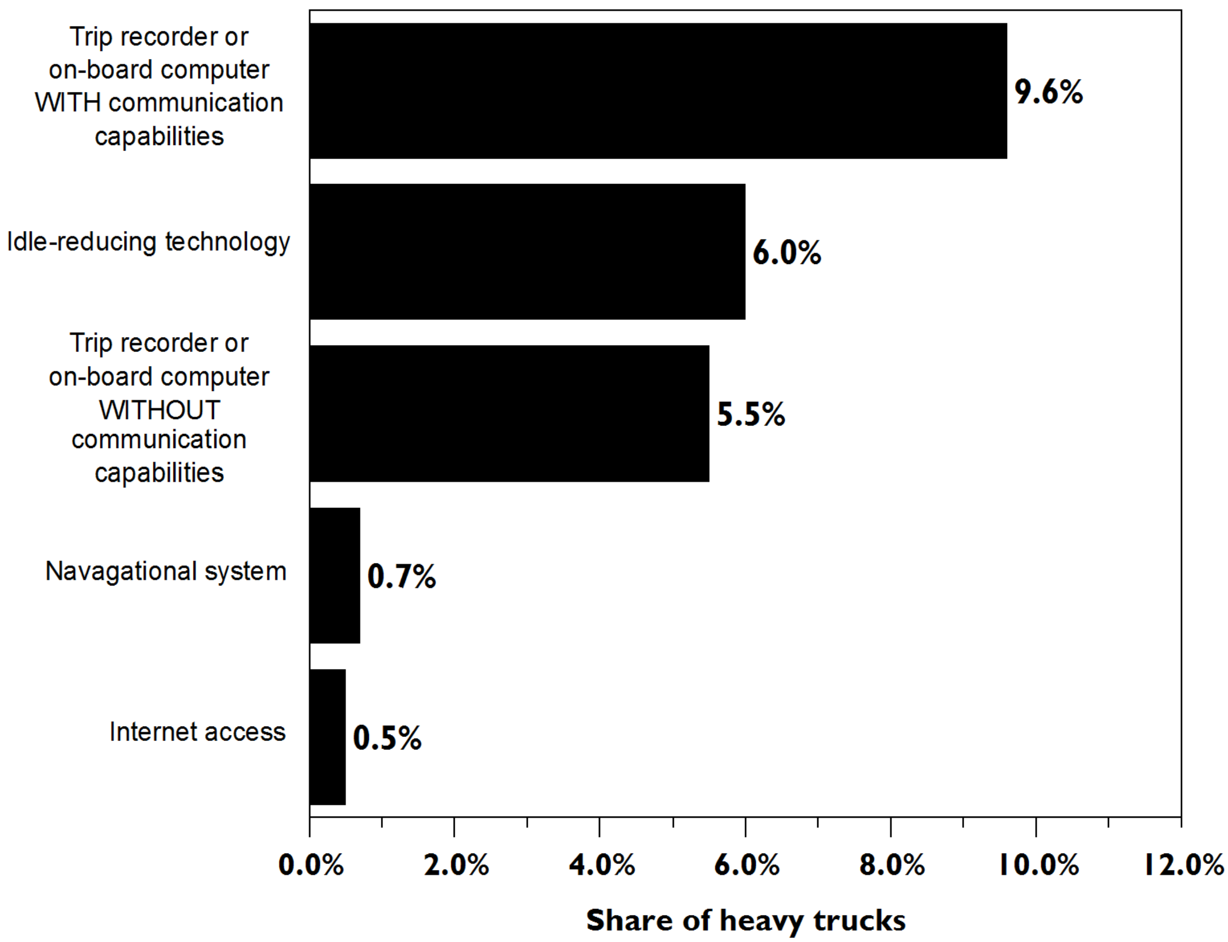
Note: Heavy trucks (class 7 & 8) are greater than 26,000 pounds gross vehicle weight based on the manufacturer's rating.

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 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



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

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

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 two 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%	23.5	21.82	25.3	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. (Additional resources: cta.ornl.gov/cta/Publications/Reports/ORNL_TM_2008-122.pdf)

This table 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 the table 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

	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		
Speed (mph)	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	368.0	124.2	3.0	156	52.8	2.96
5+ to 10	674	198.8	3.39	368	103.2	3.56	808.0	245.4	3.3	331	98.8	3.35
10+ to 15	723	192.0	3.77	396	98.3	4.03	848.0	216.5	3.9	343	87.0	3.95
15+ to 20	744	199.1	3.73	404	100.9	4.00	882.0	221.6	4.0	361	90.5	3.98
20+ to 25	938	228.4	4.11	489	113.6	4.31	1,111.0	244.2	4.6	462	101.1	4.57
25+ to 30	1,178	266.9	4.41	609	131.5	4.63	1,420.0	286.9	5.0	580	117.6	4.93
30+ to 35	1,481	336.8	4.40	753	154.2	4.88	1,774.0	341.1	5.2	708	141.1	5.02
35+ to 40	1,917	403.5	4.75	1,000	193.6	5.17	2,284.0	433.6	5.3	941	184.3	5.10
40+ to 45	2,955	584.1	5.06	1,543	285.9	5.40	3,380.0	603.6	5.6	1,350	254.4	5.31
45+ to 50	4,935	907.9	5.43	2,573	447.7	5.75	5,410.0	872.8	6.2	2,177	360.4	6.04
50+ to 55	9,397	1,629.8	5.77	4,962	811.5	6.11	10,046.0	1,622.7	6.2	3,877	625.5	6.20
55+ to 60	20,656	3,297.2	6.26	11,707	1,721.9	6.80	22,373.0	3,257.8	6.9	8,710	1,246.9	6.99
60+ to 65	38,964	5,879.6	6.63	21,472	2,980.8	7.20	34,517.0	4,840.0	7.1	14,944	2,049.4	7.29
NOT ADJUSTED FOR TERRAIN: See note below.												
65+ to 70	58,304	8,313.2	7.01	27,931	3,652.2	7.65	65,063.0	9,256.4	7.0	27,144	3,880.1	7.00
70+ to 75	56,378	7,483.2	7.53	21,751	2,745.5	7.92	66,882.0	8,435.6	7.9	32,887	4,056.1	8.11
75+ to 85	7,849	808.2	9.71	3,610	403.2	8.95	11,513.0	911.1	12.6	6,817	512.2	13.31
Total[a]	207,374	30,831.0	6.73	99,714	13,994.0	7.13	228,680.0	31,913.0	7.2	101,790	13,858.0	7.35
Percent increase in fuel economy from dual tire trac/trail			0.00%			5.93%			6.53%			9.20%

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.

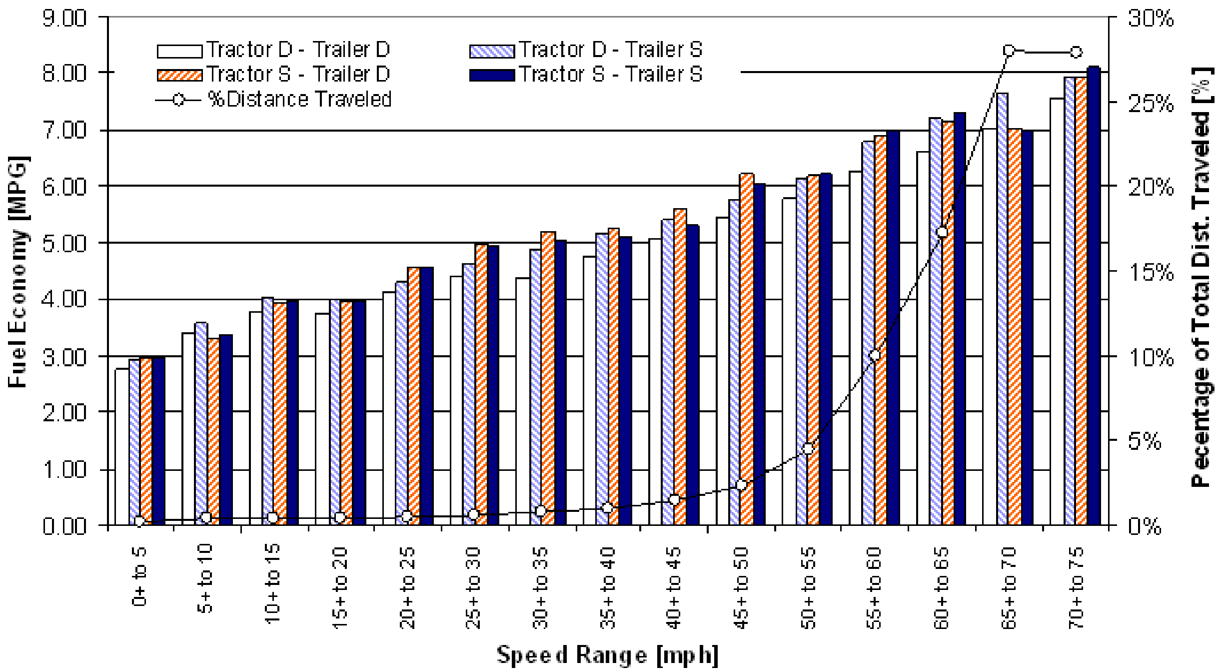
Source:
Capps, Gary, Oscar Franzese, Bill Knee, M.B. Lascurain, and Pedro Otaduy. *Class-8 Heavy Truck Duty Cycle Project Final Report*, ORNL/TM-2008/122, Oak Ridge National Laboratory, Oak Ridge, TN, December 2008. (Additional resources: cta.ornl.gov/cta/Publications/Reports/ORNL_TM_2008-122.pdf)

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

The fuel economy information presented in Table 5.11 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 5.11 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 types 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

NOT ADJUSTED FOR TERRAIN: See note below.



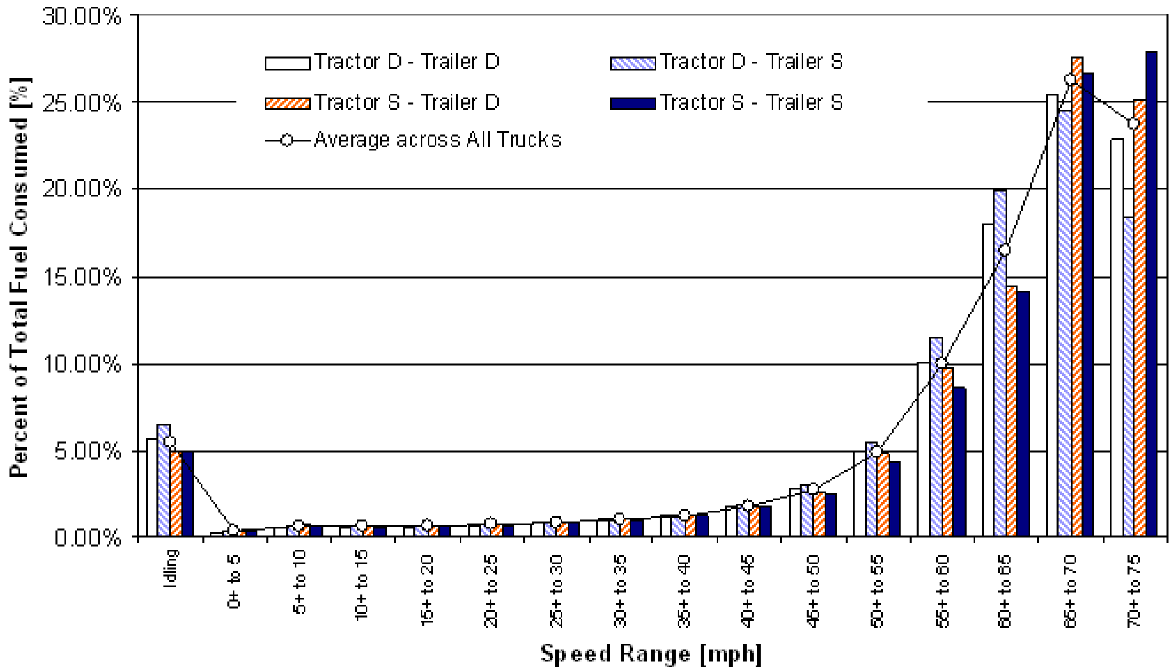
Note: D = Dual tire. S = Single (wide) tire.
These data were not adjusted to account for the effects of terrain. The increase in fuel economy for speeds above 70 mph is likely due to the vehicle achieving high speeds while traveling down slope. Therefore, this increase in fuel economy is not expected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

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.

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 5.11, 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

NOT ADJUSTED FOR TERRAIN: See note below



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.

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.

A typical class 8 truck tractor weighs about 17,000 lbs. The powertrain is nearly a quarter of the weight (24%) while the truck body structure is 19%.

Table 5.12
Class 8 Truck Weight by Component

	Pounds	Share of total
Wheels and tires	1,700	10%
Chassis/frame	2,040	12%
Drivetrain and suspension	2,890	17%
Misc. accessories/systems	3,060	18%
Truck body structure	3,230	19%
Powertrain	4,080	24%
Total	17,000	100%

Notes:
- Powertrain includes engine and cooling system, transmission and accessories.
- Truck body structure includes cab-in-white, sleeper unit, hood and fairings, interior and glass.
- Miscellaneous accessories/systems include batteries, fuel system, and exhaust hardware.
- Drivetrain and suspension includes drive axles, steer axle, and suspension system.
- Chassis/frame includes frame rails and crossmembers, fifth wheel and brackets. Wheels and tires include a set of 10 aluminum wheels, plus tires.

Source:
National Academy of Sciences, *Technologies and Approaches to Reducing the Fuel Consumption of Medium and Heavy-Duty Vehicles*, prepublication copy, March 2010, p. 5-42.

The gross weight of a vehicle (GVW) is the weight of the empty vehicle plus the weight of the maximum payload that the vehicle was designed to carry. In cars and small light trucks, the difference between the empty weight of the vehicle and the GVW is not significantly different (1,000 to 1,500 lbs). The largest trucks and tractor-trailers, however, have a payload capacity share of 200%, which means they can carry 200% of their empty weight. The medium-sized trucks (truck classes 3-6) have payload capacity shares between 50% and 100%.

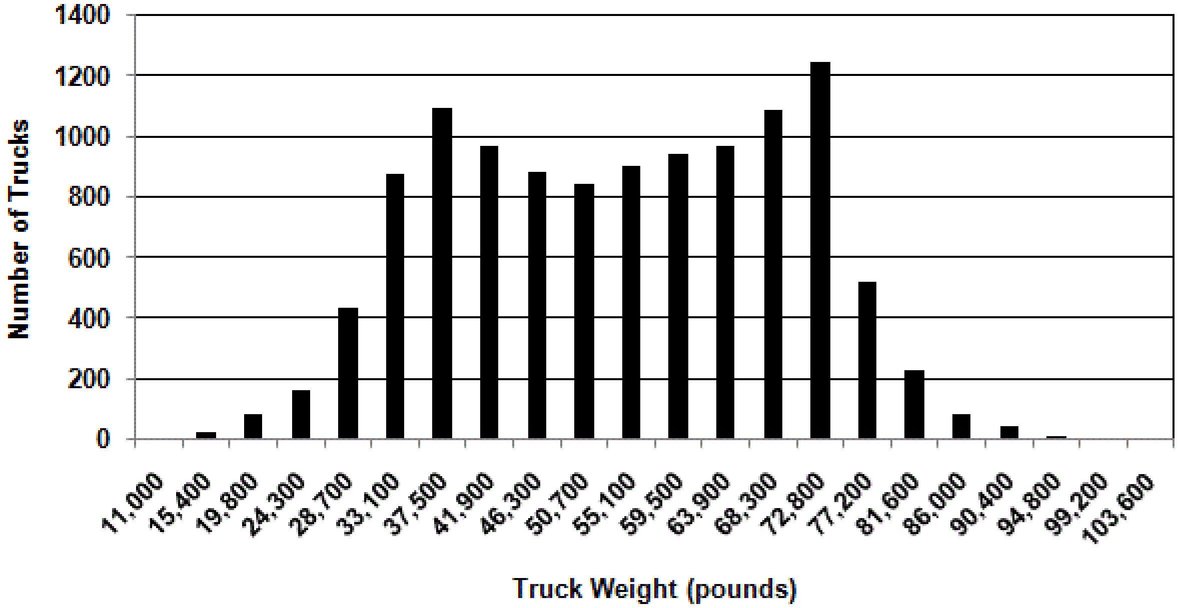
Table 5.13
Gross Vehicle Weight vs. Empty Vehicle Weight

Vehicle description	Truck class	Gross vehicle weight range (pounds)	Empty vehicle weight range (pounds)	Maximum payload capacity (pounds)	Payload capacity share (percent of empty weight)
Cars		3,200-6,000	2,400-5,000	1,000	20%
Minivans, small SUVs, small pick-ups	1	4,000-2,400	3,200-4,500	1,500	33%
Large SUVs, standard pick-ups	2a	6,001-8,500	4,500-6,000	2,500	40%
Large SUVs, standard pick-ups	2b	8,501-10,000	5,000-6,300	3,700	60%
Utility van, multi- purpose, mini-bus, step van	3	10,001-14,000	7,650-8,750	5,250	60%
City delivery, parcel delivery, large walk-in, bucket, landscaping	4	14,001-16,000	7,650-8,750	7,250	80%
City delivery, parcel delivery, large walk-in, bucket	5	16,001-19,500	9,500-10,000	8,700	80%
City delivery, school bus, large walk-in, bucket	6	19,501-26,000	11,500-14,500	11,500	80%
City bus, furniture, refrigerated, refuse, fuel tanker, dump, tow, concrete, fire engine, tractor-trailer	7	26,001-33,000	11,500-14,500	18,500	125%
Refuse, concrete, furniture, city bus, tow, fire engine (straight trucks)	8a	33,001-80,000	20,000-26,000	54,000	200%
Tractor-trailer: van, refrigerated, bulk tanker, flat bed (combination trucks)	8b	33,001-80,000	20,000-26,000	54,000	200%

Source:
National Academy of Sciences, *Technologies and Approaches to Reducing the Fuel Consumption of Medium and Heavy-Duty Vehicles*, prepublication copy, March 2010, pp. 2-2 and 5-42.

According to weigh-in-motion data collected by fifteen states, the majority of 5-axle tractor-trailers on the road weigh between 33,000 and 73,000 lbs. Eleven percent of the tractor-trailers had weight recorded around 72,800 lbs and 10% around 68,300 lbs. Another 10% of tractor-trailers were on the lighter end of the scale – around 37,500 lbs. These data show that only a small percent of trucks on the road are near the maximum roadway gross vehicle weight of 80,000 lbs. Thus, most trucks are filling the trailer space to capacity (cubing-out) before they reach the maximum weight limit (weighing-out).

Figure 5.5. Distribution of Class 8 Trucks by On-Road Vehicle Weight, 2008[a]



Note: Data are from these 15 States: California, Connecticut, Florida, Georgia, Hawaii, Iowa, Minnesota, Missouri, Montana, North Carolina, Oregon, Pennsylvania, South Dakota, Texas, and Washington.

Source:
National Academy of Sciences, *Technologies and Approaches to Reducing the Fuel Consumption of Medium and Heavy-Duty Vehicles*, prepublication copy, March 2010, p. 5-45. Original source: Federal Highway Administration, Vehicle Travel Information System, 2008.

[a] Study reported data on 5-axle tractor-trailers which are class 8 trucks. Single-unit class 8 trucks were not considered in the study.

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, 2007 and 2012 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 2012 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 and services establishments. Establishments classified in services, transportation, construction, and most retail and services industries are excluded from the survey. Farms, fisheries, foreign establishments, and most government-owned establishments are also excluded.

The 1993, 1997, 2002, 2007 and 2012 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.

The data can be viewed at: www.bts.gov/publications/commodity_flow_survey.

Industries covered by the 2012 Commodity Flow Survey (CFS) shipped goods worth over $13 trillion. Compared to the 1997 CFS, the value of shipments is up 2.2% per year and tons shipped are up 0.1% per year. By value, intermodal shipments increased 2.5% per year from 1997 to 2012.

Table 5.14
Value of Goods Shipped in the United States: Comparison of the 1997, 2002, 2007 and 2012 Commodity Flow Surveys[a]

	1997 (billion 2012 dollars)	2002 (billion 2012 dollars)	2007 (billion 2012 dollars)	2012 (billion dollars)	Average annual percent change (1997-2012)
All modes	**9,933.3**	**10,716.8**	**12,938.9**	**13,852.1**	**2.2%**
Single modes	**8,181.8**	**8,996.6**	**10,562.8**	**11,900.4**	**2.5%**
Truck[b]	7,126.0	7,957.3	9,230.4	10,132.2	2.4%
For-hire truck	4,150.4	4,794.9	5,487.5	6,504.6	3.0%
Private truck	2,913.2	3,120.8	3,742.8	3,627.6	1.5%
Rail	457.2	396.8	483.3	473.1	0.2%
Water	108.5	114.0	127.2	301.6	7.1%
Inland water	77.1	73.3	100.8	218.9	7.2%
Great Lakes	2.2	1.1	[c]	0.4	-10.7%
Deep sea	29.2	39.6	25.5	59.9	4.9%
Multiple waterways	[d]	[d]	[d]	22.3	[d]
Air (includes truck and air)	327.7	338.1	279.4	450.6	2.1%
Pipeline[e]	162.4	190.4	442.5	542.9	8.4%
Multiple modes	**1,353.1**	**1,377.3**	**2,067.1**	**1,950.8**	**2.5%**
Parcel, U.S.P.S. or courier	1,224.4	1,260.6	1,729.5	1,688.2	2.2%
Truck and rail	108.3	89.2	207.3	224.8	5.0%
Truck and water	11.8	18.3	64.7	29.0	6.2%
Rail and water	2.5	4.2	15.4	8.0	8.1%
Other multiple modes	6.1	4.9	50.2	0.7	-13.4%
Other and unknown modes	**398.5**	**342.8**	**309.1**	**1.0**	**-32.9%**

Source:
U.S. Department of Transportation, Bureau of Transportation Statistics and U.S. Department of Commerce, Bureau of the Census, *2012 Commodity Flow Survey*, Table 1a. (Additional resources: http://www.census.gov/econ/cfs/2012/ec12tcf-us.pdf)

[a] Detail may not add to total because of rounding.
[b] "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.
[c] Denotes data do not meet publication standards because of high sampling variability or poor response quality.
[d] Data are not available.
[e] CFS data for pipeline exclude most shipments of crude oil.

Industries covered by the 2012 Commodity Flow Survey (CFS) shipped over 11 billion tons of goods nationwide. Nearly three-quarters of the freight tonnage was shipped by truck.

Table 5.15
Tons of Freight in the United States: Comparison of the 1997, 2002, 2007 and 2012 Commodity Flow Surveys[a]

	1997 (millions)	2002 (millions)	2007 (millions)	2012 (millions)	Average annual percent change (1997-2012)
All modes	**11,089.7**	**11,667.9**	**12,543.4**	**11,299.4**	**0.1%**
Single modes	**10,436.5**	**11,086.7**	**11,698.1**	**10,905.5**	**0.3%**
Truck[b]	7,700.7	7,842.8	8,778.7	8,060.2	0.3%
For-hire truck	3,402.6	3,657.3	4,075.1	4,298.7	1.6%
Private truck	4,137.3	4,149.7	4,703.6	3,761.3	-0.6%
Rail	1,549.8	1,873.9	1,861.3	1,628.5	0.3%
Water	563.4	681.2	403.6	576.0	0.1%
Inland water	414.8	458.6	343.3	424.5	0.2%
Great Lakes	38.4	38.0	17.8	31.4	-1.3%
Deep sea	110.2	184.6	42.5	73.0	-2.7%
Multiple waterways	[c]	[c]	[c]	47.1	[c]
Air (includes truck and air)	4.5	3.8	3.6	4.8	0.4%
Pipeline[d]	618.2	685.0	650.9	636.0	0.2%
Multiple modes	**216.7**	**216.7**	**573.7**	**357.0**	**3.4%**
Parcel, U.S.P.S. or courier	23.7	25.5	33.9	28.5	1.2%
Truck and rail	54.2	43.0	225.6	213.8	9.6%
Truck and water	33.2	23.3	145.5	56.7	3.6%
Rail and water	79.3	105.1	54.9	55.6	-2.3%
Other multiple modes	26.2	19.8	113.8	2.5	-14.5%
Other and unknown modes	**436.5**	**364.6**	**271.6**	**36.8**	**-15.2%**

Source:
U.S. Department of Transportation, Bureau of Transportation Statistics and U.S. Department of Commerce, Bureau of the Census, *2012 Commodity Flow Survey*, Table 1a. (Additional resources: http://www.census.gov/econ/cfs/2012/ec12tcf-us.pdf)

[a] Detail may not add to total because of rounding.
[b] "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.
[c] Data are not available.
[d] CFS data for pipeline exclude most shipments of crude oil.

Industries covered by the 2012 Commodity Flow Survey (CFS) accounted for 2.9 trillion ton-miles on the nation's highways, railways, waterways, pipelines, and aviation system. Ton-miles increased an average of 0.7% per year from 1997 to 2012.

Table 5.16
Growth of Ton-Miles in the United States: Comparison of the 1997, 2002, 2007 and 2012 Commodity Flow Surveys[a]

	1997 (billions)	2002 (billions)	2007 (billions)	2012 (billions)	Average annual percent change (1997-2012)
All modes	**2,661.4**	**3,137.9**	**3,344.7**	**2,969.5**	**0.7%**
Single modes	**2,383.5**	**2,867.9**	**2,894.3**	**2,697.4**	**0.8%**
Truck[b]	1,023.5	1,255.9	1,342.1	1,247.7	1.3%
For-hire truck	741.1	959.6	1,055.6	1,050.9	2.4%
Private truck	268.6	291.1	286.5	196.8	-2.1%
Rail	1,022.5	1,261.6	1,344.0	1,211.5	1.1%
Water	261.7	282.7	157.3	192.9	-2.0%
Inland water	189.3	211.5	117.5	118.7	-3.1%
Great Lakes	13.4	13.8	6.9	11.0	-1.3%
Deep sea	59.0	57.4	33.0	22.1	-6.3%
Multiple waterways	[c]	[c]	[c]	41.0	[c]
Air (includes truck and air)	6.2	5.8	4.5	5.8	0.4%
Pipeline[d]	[e]	[e]	[e]	[e]	[c]
Multiple modes	**204.5**	**225.7**	**416.6**	**271.8**	**1.9%**
Parcel, U.S.P.S. or courier	18.0	19.0	28.0	22.7	1.6%
Truck and rail	55.6	45.5	196.8	169.5	7.7%
Truck and water	34.8	32.4	98.4	48.6	2.3%
Rail and water	77.6	115.0	47.1	29.2	-6.3%
Other multiple modes	18.6	13.8	46.4	1.9	-14.1%
Other and unknown modes	**73.4**	**44.2**	**33.8**	**0.3**	**-30.7%**

Source:
U.S. Department of Transportation, Bureau of Transportation Statistics and U.S. Department of Commerce, Bureau of the Census, *2012 Commodity Flow Survey*, Table 1a. (Additional resources: http://www.census.gov/econ/cfs/2012/ec12tcf-us.pdf)

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[a] Detail may not add to total because of rounding.
[b] "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.
[c] Data are not available.
[d] CFS data for pipeline exclude most shipments of crude oil.
[e] Denotes data do not meet publication standards because of high sampling variability or poor response quality.

Industries covered by the 2012 Commodity Flow Survey (CFS) had an average shipment length of 630 miles, a 33% increase from the 1997 survey. For single mode shipments, air had the highest shipment length in 2012; for multiple modes, truck and water had the highest length.

Table 5.17
Average Miles per Shipment in the United States: Comparison of the 1997, 2002, 2007 and 2012 Commodity Flow Surveys[a]

	1997 (miles)	2002 (miles)	2007 (miles)	2012 (miles)	Average annual percent change (1997-2012)
All modes	**472**	**546**	**619**	**630**	**1.9%**
Single modes	**184**	**240**	**234**	**262**	**2.4%**
Truck[b]	144	173	206	227	3.1%
For-hire truck	485	523	599	508	-1.1%
Private truck	53	64	57	58	0.6%
Rail	769	807	728	805	0.3%
Water	482	568	520	908	4.3%
Inland water	177	450	144	275	3.0%
Great Lakes	204	339	657	347	3.6%
Deep sea	1,024	664	923	1,157	0.8%
Multiple waterways	[c]	[c]	[c]	1,034	[c]
Air (includes truck and air)	1,380	1,919	1,304	1,295	-0.4%
Pipeline[d]	[e]	[e]	[e]	[e]	[c]
Multiple modes	**813**	**895**	**975**	**922**	**0.8%**
Parcel, U.S.P.S. or courier	813	894	975	922	0.8%
Truck and rail	1,347	1,413	1,007	988	-2.0%
Truck and water	1,265	1,950	1,429	1,562	1.4%
Rail and water	1,092	957	1,928	1,073	-0.1%
Other multiple modes	[e]	[e]	1,182	[e]	[c]
Other and unknown modes	**122**	**130**	**116**	**2**	**-24.0%**

Source:
U.S. Department of Transportation, Bureau of Transportation Statistics and U.S. Department of Commerce, Bureau of the Census, *2012 Commodity Flow Survey*, Table 1a. (Additional resources: http://www.census.gov/econ/cfs/2012/ec12tcf-us.pdf)

[a] Detail may not add to total because of rounding.
[b] "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.
[c] Data are not available.
[d] CFS data for pipeline exclude most shipments of crude oil.
[e] Denotes data do not meet publication standards because of high sampling variability or poor response quality.

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 5.18
Summary Statistics on Transit Buses and Trolleybuses, 1994–2013

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	4,262	81.1
1995	67,802	2,198	19,005	4,307	81.9
1996	72,353	2,234	19,280	4,340	83.7
1997	73,425	2,259	19,793	4,434	87.8
1998	72,788	2,188	20,542	4,399	90.4
1999	74,885	2,290	21,391	4,344	92.9
2000	75,665	2,329	21,433	4,531	97.1
2001	76,675	2,389	22,209	4,146	92.1
2002	76,806	2,425	22,029	4,133	91.1
2003	78,000	2,435	21,438	4,213	90.3
2004	81,630	2,484	21,550	4,364	94.0
2005	82,642	2,498	21,998	4,250	93.5
2006	83,689	2,507	22,985	4,316	99.2 [a]
2007	65,808	2,314	21,132	4,372	92.4
2008	67,096	2,388	21,918	4,348	95.3
2009	65,363	2,345	21,645	4,242	91.8
2010	66,810	2,425	21,172	4,118	87.2
2011	69,654	2,425	21,574	4,240	91.5
2012	70,757	2,417	21,251	4,030	89.7
2013	71,699	2,425	22,306	4,071	90.8

Source:
American Public Transportation Association, *2015 Public Transportation Fact Book*, Washington, DC, June 2015, Appendix A. (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, 2011 (latest available)	1,191,786
	E85	862,837
	LPG	139,477
	CNG	118,214
	Electric	67,295
	LNG	3,436
	M85	0
Table 6.8	Number of alternative fuel refuel sites, 2015	48,177
	Electric outlets	28,275
	LPG	3,146
	CNG	1,549
	Biodiesel	753
	Hydrogen	45

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	=	*liquefied natural gas*
LPG	=	*liquefied petroleum gas*
M85	=	*85% methanol, 15% gasoline*
M100	=	*100% methanol*

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,
- electricity,
- biodiesel (B100),
- fuels (other than alcohol) derived from biological materials,
- P-series.

Alternative Fuels 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 expanded its focus to include all advanced transportation fuels, vehicles, and technologies. 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 website: **www.afdc.energy.gov**. 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 website.

Alternative & Advanced Fuels – www.afdc.energy.gov

Alternative Fueling Station Locator – www.afdc.energy.gov/afdc/locator/stations

Alternative & Advanced Vehicles – www.afdc.energy.gov/fuels

State & Federal Incentives & Laws – www.afdc.energy.gov/afdc/laws

Data Analysis & Trends – www.afdc.energy.gov/data

Tools – www.afdc.energylgov/tools

There are almost 1.2 million 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 and represent only fleet vehicles covered under the Energy Policy Act. The Energy Information Administration has not updated these data since the 2011 data were released.

Table 6.1
Estimates of Alternative Fuel Highway Vehicles in Use[a], 1995–2011

Year	LPG	CNG	LNG	M85	M100	E85[b]	E95	Electricity[c]	Hydrogen	**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	176,799	0	47,485	9	**531,708**
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	**634,559**
2007	158,254	114,391	2,781	0	0	364,384	0	55,730	223	**695,763**
2008	151,049	113,973	3,101	0	0	450,327	0	56,901	313	**775,664**
2009	147,030	114,270	3,176	0	0	504,297	0	57,185	357	**826,315**
2010	143,037	115,863	3,354	0	0	618,506	0	57,462	421	**938,643**
2011	139,477	118,214	3,436	0	0	862,837	0	67,295	527	**1,191,786**
				Average annual percentage change						
1995-2011	-1.3%	5.5%	11.5%	-100.0%	-100.0%	48.6%	-100.0%	21.8%		**10.3%**

Note: These are the latest available data from the Energy Information Administration.

Source:
U. S. Department of Energy, Energy Information Administration, *Alternative Fuel Vehicle Data*, Washington, DC, May 2013, website: www.eia.gov/renewable/afv/. 1995-2006, *Annual Energy Review*, Table 10.4. Estimated Number of Alternative-Fueled Vehicles in Use and Replacement Fuel Consumption.

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[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 2009, 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 10 million. Many of these AFVs are sold and used as traditional gasoline-powered vehicles.

[c] Excludes HEVs.

Trollybus, heavy rail, and light rail use nearly all alternative fuels. However, the 41.4% of buses using alternative fuels replace a lot of traditional fuel use. Ferry boats have the highest average age.

Table 6.2
Alternative Fuel Transit Vehicles, 2014

Mode	Average age	Percent powered by alternative fuels	Number of vehicles
Bus[a]	7.8	41.4%	71,139
Commuter rail locomotive[b]	20.0	4.1%	7,310
Commuter rail self-propelled car	20.1	95.0%	[c]
Ferry Boat	27.1	[c]	189
Heavy Rail[d]	21.5	100.0%	10,380
Light Rail[e]	14.4	100.0%	2,054
Paratransit	4.2	16.4%	68,559
Trolleybus	12.4	100.0%	560
Vanpool	[c]	17.0%	14,773

Note: See Glossary for definition of modes, such as paratransit and vanpool. The number of vehicles is a 2012 estimate.

Source:
American Public Transportation Association, *2015 Public Transportation Fact Book*, Washington, DC, June 2015, Appendix A. (Additional resources: www.apta.com)

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[a] Includes bus rapid transit and commuter bus vehicles.
[b] Electric car or diesel-propelled railway for urban passenger train service between a central city and adjacent suburbs.
[c] Data are not available.
[d] An electric railway with the capacity for a heavy volume of traffic.
[e] Typically an electric railway with a light volume traffic capacity with power drawn from an overhead electric line.

Table 6.3
E85 Flex-Fuel Vehicles Available by Manufacturer, Model Year 2015

Model	Type	Emission class
Audi: 1-800-822-AUDI; www.audiusa.com		
A4 quattro	Sedan/Wagon	Tier 2 Bin 5LEV II ULEV
A5 Cabriolet quattro	Sedan/Wagon	Tier 2 Bin 5 LEV II ULEV
A5 quattro	Sedan/Wagon	Tier 2 Bin 5 LEV II ULEV
Allroad quattro	Wagon/Wagon	Tier 2 Bin 5 LEV II ULEV
Q5 AWD	SUV	Tier 2 Bin 5 LEV II ULEV
Bentley: 1-800-777-6923; www.bentleymotors.com		
Continental GT	Sedan	Tier 2 Bin 5 LEV II LEV
Continental GTC	Sedan	Tier 2 Bin 5 LEV II LEV
Continental Flying Spur	Sedan	Tier 2 Bin 5 LEV II LEV
FCA: 1-800-999-FLEET; www.fleetchrysler.com; www.fcagroup.com		
Chrysler 200	Sedan/Wagon	Tier 2 Bin 4
Chrysler 200 FWD/AWD	Sedan/Wagon	Tier 2 Bin 4
Chrysler 300 RWD/AWD	Sedan/Wagon	Tier 2 Bin 4
Chrysler Dart	Sedan/Wagon	Tier 2 Bin 4
Chrysler Town & Country	Van	Tier 2 Bin 4
Dodge Charger Police Pursuit	Sedan/Wagon	TBD
Dodge Charger RWD/AWD	Sedan/Wagon	Tier 2 Bin 4
Dodge Durango Police Special Service Vehicle	SUV	TBD
Dodge Durango RWD/AWD	SUV	Tier 2 Bin 4
Dodge Grand Caravan	Van	Tier 2 Bin 4
Dodge Journey FWD	SUV	Tier 2 Bin 4
Dodge Ram 1500 2WD/4WD	Truck	TBD
Dodge Ram CV	Van	Tier 2 Bin 4
Ford: 1-800-392-3673 (Ford); 1-800-521-4140 (Lincoln); www.ford.com; www.fleet.ford.com		
Ford Expedition 2WD/4WD	SUV	TBD
Ford Explorer FWD/AWD	SUV	Tier 2 Bin 5
Ford F-150 2WD/4WD	Truck	Tier 2 Bin 5
Ford Focus	Sedan/Wagon	TBD
Ford Police Interceptor	Sedan/Wagon	TBD
Ford Police Interceptor Utility	SUV	TBD
Ford Super Duty F-250/350	Truck	Tier 2 Bin 8
Ford Super Duty F-350	Vocational/Cab Chassis	Tier 2 Bin 8
Ford Taurus FWD/AWD	Sedan/Wagon	Tier 2 Bin 5
Ford Transit 150/250/350	Van	Tier 2 Bin 8
Ford Transit 250/350	Vocational/Cab Chassis	TBD
General Motors Corporation: 1-800-988-7267; 1-866-694-6546; www.gm.com		
Buick LaCrosse FWD/AWD	Sedan/Wagon	Tier 2 Bin 4
Buick Regal FWD/AWD	Sedan/Wagon	TBD
Buick Verano	Sedan/Wagon	TBD
Cadillac ATS RWD/AWD	Sedan/Wagon	TBD
Chevrolet Caprice Police Patrol Vehicle	Sedan/Wagon	TBD
Chevrolet Captiva	SUV	Tier 2 Bin 4
Chevrolet Equinox	SUV	Tier 2 Bin 4
Chevrolet Express 2500/3500	Van	TBD
Chevrolet Impala	Sedan/Wagon	Tier 2 Bin 4
Chevrolet Impala Limited Police	Sedan/Wagon	Tier 2 Bin 4
Chevrolet Silverado 1500 2WD/4WD	Truck	Tier 2 Bin 4
Chevrolet Silverado 1500 Cab-chassis 2WD/4WD	Vocational/Cab Chassis	TBD
Chevrolet Silverado 1500 Special Services 2WD/4WD	Truck	Tier 2 Bin 4

Table 6.3 (continued)
E85 Flex-Fuel Vehicles Available by Manufacturer, Model Year 2015

Model	Type	Emission class
General Motors Corporation (continued)		
Chevrolet Silverado 2500 2WD/4WD	Truck	TBD
Chevrolet Silverado 3500 2WD/4WD	Truck	TBD
Chevrolet Suburban 2WD/4WD	SUV	Tier 2 Bin 4
Chevrolet Tahoe 2WD/4WD	SUV	Tier 2 Bin 4
Chevrolet Tahoe Police 2WD/4WD	SUV	Tier 2 Bin 4
GMC Savana 2500/3500	Van	TBD
GMC Sierra 1500 2WD/4WD	Truck	Tier 2 Bin 4
GMC Sierra 1500 Cab-chassis 2WD/4WD	Vocational/Cab Chassis	TBD
GMC Sierra 2500 2WD/4WD	Truck	TBD
GMC Sierra 3500 2WD/4WD	Truck	TBD
GMC Terrain	SUV	Tier 2 Bin 4
GMC Yukon 2WD/4WD	SUV	Tier 2 Bin 4
GMC Yukon XL 2WD/4WD	SUV	Tier 2 Bin 4
Jeep Cherokee FWD/4WD	SUV	Tier 2 Bin 4
Jeep Grand Cherokee 2WD/4WD	SUV	Tier 2 Bin 4
Jaguar: 1-800-4-JAGUAR; www.jaguarusa.com		
XF E85 flex fuel	Sedan/Wagon	Tier 2 Bin 5 LEV II ULEV
XJ E85 flex fuel	Sedan/Wagon	Tier 2 Bin 5 LEV II ULEV
XJL E85 flex fuel	Sedan/Wagon	Tier 2 Bin 5 LEV II ULEV
Land Rover: 1-800-FIND-4WD or 1-800-637-6837; www.landrover.com/us/en/lr/		
Range Rover	SUV	Tier 2 Bin 5 LEV II ULEV
Range Rover L	SUV	Tier 2 Bin 5 LEV II ULEV
Range Rover Sport	SUV	Tier 2 Bin 5 LEV II ULEV
Mercedes-Benz: 1-800-FOR-MERCEDES; www.mbusa.com		
E300	Sedan/Wagon	Tier 2 Bin 5
E350 4Matic	Sedan/Wagon	Tier 2 Bin 5 LEV II ULEV
GLA 250 4Matic	SUV	Tier 2 Bin 5
ML350 4Matic	SUV	Tier 2 Bin 5 LEV II ULEV
Nissan: 1-800-NISSAN-1; www.nissanusa.com		
Armada 2WD/4WD	SUV	Tier 2 Bin 5
Titan 2WD/4WD	Truck	Tier 2 Bin 5
Toyota: 1-800-331-4331; www.toyota.com		
Sequoia 4WD	SUV	Tier 2 Bin 5 LEV II ULEV
Tundra 4WD	Truck	Tier 2 Bin 5 LEV II ULEV

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. TBD = to be determined.

Source:
U.S. Department of Energy, Alternative Fuels Data Center, website,
www.afdc.energy.gov/afdc/vehicles/flexible_fuel.html, April 2015. (Additional resources: www.eere.energy.gov/afdc/)

Table 6.4
Non-E85 Alternative Fuel Vehicles Available by Manufacturer, Model Year 2015

Model	Fuel	Vehicle type
FCA: 1-800-999-FLEET; www.fleetchrysler.com; www.fcagroup.com		
Dodge Ram 1500 2WD/4WD	B20	SUV
Dodge Ram 2500 HD 2WD/4WD	Bi-fuel/CNG	Truck
Dodge Ram 2500/3500 HD 2WD/4WD	B20	Truck
Dodge Ram 3500 HD 2WD/4WD	B20	Vocational/Cab Chassis
Ford: 1-800-392-3673 (Ford); www.ford.com; www.fleet.ford.com		
Ford E-350/450	CNG	Vocational/Cab Chassis
Ford E-350/450	LPG	Vocational/Cab Chassis
Ford Super Duty F-250/350	CNG	Truck
Ford Super Duty F-250/350	LPG	Truck
Ford Super Duty F-250/350/450	B20	Truck
Ford Super Duty F-350/450/550	CNG	Vocational/Cab Chassis
Ford Super Duty F-350/450/550	LPG	Vocational/Cab Chassis
Ford Super Duty F-450/550/650	B20	Vocational/Cab Chassis
Ford Super Duty F-650	LPG	Vocational/Cab Chassis
Ford Super Duty F-650	CNG	Vocational/Cab Chassis
Ford Transit 150/250/350	B20	Van
Ford Transit 250/350	B20	Vocational/Cab Chassis
Ford Transit Connect	LPG	Van
Ford Transit Connect	CNG	Van
Ford Transit T-150/250/350	LPG	Vocational/Cab Chassis
Ford Transit T-150/250/350	CNG	Vocational/Cab Chassis
General Motors Corporation: 1-800-988-7267; 1-866-694-6546; www.gm.com		
Chevrolet Cruze	B20	Sedan/Wagon
Chevrolet Express 2500/3500	B20	Van
Chevrolet Express 2500/3500	CNG	Van
Chevrolet Express 3500/4500	LPG	Vocational/Cab Chassis
Chevrolet Express 3500/4500	B20	Vocational/Cab Chassis
Chevrolet Express 3500/4500	CNG	Vocational/Cab Chassis
Chevrolet Impala	Bi-fuel/CNG	Sedan/Wagon
Chevrolet Silverado 2500/3500 HD (2WD/4WD)	Bi-fuel/CNG	Truck
Chevrolet Silverado 2500/3500 HD (2WD/4WD)	B20	Truck
Chevrolet Silverado 3500 HD (2WD/4WD)	B20	Vocational/Cab Chassis
GMC Savana 2500/3500	B20	Van
GMC Savana 2500/3500	CNG	Van
GMC Savana 3500/4500	LPG	Vocational/Cab Chassis
GMC Savana 3500/4500	CNG	Vocational/Cab Chassis
GMC Savana 3500/4500	B20	Vocational/Cab Chassis
GMC Sierra 2500/3500 HD (2WD/4WD)	B20	Truck
GMC Sierra 2500/3500 HD (2WD/4WD)	Bi-fuel/CNG	Truck
GMC Sierra 3500 HD (2WD/4WD)	B20	Vocational/Cab Chassis
Jeep Grand Cherokee 2WD/4WD	B20	SUV
Honda: 1-888-999-1009; www.automobiles.honda.com		
Honda Civic	CNG	Sedan/Wagon

Table 6.4 (continued)
Non-E85 Alternative Fuel Vehicles Available by Manufacturer, Model Year 2015

Model	Fuel	Vehicle type
Hyundai: 1-800-633-5151; www.hyundai.com		
Hyundai Tucson Fuel Cell Vehicle	Hydrogen Fuel Cell	SUV
Mercedes-Benz: 1-800-367-6372; www.mbusa.com		
Mercedes-Benz B-Class F-Cell	Hydrogen Fuel Cell	Sedan/Wagon
Toyota: 1-800-331-4331; www.toyota.com		
Toyota Mirai	Hydrogen Fuel Cell	Sedan/Wagon

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

Source:
U.S. Department of Energy, Alternative Fuels Data Center, website, www.afdc.energy.gov/afdc/vehicles/flexible_fuel.html. (Additional resources: www.eere.energy.gov/afdc/)

The hybrid share of all light vehicles fell to 2.8% of all light vehicle sales in 2014. Plug-in vehicles certified for highway use began selling in 2010 and were 0.7% of the light vehicle market in 2014.

Table 6.5
Hybrid and Plug-In Vehicle Sales, 1999-2014

Calendar year	Hybrid vehicle sales (thousands)	Plug-in vehicle sales (thousands)	All light vehicle sales (thousands)	Hybrid share of all light vehicles	Plug-in share of all light vehicles
1999	0.0	0.0	16,711	0.0%	0.0%
2000	9.4	0.0	17,164	0.1%	0.0%
2001	20.3	0.0	16,950	0.1%	0.0%
2002	36.0	0.0	16,675	0.2%	0.0%
2003	47.6	0.0	16,494	0.3%	0.0%
2004	84.2	0.0	16,737	0.5%	0.0%
2005	205.9	0.0	16,774	1.2%	0.0%
2006	251.9	0.0	16,336	1.5%	0.0%
2007	351.1	0.0	15,867	2.2%	0.0%
2008	315.8	0.0	13,015	2.4%	0.0%
2009	290.3	0.0	10,236	2.8%	0.0%
2010	274.6	0.3	11,394	2.4%	0.0%
2011	266.5	17.8	12,539	2.1%	0.1%
2012	434.6	53.2	14,219	3.1%	0.4%
2013	495.5	97.1	15,278	3.2%	0.6%
2014	452.2	118.9	16,171	2.8%	0.7%

Note: Plug-in vehicle sales include only those vehicles certified for highway use. Small electric carts and neighborhood electric vehicles are excluded.

Sources:
Hybrid and Electric Vehicle Sales – Compiled by the Transportation Research Center at Argonne National Laboratory, 2015.
All Light Vehicle Sales – Table 3.11.

Table 6.6
Electric Drive Vehicles Available by Manufacturer, Model Year 2015

Model	Drive Type	Vehicle Type	Emissions Class
Audi: 1-800-822-AUDI; www.audiusa.com			
A3 e-tron	PHEV	Sedan/Wagon	
Q5 Hybrid AWD	HEV	SUV	LEV II ULEV, Tier 2 Bin 5
BMW: 1-800-831-1117; www.bmwusa.com			
ActiveHybrid 3	HEV	Sedan/Wagon	LEV II ULEV, Tier 2 Bin 5
ActiveHybrid 5	HEV	Sedan/Wagon	Tier 2 Bin 5, LEV II ULEV
ActiveHybrid 7	HEV	Sedan/Wagon	Tier 2 Bin 5, LEV II ULEV
i3	EV	Sedan/Wagon	N/A
i3 w/Range Extender	PHEV	Sedan/Wagon	N/A
i8	PHEV	Sedan/Wagon	N/A
FCA: 1-800-999-FLEET; www.fleetchrysler.com; www.fcagroup.com			
Fiat 500e	EV	Sedan/Wagon	Tier 2 Bin 1, ZEV
Ford: 1-800-392-3673 (Ford); 1-800-521-4140 (Lincoln); www.ford.com; www.fleet.ford.com			
Ford C-MAX Energi	PHEV	Sedan/Wagon	LEV II PZEV, Tier 2 Bin 3
Ford C-MAX Hybrid	HEV	Sedan/Wagon	Tier 2 Bin 3, LEV II PZEV
Ford Focus	EV	Sedan/Wagon	Tier 2 Bin 1, ZEV
Ford Fusion Energi	PHEV	Sedan/Wagon	LEV II PZEV, Tier 2 Bin 3
Ford Fusion Hybrid	HEV	Sedan/Wagon	Tier 2 Bin 3, LEV II PZEV
Lincoln MKZ Hybrid	HEV	Sedan/Wagon	LEV II PZEV, Tier 2 Bin 3
General Motors: 1-800-988-7267; 1-866-694-6546; www.gm.com			
Cadillac ELR	PHEV	Sedan	LEV III SULEV30, Tier 2 Bin 3
Chevrolet Spark	EV	Sedan	Tier 2 Bin 1, ZEV
Chevrolet Volt	PHEV	Sedan	Tier 2 Bin 3, LEV III SULEV30
Honda: 1-888-999-1009; www.automobiles.honda.com			
Accord Hybrid	HEV	Sedan/Wagon	Tier 2 Bin 3, LEV III SULEV30
Accord Plug-in Hybrid	PHEV	Sedan/Wagon	California SULEV, Tier 2 Bin 2
Civic Hybrid	HEV	Sedan/Wagon	LEV II PZEV, Tier 2 Bin 3
CR-Z	HEV	Sedan/Wagon	LEV II PZEV, Tier 2 Bin 2
Hyundai: 1-800-633-5151; www.hyundai.com			
Sonota	HEV	Sedan/Wagon	LEV II PZEV, Tier 2 Bin 2
Tucson Fuel Cell Vehicle	FCV	SUV	LEV II ZEV
Infiniti: 1-800-662-6200; www.infinitiusa.com			
Q50 Hybrid FWD/AWD	HEV	Sedan/Wagon	Tier 2 Bin 5, LEV II ULEV
Q50 Hybrid S FWD/AWD	HEV	Sedan/Wagon	LEV II ULEV, Tier 2 Bin 5
Q70 Hybrid	HEV	Sedan/Wagon	Tier 2 Bin 5, LEV II ULEV
QX60 Hybrid	HEV	SUV	LEV II ULEV, Tier 2 Bin 5
Kia: 1-800-333-4KIA; www.kia.com			
Optima	HEV	Sedan/Wagon	Tier 2 Bin 2, LEV II PZEV
Soul	EV	Sedan/Wagon	ZEV, Tier 2 Bin 1
Lexus: 1-800-255-3987; www.lexus.com			
300h	HEV	Sedan/Wagon	Tier 2 Bin 3, LEV II SULEV
CT 200h	HEV	Sedan/Wagon	Tier 2 Bin 3, LEV II SULEV
GS 450h	HEV	Sedan/Wagon	Tier 2 Bin 3, LEV II SULEV
GS 450h F Sport	HEV	Sedan/Wagon	TBD
LS 600h L	HEV	Sedan/Wagon	TBD
NX 300h	HEV	Sedan/Wagon	Tier 2 Bin 3, LEV III SULEV30
RX 450h	HEV	SUV	Tier 2 Bin 3, LEV II SULEV

Table 6.6 (continued)
Electric Drive Vehicles Available by Manufacturer, Model Year 2015

Model	Drive Type	Vehicle Type	Emissions Class
McLaren: +44 (0) 1483 261500; www.cars.mclaren.com			
P1	PHEV	Sedan/Wagon	N/A
Mercedes-Benz: 1-800-FOR MERCEDES; www.mbusa.com			
B-Class Electric	EV	Sedan/Wagon	ZEV, Tier 2 Bin 1
B-Class F-Cell	FCV	Sedan/Wagon	California ZEV, Tier 2 Bin 1
E 400 Hybrid	HEV	Sedan/Wagon	LEV II PZEV, Tier 2 Bin 4
S550 Plug-in Hybrid	PHEV	Sedan/Wagon	TBD
Mitsubishi: 1-800-648-7820; www.mitsubishicars.com			
i-MiEV	EV	Sedan/Wagon	ZEV, Tier 2 Bin 1
Nissan: 1-800-NISSAN-1; www.nissanusa.com			
Leaf	EV	Sedan/Wagon	Tier 2 Bin 1, ZEV
Pathfinder Hybrid 2WD/AWD	HEV	SUV	Tier 2 Bin 5, LEV II ULEV
Porsche: 1-800-PORSCHE; www.porsche.com/usa/			
918 Spyder	PHEV	Sedan/Wagon	Tier 2 Bin 5, LEV II LEV
Cayenne S E-Hybrid	PHEV	SUV	LEV II ULEV, Tier 2 Bin 5
Panamera S E-Hybrid	PHEV	Sedan/Wagon	LEV II ULEV, Tier 2 Bin 5
Smart: 1-800-762-7887; www.smartusa.com			
fortwo	EV	Sedan/Wagon	ZEV, Tier 2 Bin 1
Subaru: 1-800-782-2783; www.subaru.com			
XV Crosstrek	HEV	SUV	Tier 2 Bin 3, LEV II SULEV
Tesla: 1-877-798-3752; www.teslamotors.com			
Model S	EV	Sedan/Wagon	ZEV, Tier 2 Bin 1
Toyota: 1-800-331-4331; www.toyota.com			
Avalon	HEV	Sedan/Wagon	Tier 2 Bin 3, LEV II SULEV
Camry	HEV	Sedan/Wagon	Tier 2 Bin 3, LEV II PZEV
Highlander	HEV	SUV	LEV II PZEV, Tier 2 Bin 3
Mirai	FCV	FCV	California ZEV, Tier 2 Bin 1
Prius	HEV	Sedan/Wagon	Tier 2 Bin 3, LEV II PZEV
Prius c	HEV	Sedan/Wagon	LEV II SULEV, Tier 2 Bin 3
Prius Plug-in	PHEV	Sedan/Wagon	LEV II PZEV, Tier 2 Bin 3
Prius v	HEV	Sedan/Wagon	Tier 2 Bin 3, LEV II SULEV
Volkswagen: 1-800-822-8987; www.vw.com			
e-Golf	EV	Sedan/Wagon	ZEV, Tier 2 Bin 1
Jetta Hybrid	HEV	Sedan/Wagon	Tier 2 Bin 3, LEV II PZEV
Touareg Hybrid	HEV	SUV	TBD

Note: HEV = hybrid-electric vehicle; PHEV = plug-in hybrid-electric vehicle; EV = electric vehicle; FCV = fuel cell vehicle; 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 = advanced technology - partial zero emissions vehicle. See Chapter 12 for details on emissions.

Source:
U.S. Department of Energy, Alternative Fuels Data Center, website, www.afdc.energy.gov/afdc/flexible_fuel.html, April 2015. (Additional resources: www.eere.energy.gov/afdc/)

Table 6.7
Electric-Drive Medium/Heavy Trucks and Buses Available by Manufacturer, 2015

Manufacturer - Model	Drive type	Truck type
Autocar E3 Hybrid	Hybrid electric	Refuse
Balqon Mule M150	Electric	Vocational truck
Balqon XE-20	Electric	Tractor
Balqon XE-30	Electric	Tractor
Boulder Electric Vehicle DV-500 Delivery Truck	Electric	Step van
Capacity Trucks HETT	Electric	Tractor
Capacity Trucks ZETT	Fuel cell vehicle	Tractor
Champion Bus Inc. Defender	Hybrid electric	Shuttle bus
Collins Bus Corp. NexBus Gasoline Hybrid	Hybrid electric	Shuttle bus
Daimler Buses North America Orion VII Hybrid Low-Floor	Hybrid electric	Transit bus
DesignLine Corp. EcoSaver IV	Hybrid CNG-electric	Transit bus
DesignLine Corp. Eco-Smart 1	Electric	Transit bus
Ebus EBUS22FC	Fuel cell vehicle	Shuttle bus
ElDorado National Axess	Fuel cell vehicle	Transit bus
ElDorado National Axess	Hybrid electric	Transit bus
ElDorado National E-Z Rider II BRT	Hybrid electric	Transit bus
Electric Vehicles International EVI-MD	Electric	Vocational truck
Electric Vehicles International WI EVI	Electric	Step van
Enova Systems Enova Ze step van	Electric	Step van
Foton America FCB 30-foot; FCB 35-foot; FCB 40-foot	Hybrid electric	Transit bus
Freightliner M2 106	Hybrid electric	Tractor
Freightliner M2 106 Hybrid	Hybrid electric	Vocational tractor
GGT Electric Electric	Electric	Vocational truck
Gillig Corp. Diesel-Electric Hybrid Bus and CNG Bus	Hybrid electric	Transit bus
Glaval Bus Universal	Hybrid electric	Shuttle bus
Hino 195h	Hybrid electric	Vocational truck
IC Bus HC Hybrid Series	Hybrid electric	Shuttle bus
International DuraStar Hybrid	Hybrid electric	Vocational truck
Kenworth T270 hybrid	Hybrid electric	Vocational tractor
Kenworth T370 diesel electric tractor	Hybrid electric	Tractor
Kenworth T370 hybrid truck	Hybrid electric	Vocational truck
Motor Coach Industries D4500 CT Hybrid Commuter Coach	Hybrid electric	Transit bus
Navistar HC300 Hybrid	Hybrid electric	School bus
Navistar-Modec EV Alliance eStar	Electric	Step van
New Flyer Xcelsior	Fuel cell vehicle	Transit bus
New Flyer Xcelsior	Hybrid electric	Transit bus
New Flyer Xcelsior	Electric	Transit bus
North American Bus Industries 31LFW / 35LFW / 40LFW	Hybrid electric	Transit bus
North American Bus Industries 42BRT	Hybrid electric	Transit bus
North American Bus Industries 60BRT	Hybrid electric	Transit bus
North American Bus Industries CompoBus	Hybrid electric	Transit bus
Nova Bus LFS Artic HEV	Hybrid electric	Transit bus
Nova Bus LFS HEV	Hybrid electric	Transit bus
Nova Bus LFX	Hybrid electric	Transit bus
Peterbilt Motors 330 Hybrid	Hybrid electric	Vocational truck
Peterbilt Motors 337/338	Hybrid electric	Vocational tractor
Peterbilt Motors 386HE	Hybrid electric	Tractor
Proterra EcoRide BE35	Electric	Transit bus
Smith Electric Vehicles Newton	Electric	Vocational truck
Smith Electric Vehicles Newton Step Van	Electric	Step van
Thomas Built Buses Saf-T-Liner C2e Hybrid	Hybrid electric	School bus
Trans Tech ETrans	Electric	School bus
Turtle Top Odyssey XLT	Hybrid electric	Shuttle bus
Van Hool A300L Fuel Cel	Fuel cell vehicle	Transit bus
Vision Motor Corp. Tyrano	Fuel cell vehicle	Tractor
Vision Motor Corp. ZETT Zero Emission Terminal Tractor	Fuel cell vehicle	Tractor
ZeroTruck	Electric	Vocational truck

Source:
U.S. Department of Energy, Alternative Fuels Data Center, website, www.afdc.energy.gov/vehicles/search/, May 2015. (Additional resources: www.eere.energy.gov/afdc/)

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

Table 6.8
Number of Alternative Refuel Sites by State and Fuel Type, 2015

State	B20 sites	CNG sites	E85 sites	Electric stations	Electric charging outlets	Hydrogen sites	LNG sites	LPG sites	Totals by State[a]
Alabama	5	25	32	71	110	1	2	102	348
Alaska	0	1	0	1	1	0	0	6	9
Arizona	78	36	31	317	801	1	7	74	1,345
Arkansas	4	13	47	44	62	0	1	42	213
California	64	294	98	2,513	8,079	18	44	299	11,409
Colorado	18	41	89	234	531	1	0	51	965
Connecticut	3	14	3	209	405	1	1	16	652
Delaware	1	1	1	18	30	1	0	7	59
Dist. of Columbia	7	2	3	68	159	0	0	0	239
Florida	17	46	62	601	1,341	0	1	72	2,140
Georgia	24	31	49	359	805	0	4	60	1,332
Hawaii	9	1	3	214	486	3	0	3	719
Idaho	3	10	7	19	34	0	8	27	108
Illinois	12	51	237	427	923	1	1	112	1,764
Indiana	6	30	192	137	255	0	2	182	804
Iowa	9	7	211	64	118	0	0	23	432
Kansas	7	12	25	119	281	0	0	38	482
Kentucky	4	8	67	46	144	0	1	51	321
Louisiana	2	25	9	47	77	0	2	33	195
Maine	3	2	0	38	56	0	0	15	114
Maryland	8	11	34	292	677	0	0	21	1,043
Massachusetts	12	25	9	316	803	1	1	22	1,189
Michigan	16	26	238	299	731	4	0	83	1,397
Minnesota	6	19	278	222	464	0	0	30	1,019
Mississippi	4	8	5	33	35	0	0	115	200
Missouri	5	20	105	115	205	1	0	69	520
Montana	7	2	2	9	32	0	0	50	102
Nebraska	3	11	79	28	50	0	0	27	198
Nevada	5	8	22	95	284	1	3	36	454
New Hampshire	4	3	0	55	90	0	0	13	165
New Jersey	5	27	5	159	376	0	0	10	582
New Mexico	8	14	12	26	63	0	1	48	172
New York	37	114	84	523	1,137	5	0	52	1,952
North Carolina	132	38	24	288	704	0	1	91	1,278
North Dakota	4	1	68	4	5	0	0	20	102
Ohio	13	49	134	159	272	0	3	78	708
Oklahoma	5	106	28	35	49	0	1	143	367
Oregon	23	15	6	429	1,014	0	2	37	1,526
Pennsylvania	6	52	37	241	387	2	1	79	805
Rhode Island	6	6	0	63	163	0	0	5	243
South Carolina	41	9	72	153	262	2	1	52	592
South Dakota	2	0	85	11	32	0	0	22	152
Tennessee	37	17	71	384	894	0	2	95	1,500
Texas	21	103	137	719	1,904	1	13	455	3,353
Utah	3	91	3	79	165	0	6	36	383
Vermont	1	3	1	64	155	0	0	2	226
Virginia	11	22	17	258	670	1	0	74	1,053
Washington	31	24	21	562	1,525	0	1	74	2,238
West Virginia	2	3	9	29	102	0	0	12	157
Wisconsin	6	60	152	178	310	0	1	57	764
Wyoming	13	12	10	10	17	0	0	25	87
Totals by Fuel	753	1,549	2,914	11,384	28,275	45	111	3,146	48,177

Source:
U.S. Department of Energy, Alternative Fuels Data Center website, www.afdc.energy.gov/afdc/fuels/stations_counts.html, May 2015.

[a] Totals by State is the total number of fuel types available at stations. Stations are counted once for each type of fuel available.

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, May 2015. (Additional resources: www.eere.energy.gov/cleancities/progs/coalition_locations.php)

Table 6.9
Properties of Conventional and Alternative Liquid Fuels

Property	Liquid Fuels			
	Gasoline	Low-sulfur diesel	Methanol	Ethanol
Standard chemical formula[a]	C_4 to C_{12}	C_8 to C_{25}	CH_3OH	CH_3CH_2OH
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
Gasoline gallon equivalent (GGE)[b] (Fuel unit measured/GGE)	1.0 (EO gasoline)	0.889 (Diesel gal/GGE)	2.04 Methanol gal/GGE)	1.20-1.37 (E85[c] gal/GGE) 1.03 (E10 gal/GGE)
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
Autoignition temperature (F˚)	495	~600	897	793
Reid vapor pressure (psi)	8–15	<0.2	4.6	2.3

Source:
Alternative Fuels Data Center, "Properties of Fuel," www.eere.energy.gov/afdc/pdfs/fueltable.pdf , July 2015 and communication with George Mitchell, National Renewable Energy Laboratory, July 2015.

[a] Standard Chemical Formulas represent idealized fuels. Some table values are expressed in ranges to represent typical fuel variations that are encountered in the field.
[b] GGE table values above reflect BTU range for common gasoline baseline references (E0, E10, and indolene certification fuel).
[c] 1 gallon of E85 has 73% to 83% of the energy of one gallon gasoline (variation due to ethanol content in E85)

Table 6.10
Properties of Conventional and Alternative Gaseous Fuels

Property	Gaseous Fuels		
	Propane (LPG)	CNG	Hydrogen
Standard chemical formula[a]	C_3H_8	CH_4	H_2
Physical state	Pressurized liquid	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(s)	Underground reserves	Underground reserves and renewable Bio-gas	Natural gas, methanol, electrolysis, and other energy sources
Gasoline gallon equivalent (GGE)[b] (Fuel unit measured/GGE)	1.34-1.38 (LPG gal/GGE)	5.56-5.71 (lb. mass/GGE)[c]	0.991-1.017 (kg mass/GGE)
Diesel gallon equivalent (DGE) (Fuel unit measured/DGE)	1.54 (LPG gal/DGE)	6.38 (lb. mass/DGE)	n/a
Specific Gravity (60˚ F/60˚F)	1.55	0.60	0.069
Density (lb./cu ft @ 60˚F)	0.124	0.0458	0.0056
Freezing point (F˚)	-305.8	-296	-435
Boiling Point (˚F)	-44	-260	-423
Autoignition temperature (F˚)	850-950	1,004	1,050-1,080
Reid vapor pressure (psi)	208	n/a	n/a

Note: n/a = not applicable.

Source:
Alternative Fuels Data Center, "Properties of Fuel," www.eere.energy.gov/afdc/pdfs/fueltable.pdf , July 2015 and communication with George Mitchell, National Renewable Energy Laboratory, July 2015.

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[a] Standard Chemical Formulas represent idealized fuels. Some table values are expressed in ranges to represent typical fuel variations that are encountered in the field.
[b] GGE table values above reflect BTU range for common gasoline baseline references (E0, E10, and indolene certification fuel).
[c] CNG: 1 Gasoline Gallon Equivalent = 5.66 lb. (as referenced by NIST Special Publication 854; Report of the 78th NCWM (1993); p. 326; NG data derived from field sampling of pipeline natural gas by IGT/GRI).

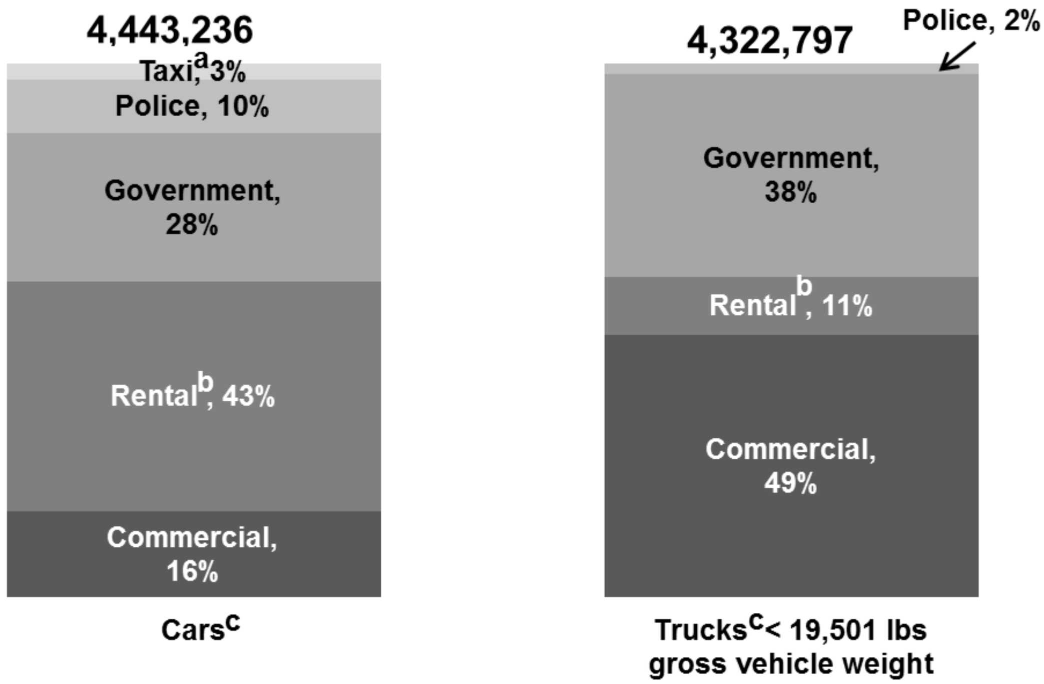
Chapter 7
Fleet Vehicles and Characteristics

Summary Statistics from Tables in this Chapter

Source		
Figure 7.1	Fleet cars, 2014	4,443,236
Figure 7.1	Fleet trucks ≤ 19,500 lbs. GVW, 2014	4,322,797
Table 7.3	Average annual miles per business fleet vehicle	
	SUVs	*27,816*
	Intermediate cars	*25,068*
	Pickup trucks	*25,824*
Figure 7.2	Average annual miles per Federal Government fleet vehicle, 2013	
	Sedans	*10,598*
	SUVs	*9,686*
	Buses	*7,923*
	Heavy trucks	*6,760*
	Medium trucks	*6,547*
	Light trucks	*6,237*
	Ambulances	*6,078*
Table 7.4	Federal government vehicles, FY 2013	635,748
	Light trucks (<8,500 lbs. GVW)	*278,716*
	Cars and other passenger vehicles	*235,624*
	Medium trucks (8,500–26,000 lbs. GVW)	*77,325*
	Heavy trucks (>26,000 lbs. GVW)	*34,624*
	Buses and ambulances	*9,549*

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 January 1, 2014



Source:
Bobit Publishing Company, Automotive Fleet Research Department, *Automotive Fleet Factbook 2014*, Redondo Beach, CA, 2015. (Additional resources: www.fleet-central.com)

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[a] Taxi category includes taxis that are vans in addition to cars.
[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 had the largest light fleet vehicle registrations in 2013 with over 1.6 million new vehicles, most of them cars (60.8%). Only 28.2% of the new commercial fleet registrations were cars.

Table 7.1
New Light Fleet Vehicle Registrations by Vehicle Type, Calendar Year 2013

	Commercial	Rental	Government	Total
Cars	28.2%	60.8%	33.4%	50.3%
Pickup trucks	31.5%	5.0%	25.5%	13.4%
Vans	19.3%	9.3%	13.7%	12.2%
Sport utility vehicles	21.0%	24.9%	27.4%	24.1%
Total	641,990	1,615,421	170,027	2,247,438

Source:
Bobit Publishing Company, *Automotive Fleet Factbook 2014*, www.automotive-fleet.com/statistics. (Additional resources: www.fleet-central.com)

Table 7.2
Average Length of Time Commercial Fleet Vehicles Are in Service, 2013

Vehicle type	Average months in service
Compact cars	44
Intermediate cars	34
Pickup trucks	49
Minivans	41
Sport utility vehicles	33
Full-size vans	55

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

Source:
Bobit Publishing Company, *Automotive Fleet Factbook 2014*, www.automotive-fleet.com. (Additional resources: www.fleet-central.com)

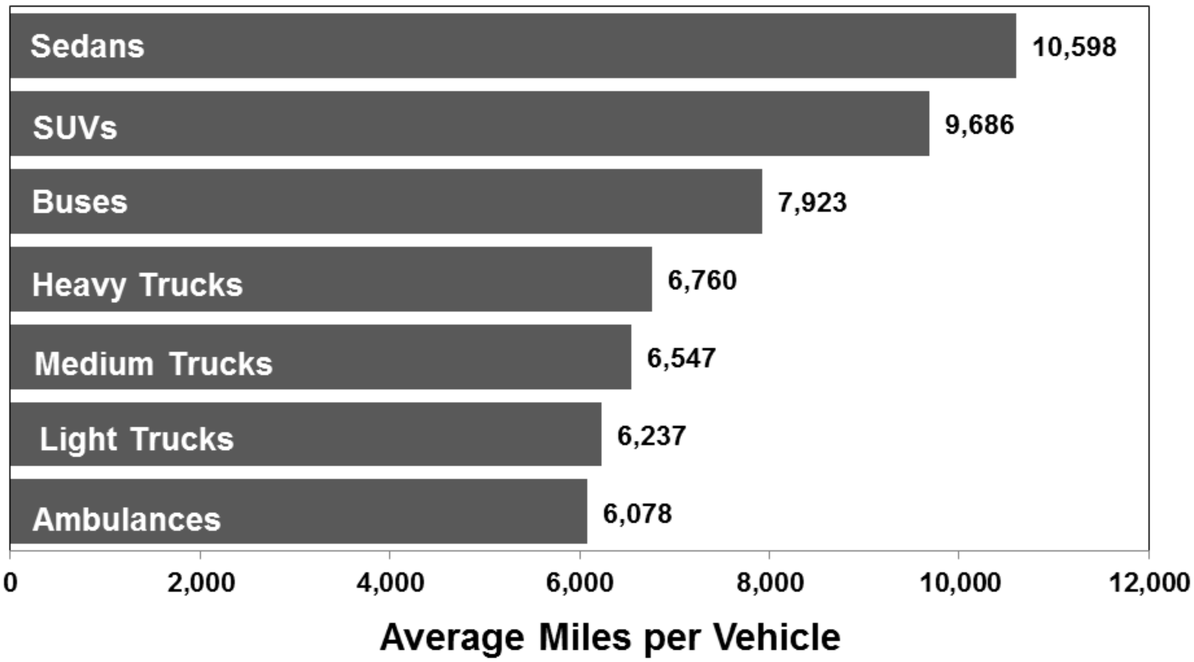
Table 7.3
Average Annual Vehicle-Miles of Travel
for Commerical Fleet Vehicles, 2013

Business fleet vehicles	Average annual miles of travel
Compact cars	24,876
Intermediate cars	25,068
Pickup trucks	25,824
Minivans	27,864
Sport utility vehicles	27,816
Full-size vans	30,204

Source:
Bobit Publishing Company, *Automotive Fleet Factbook 2014*, www.automotive-fleet.com. (Additional resources: www.fleet-central.com)

These data, which apply to domestic Federal fleet vehicles, indicate that sedans now have the highest average annual miles per vehicle, followed closely by sport utility vehicles (SUVs) and buses.

Figure 7.2. Average Miles per Domestic Federal Vehicle by Vehicle Type, 2013



Note: Light trucks = less than 8,500 pounds gross vehicle weight ratio (GVWR).
Medium trucks = 8,501-23,999 pounds GVWR.
Heavy trucks = 24,000 pounds GVWR or more.

Source:
U.S. General Services Administrations, Federal Vehicle Policy Division, *FY 2013 Federal Fleet Report*, Washington, DC, 2014, 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, 2001-2013

Vehicle Type	2001	2005	2007	2008	2009	2010	2011	2012	2013
Passenger vehicles									
Low-speed vehicle	0	0	0	0	0	3,029	3,869	3,893	3,729
Subcompact	5,462	2,401	1,968	3,058	5,935	6,797	10,658	13,867	20,368
Compact	60,938	58,284	48,495	41,482	36,662	46,489	49,657	47,999	41,564
Midsize	36,921	36,656	48,622	55,157	57,284	48,242	38,057	33,321	30,659
Large	11,107	15,966	11,907	10,679	10,230	10,063	9,146	8,571	6,753
Limousines	116	191	217	238	349	412	158	130	123
Light duty passenger vans	56,563	42,109	43,203	43,131	41,855	41,676	40,964	39,518	38,409
Medium duty passenger vans	727	13,252	15,231	15,696	15,362	15,218	16,633	15,740	14,115
Light duty SUVs	40,842	50,445	53,837	56,329	64,793	66,316	68,807	73,356	70,371
Medium duty SUVs	0	6,096	7,733	10,837	7,344	11,117	11,448	9,405	9,533
Total passenger vehicles	**212,676**	**225,400**	**231,213**	**236,607**	**239,814**	**249,359**	**249,397**	**245,800**	**235,624**
Trucks and other vehicles									
Light trucks 4x2	227,937	243,477	243,720	243,143	244,022	241,011	238,261	233,629	231,886
Light trucks 4x4	29,975	35,417	40,115	34,962	36,713	40,105	47,035	48,690	46,830
Medium trucks	88,993	83,747	84,414	88,509	89,052	89,253	81,791	78,630	77,325
Heavy trucks	27,988	35,230	32,492	32,752	32,629	32,760	33,951	33,642	34,624
Ambulances	1,819	1,580	1,982	1,474	1,433	1,480	1,445	1,401	1,363
Buses	6,726	7,837	8,297	8,044	8,040	8,186	7,978	8,269	8,186
Total trucks and other vehicles	**383,438**	**407,288**	**411,020**	**408,884**	**411,889**	**412,795**	**410,461**	**404,261**	**400,124**
GRAND TOTAL ALL VEHICLES	**596,114**	**632,688**	**642,233**	**645,491**	**651,703**	**662,154**	**659,858**	**650,061**	**635,748**

Note: Light trucks = less than 8,500 pounds gross vehicle weight rating (GVWR).
Medium trucks = 8,501-23,999 pounds GVWR.
Heavy trucks = 24,000 pounds GVWR or more.

Source:
U.S. General Services Administration, Federal Supply Service, *FY 2013 Federal Fleet Report*, Washington, DC, 2014, Tables 2-5 and 2-6. (Additional resources: www.gsa.gov)

Table 7.5
Federal Fleet Vehicle Acquisitions
by Fuel Type, FY 2002–2013

	Acquisitions by year							
Fuel type	2002	2005	2007	2009	2010	2011	2012	2013
Gasoline	44,850	41,247	32,089	31,782	26,547	20,785	15,660	15,994
Gasoline hybrid	[a]	222	458	3,959	4,853	3,787	1,254	1,364
Gasoline LGHG[b]	0	0	0	0	0	601	745	369
Gasoline plug-in hybrid	0	0	0	0	0	6	144	258
Diesel	8,107	6,049	5,809	4,742	4,136	4,422	4,383	4,625
Diesel hybrid	[c]	1	4	4	27	50	36	51
Diesel LGHG[b]	0	0	0	0	0	14	10	0
CNG	1,267	188	129	77	60	84	106	123
E-85	8,054	16,892	26,581	27,850	26,789	24,785	24,214	21,644
Electric	7	13	7	7	1,376	450	258	284
LNG	3	0	0	0	0	0	0	0
LPG	59	1	4	23	2	11	15	23
M-85	25	0	0	0	0	0	0	0
Hydrogen	0	0	0	1	4	4	0	2
Grand total	62,372	64,613	65,081	68,445	63,794	54,999	46,825	44,737

Source:
U.S. General Services Administrations, Federal Vehicle Policy Division, *FY 2013 Federal Fleet Report*, Washington, DC, 2014, Table 5-4. (Additional resources: www.gsa.gov)

Table 7.6
Fuel Consumed by Federal Government Fleets, FY 2000–2013
(thousand gasoline equivalent gallons)

	FY00	FY05	FY07	FY09	FY10	FY11	FY12	FY13
Gasoline	284,480	300,261	293,848	301,437	322,023	321,066	302,089	295,076
Diesel	70,181	53,363	74,806	76,456	75,329	78,252	73,228	67,332
CNG	865	1,245	889	499	504	436	421	369
Electricity	1	6	5	4	36	90	85	88
Biodiesel (B20)	569	8,052	9,515	7,393	8,258	7,696	6,353	5,619
Biodiesel (B100)[d]	0	0	0	5	0	61	344	358
Methanol/M-85	14	0	0	0	0	0	0	0
LPG	34	231	322	208	195	187	211	257
Ethanol/E-85	347	3,060	3,854	7,923	8,201	9,521	12,261	14,158
LNG	0	102	95	35	0	0	0	0
Hydrogen	0	0	0	0	1	0	1	0
Total	356,491	366,320	383,334	393,961	414,548	417,308	394,994	383,257

Source:
U.S. General Services Administrations, Federal Vehicle Policy Division, *FY 2013 Federal Fleet Report*, Washington, DC, 2014, Table 5-1. (Additional resources: www.gsa.gov)

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[a] Combined with gasoline.
[b] Low greenhouse gas emissions.
[c] Combined with diesel.
[d] B100 cannot be separated from B20 from 2000-2007.

In FY2000, the General Services Administration owned 143,948 vehicles which they leased to other agencies. In FY2013, they owned 1,040 vehicles.

Table 7.7
Federal Government Vehicles by Agency, FY 2013

Department or agency	Cars	Buses	Light trucks	Medium trucks	Heavy trucks	Total
CIVILIAN						
American Battle Monuments Commission	29	0	9	5	0	43
Broadcasting Board of Governors	70	8	41	23	18	160
Consumer Product Safety Commission	92	0	3	1	0	96
Court Services and Offender Supervision Agency	75	0	1	0	0	76
Department of Agriculture	14,073	79	16,533	7,411	2,297	40,393
Department of Commerce	1,237	5	341	321	44	1,948
Department of Education	95	0	0	0	0	95
Department of Energy	4,621	167	3,328	3,815	2,197	14,128
Department of Health and Human Services	3,625	15	581	281	118	4,620
Department of Homeland Security	39,052	408	9,504	3,903	1,223	54,090
Department of Housing and Urban Development	381	0	1	0	0	382
Department of Justice	34,551	235	3,926	1,293	1,045	41,050
Department of Labor	3,256	306	308	194	26	4,090
Department of State	9,160	154	1,596	1,374	732	13,016
Department of the Interior	11,024	427	8,753	8,699	3,347	32,250
Department of Transportation	4,245	4	730	1,012	153	6,144
Department of the Treasury	3,389	1	117	7	9	3,523
Department of Veterans Affairs	13,558	848	1,911	911	735	17,963
Environmental Protection Agency	784	7	84	136	28	1,039
Equal Employment Opportunity Commission	80	0	1	0	0	81
Federal Communications Commission	95	0	2	0	0	97
Federal Housing Finance Agency	6	0	0	0	0	6
Federal Maritime Commission	8	0	0	0	0	8
Federal Trade Commission	2	0	0	1	0	3
General Services Administration	951	3	58	24	4	1,040
Government Printing Office	12	0	19	6	5	42
Library of Congress	7	1	0	0	5	13
National Aeronautics and Space Administration	1,508	88	677	722	364	3,359
National Archives & Records Administration	40	0	4	11	8	63
National Gallery of Art	5	0	2	2	1	10
National Labor Relations Board	36	0	0	0	0	36
National Science Foundation	181	13	91	176	100	561
National Transportation Safety Board	5	0	0	0	0	5
Nuclear Regulatory Commission	28	0	1	0	5	34
Office of Personnel Management	1,518	0	1	2	0	1,521
Peace Corps	553	18	60	0	0	631
Pretrial Services Agency for the Dist of Columbia	2	0	0	0	0	2
Small Business Administration	152	0	2	1	0	155
Smithsonian Institution	236	8	192	59	38	533
Social Security Administration	435	5	5	6	22	473
Tennessee Valley Authority	1,065	0	602	1,056	41	2,764
US Agency for International Development	517	8	58	13	11	607
TOTAL CIVILIAN AGENCIES	**150,759**	**2,808**	**49,542**	**31,465**	**12,576**	**247,150**
MILITARY						
Corps of Engineers, Civil Works	2,581	1	2,684	1,832	671	7,769
Defense Agencies	4,272	161	634	638	466	6,171
Department of Air Force	11,510	1,601	12,985	14,944	6,117	47,157
Department of Army	33,102	2,228	12,460	12,150	5,464	65,404
Department of Navy	17,571	914	10,407	7,211	3,062	39,165
United States Marine Corps	6,941	464	2,283	1,804	1,271	12,763
TOTAL MILITARY AGENCIES	**75,977**	**5,369**	**41,453**	**38,579**	**17,051**	**178,429**
U. S. POSTAL SERVICE	**8,888**	**9**	**187,721**	**7,191**	**4,997**	**208,806**
TOTAL ALL FLEETS	**235,624**	**8,186**	**278,716**	**77,235**	**34,624**	**634,385**

Note: Light trucks – Less than 8,500 pounds gross vehicle weight ratio (GVWR) (Includes ambulances). Medium trucks – 8,501—23,999 pounds GVWR. Heavy trucks – 24,000 pounds GVWR or more. Does not include low-speed vehicles.

Source:
U.S. General Services Administration, Federal Supply Service, *FY 2013 Federal Fleet Report*, Washington, DC, 2014, Table 2-1. (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, 2013	0.798
	Vehicles per licensed driver, 2013	1.19
	Vehicles per household, 2013	2.06
Table 8.4	Average household transportation expense, 2013	17.4%
Table 8.5	Share of households owning 3 or more vehicles	
	1960	*2.5%*
	1970	*5.5%*
	1980	*17.5%*
	1990	*17.3%*
	2000	*18.3%*
	2010	*19.5%*
	2013	*19.7%*
Figure 8.1	Average occupancy rates by vehicle type, 2009	
	Van	*2.35*
	Sports Utility	*1.90*
	Car	*1.55*
	Pickup Truck	*1.49*
Table 8.10	Average annual miles per household vehicle, 2009	11,300
Table 8.16	Share of workers who car pooled, 2013	9.8%
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, 1950–2013

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	151,868	43,554	43,501	458,246	62,194	58,920
1955	165,069	47,874	56,540	605,646	74,686	62,171
1960	179,979	52,799	67,906	718,762	87,253	65,778
1965	193,526	57,436	82,066	887,812	98,502	71,088
1970	205,052	63,401	98,136	1,109,724	111,543	78,628
1975	215,973	71,120	120,054	1,327,664	129,791	85,846
1980	227,226	80,776	139,831	1,527,295	145,295	99,303
1985	238,466	86,789	157,048	1,774,826	156,868	107,150
1986	240,651	88,458	162,094	1,834,872	159,487	109,597
1987	242,804	89,479	167,193	1,921,204	161,975	112,440
1988	245,021	91,066	171,741	2,025,962	162,853	114,968
1989	247,342	92,830	175,960	2,096,487	165,555	117,342
1990	250,132	93,347	179,299	2,144,362	167,015	118,793
1991	253,493	94,312	181,438	2,172,050	168,995	117,718
1992	256,894	95,669	181,519	2,247,151	173,125	118,492
1993	260,255	96,391	186,315	2,296,378	173,149	120,259
1994	263,436	97,107	188,714	2,357,588	175,403	123,060
1995	266,557	98,990	193,441	2,422,696	176,628	124,900
1996	269,667	99,627	198,294	2,485,848	179,539	126,708
1997	272,912	101,018	201,071	2,561,695	182,709	129,558
1998	276,115	102,528	205,043	2,631,522	184,980	131,463
1999	279,295	103,874	209,509	2,691,056	187,170	133,488
2000	282,385	104,705	213,300	2,746,925	190,625	136,891
2001	285,309	108,209	216,683	2,797,287	191,276	136,933
2002	288,105	109,297	221,027	2,855,508	194,296	136,485
2003	290,820	111,278	225,882	2,890,450	196,166	137,736
2004	293,463	112,000	232,167	2,964,788	198,889	139,252
2005	296,186	113,343	238,384	2,989,430	200,549	141,730
2006	298,996	114,384	244,643	3,014,371	202,810	144,427
2007	302,004	116,011	248,701	3,031,124	205,742	146,047
2008	304,798	116,783	249,813	2,976,528	208,321	145,362
2009	307,439	117,181	248,972	2,956,764	209,618	139,877
2010	309,347	117,538	248,231	2,967,266	210,115	139,064
2011	311,722	118,682	248,932	2,950,402	211,875	139,869
2012	314,112	121,084	251,497	2,969,433	211,815	142,469
2013	316,498	122,459	252,715	2,988,323	212,160	143,929
			Average annual percentage change			
1950–2013	1.2%	1.7%	2.8%	3.0%	2.0%	1.4%
2003–2013	0.8%	1.0%	1.1%	0.3%	0.8%	0.4%

Sources:

Resident population and civilian employed persons – U.S. Department of Commerce, Bureau of the Census, Online Data Retrieval, Washington, DC, 2015. (Additional resources: www.census.gov)

Vehicles in operation – IHS Automotive. FURTHER REPRODUCTION PROHIBITED. (Additional resources: https://www.ihs.com/industry/automotive.html)

Licensed drivers and vehicle-miles – U.S. Department of Transportation, Federal Highway Administration, *Highway Statistics 2013*, Tables DL-20 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 but have declined since that time. There were 1.76 vehicles for every employed civilian in the United States in 2013.

Table 8.2
Vehicles and Vehicle-Miles per Capita, 1950–2013[a]

Year	Vehicles per capita	Vehicle-miles per capita	Licensed drivers per household	Vehicles per household	Vehicles per licensed driver	Vehicles per civilian employed persons
1950	0.286	3,017	1.43	1.00	0.70	0.74
1955	0.343	3,669	1.56	1.18	0.76	0.91
1960	0.377	3,994	1.65	1.29	0.78	1.03
1965	0.424	4,588	1.71	1.43	0.83	1.15
1970	0.479	5,412	1.76	1.55	0.88	1.25
1975	0.556	6,147	1.82	1.69	0.92	1.40
1980	0.614	6,707	1.80	1.73	0.96	1.41
1985	0.659	7,443	1.81	1.81	1.00	1.47
1986	0.674	7,625	1.80	1.83	1.02	1.48
1987	0.689	7,913	1.81	1.87	1.03	1.49
1988	0.701	8,269	1.79	1.89	1.05	1.49
1989	0.711	8,476	1.78	1.90	1.06	1.50
1990	0.717	8,573	1.79	1.92	1.07	1.51
1991	0.716	8,568	1.79	1.92	1.07	1.54
1992	0.707	8,747	1.81	1.90	1.05	1.53
1993	0.716	8,824	1.80	1.93	1.08	1.55
1994	0.716	8,949	1.81	1.94	1.08	1.53
1995	0.726	9,089	1.78	1.95	1.10	1.55
1996	0.735	9,218	1.80	1.99	1.10	1.56
1997	0.737	9,387	1.81	1.99	1.10	1.55
1998	0.743	9,531	1.80	2.00	1.11	1.56
1999	0.750	9,635	1.80	2.02	1.12	1.57
2000	0.755	9,728	1.82	2.04	1.12	1.56
2001	0.759	9,804	1.77	2.00	1.13	1.58
2002	0.767	9,911	1.78	2.02	1.14	1.62
2003	0.777	9,939	1.76	2.03	1.15	1.64
2004	0.791	10,103	1.78	2.07	1.17	1.67
2005	0.805	10,093	1.77	2.10	1.19	1.68
2006	0.818	10,082	1.77	2.14	1.21	1.69
2007	0.824	10,037	1.77	2.14	1.21	1.70
2008	0.820	9,766	1.78	2.14	1.20	1.72
2009	0.810	9,617	1.79	2.12	1.19	1.78
2010	0.802	9,592	1.79	2.11	1.18	1.79
2011	0.799	9,465	1.79	2.10	1.17	1.78
2012	0.801	9,453	1.75	2.08	1.19	1.77
2013	0.798	9,442	1.73	2.06	1.19	1.76
			Average annual percentage change			
1950–2013	1.6%	1.8%	0.3%	1.2%	0.8%	1.4%
2003–2013	0.3%	-0.5%	-0.2%	0.1%	0.3%	0.7%

Sources:

Resident population and civilian employed persons – U.S. Department of Commerce, Bureau of the Census, Online Data Retrieval, Washington, DC, 2015. (Additional resources: www.census.gov)

Vehicles in operation – IHS Automotive. FURTHER REPRODUCTION PROHIBITED. (Additional resources: https://www.ihs.com/industry/automotive.html)

Vehicle-miles – U.S. Department of Transportation, Federal Highway Administration, *Highway Statistics 2013*, Table VM-1 and annual. (Additional resources: www.fhwa.dot.gov)

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

Table 8.3
Average Annual Expenditures of Households by Income, 2013[a]

	All households	Income before taxes: Less than $5,000	$5,000–$9,999	$10,000–$14,999	$15,000–$19,999
Total expenditures	$51,100	$22,830	$20,697	$21,452	$25,506
		Percentage of total expenditures[b]			
Food[c]	12.9%	15.9%	17.3%	15.4%	16.0%
Housing	33.6%	41.6%	39.4%	40.9%	39.2%
Apparel and services	3.1%	3.5%	3.1%	3.1%	3.1%
Transportation	17.6%	15.0%	15.0%	14.4%	14.6%
Vehicle purchases (net outlay)	**6.4%**	**3.8%**	**4.3%**	**3.1%**	**3.6%**
Gasoline and motor oil	**5.1%**	**5.7%**	**5.3%**	**5.6%**	**5.5%**
Other vehicle expenditures	**5.1%**	**4.6%**	**4.7%**	**5.1%**	**4.6%**
Public transportation	**1.1%**	**1.0%**	**0.7%**	**0.6%**	**0.9%**
Health care	7.1%	7.3%	6.0%	9.0%	9.7%
Entertainment	4.9%	4.4%	5.1%	4.1%	4.6%
Personal Insurance & pensions	10.8%	1.0%	1.8%	2.6%	3.1%
Others[d]	9.1%	10.3%	11.8%	10.1%	8.7%
Households[e] (thousands)	125,670	5,675	5,686	8,751	8,261
Percentage of households	100.0%	4.5%	4.5%	7.0%	6.6%
Average number of vehicles in HH	1.9	0.9	0.8	1.0	1.1

	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	$32,491	$36,093	$41,750	$50,637	$85,264
		Percentage of total expenditures[b]			
Food[c]	14.4%	14.1%	13.8%	13.3%	11.7%
Housing	36.3%	36.0%	35.5%	33.5%	31.4%
Apparel and services	3.1%	3.2%	3.0%	3.1%	3.1%
Transportation	18.2%	19.0%	18.8%	19.1%	17.4%
Vehicle purchases (net outlay)	**6.4%**	**6.4%**	**6.8%**	**6.5%**	**6.9%**
Gasoline and motor oil	**5.5%**	**6.2%**	**6.2%**	**6.0%**	**4.5%**
Other vehicle expenditures	**5.6%**	**5.6%**	**5.0%**	**5.8%**	**4.8%**
Public transportation	**0.8%**	**0.8%**	**0.8%**	**0.9%**	**1.3%**
Health care	8.8%	8.4%	7.9%	7.9%	6.1%
Entertainment	4.5%	4.2%	4.4%	4.8%	5.1%
Personal Insurance & pensions	4.9%	6.4%	7.9%	9.6%	14.6%
Others[d]	8.9%	7.8%	7.9%	8.0%	9.7%
Households[e] (thousands)	14,750	13,031	11,179	17,887	40,451
Percentage of households	11.7%	10.4%	8.9%	14.2%	32.2%
Average number of vehicles in HH	1.4	1.6	1.9	2.1	2.6

Source:
U.S. Department of Labor, Bureau of Labor Statistics, website: www.bls.gov/cex/, March 2015. (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.

The average amount of money that a household spends in a year has changed very little between 1985 and 2013 in constant dollar terms. Expenditures on transportation were 19.4% of the total in 1985, but were 17.6% in 2013. Vehicle purchases made up more than one-third of transportation expenditures in 2013, while gas and oil were 29%.

Table 8.4
Annual Household Expenditures for Transportation, 1985-2013
(constant 2013 dollars)

	Transportation expenditures					Average	Transportation
Year	Vehicle purchases	Gas & Oil	Other vehicle expenses[a]	Public transportation	Total transportation	annual household expenditures	share of annual expenditures
1985	4,466	2,265	2,763	574	10,065	51,909	19.4%
1986	4,969	1,962	2,920	531	10,383	51,946	20.0%
1987	4,134	1,807	2,935	531	9,409	50,808	18.5%
1988	4,702	1,839	3,058	524	10,122	51,965	19.5%
1989	4,411	1,854	3,126	522	9,914	53,210	18.6%
1990	3,870	1,879	2,973	540	9,261	51,800	17.9%
1991	3,684	1,707	3,038	527	8,954	52,145	17.2%
1992	3,598	1,616	2,999	477	8,687	50,688	17.1%
1993	3,731	1,575	3,044	513	8,860	50,680	17.5%
1994	4,249	1,556	3,127	618	9,551	51,464	18.6%
1995	4,091	1,550	3,153	561	9,356	51,356	18.2%
1996	4,338	1,642	3,188	635	9,802	52,844	18.5%
1997	4,145	1,611	3,356	566	9,680	52,464	18.5%
1998	4,349	1,472	3,266	610	9,697	53,251	18.2%
1999	4,764	1,498	3,265	571	10,099	54,734	18.5%
2000	4,689	1,780	3,172	597	10,238	54,435	18.8%
2001	4,970	1,697	3,219	533	10,417	54,451	19.1%
2002	4,892	1,621	3,302	523	10,339	55,108	18.8%
2003	4,901	1,713	3,059	506	10,180	54,114	18.8%
2004	4,189	1,971	2,917	544	9,620	53,516	18.0%
2005	4,227	2,401	2,790	534	9,953	55,357	18.0%
2006	3,953	2,573	2,721	584	9,831	55,926	17.6%
2007	3,645	2,679	2,912	604	9,840	55,770	17.6%
2008	2,981	2,938	2,836	555	9,309	54,626	17.0%
2009	2,885	2,157	2,754	520	8,316	53,280	15.6%
2010	2,765	2,278	2,632	527	8,202	51,397	16.0%
2011	2,764	2,750	2,541	534	8,589	51,477	16.7%
2012	3,257	2,796	2,526	550	9,130	52,196	17.5%
2013	3,271	2,611	2,584	537	9,004	51,100	17.6%

Source:
U.S. Department of Labor, Bureau of Labor Statistics, Consumer Expenditure Survey, www.bls.gov/cex, March 2015. (Additional resources: www.bls.gov)

[a] Other vehicle expenses include vehicle finance charges, maintenance and repairs, insurance, licenses, and other vehicle charges.

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. Since 2000, less than 10% of households had no vehicles. The American Community Survey now collects these data on an annual basis, thus annual data are available after 2010.

Table 8.5
Household Vehicle Ownership, 1960–2013 Census
(percentage)

	No vehicles	One vehicle	Two vehicles	Three or more vehicles
1960	21.5%	56.9%	19.0%	2.5%
1970	17.5%	47.7%	29.3%	5.5%
1980	12.9%	35.5%	34.0%	17.5%
1990	11.5%	33.7%	37.4%	17.3%
2000	9.4%	33.8%	38.6%	18.3%
2010	9.1%	33.8%	37.6%	19.5%
2011	9.3%	34.1%	37.5%	19.1%
2012	9.2%	34.1%	37.3%	19.3%
2013	9.1%	33.9%	37.3%	19.7%

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)
2010-2013 data – U.S. Bureau of the Census, American Community Survey, Table CP04, 2014.

2009 National Household Travel Survey Daily Trip Data

The Department of Transportation (DOT) collected data on daily trips in 1969, 1977, 1983, 1990 and 1995 via the Nationwide Personal Transportation Survey (NPTS). For 2001, the DOT combined the collection of long trip and daily trip data into one survey – the 2001 National Household Travel Survey (NHTS). The long trip data were not included in the 2009 NHTS.

The NHTS is the nation's inventory of daily travel. The survey includes demographic characteristics of households, people, vehicles, and detailed information on daily 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 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 and 2009 surveys 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 next NHTS will be conducted in 2015.

Table 8.6
Demographic Statistics from the 1969, 1977, 1983, 1990, 1995 NPTS and 2001, 2009 NHTS

	1969	1977	1983	1990	1995	2001	2009	Percent change 1969–2009
Persons per household	3.16	2.83	2.69	2.56	2.63	2.58	2.50	-21%
Vehicles per household	1.16	1.59	1.68	1.77	1.78	1.89	1.87	61%
Workers per household	1.21	1.23	1.21	1.27	1.33	1.35	1.34	11%
Licensed drivers per household	1.65	1.69	1.72	1.75	1.78	1.77	1.88	14%
Vehicles per worker	0.96	1.29	1.39	1.40	1.34	1.39	1.40	46%
Vehicles per licensed driver	0.70	0.94	0.98	1.01	1.00	1.06	1.00	42%
Average vehicle trip length (miles)	8.89	8.34	7.90	8.98	9.06	9.87	9.72	9%

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. Data on vehicles per household and licensed drivers per household will not match Table 8.2.

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, 2001 and 2009 were generated from the website *nhts.ornl.gov*. (Additional resources: www.fhwa.dot.gov)

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 8.7
Average Annual Vehicle-Miles, Vehicle Trips and Trip Length per Household
1969, 1977, 1983, 1990, 1995 NPTS and 2001, 2009 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
2009	5,513	19,850
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
2009	457	2,068
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
2009	12.2	9.7

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. 1990 adjusted data – Oak Ridge National Laboratory, Oak Ridge, TN, August 1998. 1995 NPTS, 2001, 2009 NHTS data were generated from the website *nhts.ornl.gov*. (Additional resources: www.fhwa.dot.gov, nhts.ornl.gov)

[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 and 2009 annual vehicle-miles traveled (vmt) for a three-person household is around 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 more than double the vmt of households without children.

Table 8.8
Average Number of Vehicles and Vehicle Travel per Household, 1990 NPTS and 2001 and 2009 NHTS

	Average number of vehicles per household			Average vehicle-miles traveled per household		
Number of licensed drivers	**1990**	**2001**	**2009**	**1990**	**2001**	**2009**
1	1.5	1.2	1.1	15,200	9,700	8,800
2	2.1	2.2	2.2	22,900	25,800	23,500
3	2.9	3.0	3.0	29,400	37,900	37,700
4 or more	3.8	3.8	3.9	40,500	47,200	55,200
Household size						
1 person	1.2	1.0	1.0	11,400	7,500	7,100
2 persons	1.9	2.0	2.0	19,300	21,200	17,500
3 persons	2.2	2.3	2.3	23,700	28,400	27,900
4 persons	2.4	2.4	2.4	25,300	28,600	33,200
5 persons	2.4	2.4	2.4	24,900	33,200	33,700
6 or more persons	2.7	2.5	2.4	29,200	33,800	33,600
Household urban status						
Urban	1.9	1.8	1.7	19,000	19,300	17,600
Rural	2.1	2.3	2.4	22,200	28,400	27,700
Household composition						
With children	2.2	2.2	2.2	24,100	28,300	30,400
Without children	1.8	1.7	1.7	17,600	16,700	14,400
All households	**1.8**	**1.9**	**1.9**	**18,300**	**21,200**	**19,900**

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 website: nhts.ornl.gov. (Additional resources: nhts.ornl.gov)

In 2009, 22% of vehicle trips were traveling to and from work. Another 22% of trips were for shopping. Shopping is done close to home, as the average trip length for shopping was only 6.5 miles.

Table 8.9
Trip Statistics[a] by Trip Purpose, 2001 and 2009 NHTS

	Share of trips		Share of vehicle-miles traveled		Trip length (miles)		Trip length (minutes)	
Trip purpose	2001	2009	2001	2009	2001	2009	2001	2009
To/from work	22.1%	22.3%	27.0%	28.7%	12.1	12.2	22.3	22.9
Work-related business	4.1%	3.9%	8.4%	7.2%	20.3	17.2	30.9	27.5
Shopping	21.1%	22.8%	14.5%	15.5%	6.7	6.5	14.4	14.4
Other family/personal business	24.7%	21.9%	18.7%	15.7%	7.5	6.8	15.2	14.8
School/church	4.9%	5.0%	3.7%	4.6%	7.5	8.8	15.8	17.5
Medical/dental	2.2%	2.6%	2.2%	2.6%	9.9	9.9	20.7	21.2
Vacation	0.4%	0.7%	1.8%	2.3%	47.4	31.4	59.6	41.3
Visit friends/relatives	6.3%	5.7%	9.4%	9.4%	14.9	15.7	24.4	24.6
Other social/recreational	13.7%	14.9%	13.2%	13.5%	9.6	8.6	18.2	17.2
Other	0.5%	0.3%	1.0%	0.6%	18.1	19.0	31.4	29.7
All	100.0%	100.0%	100.0%	100.0%	9.9	9.7	18.7	18.6

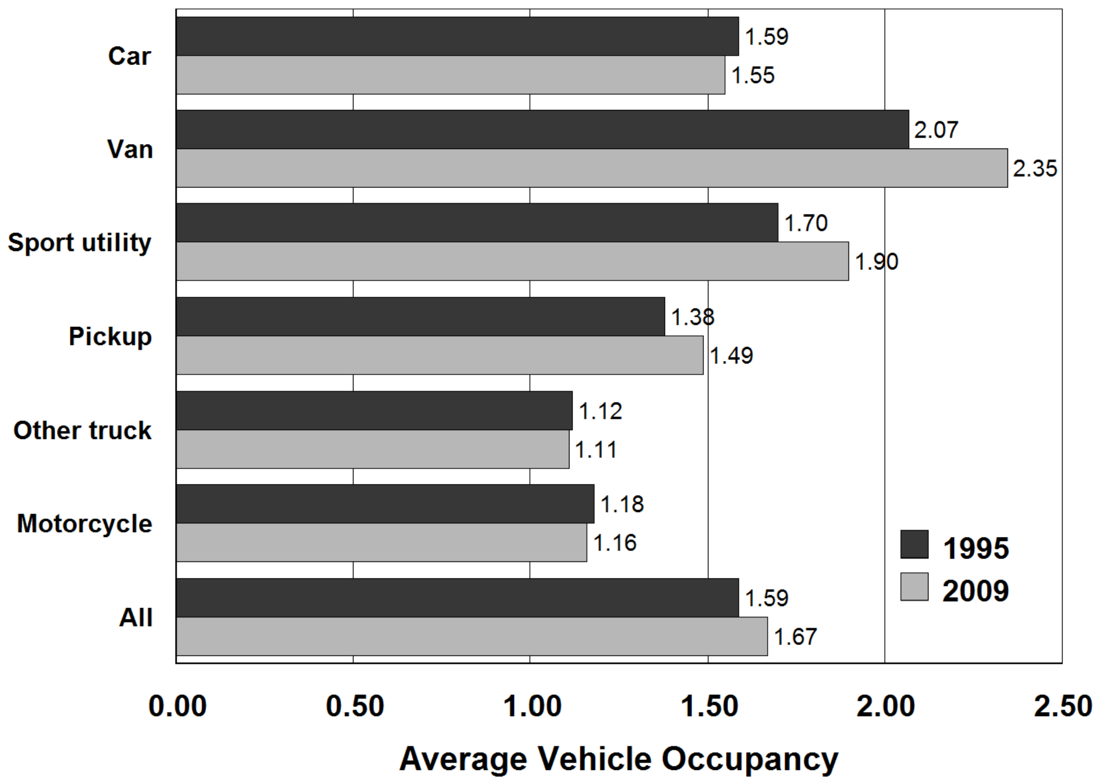
Note: The "All" category for average trip length and duration includes records for which trip purpose was not identified.

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

[a] Percentages may not sum to totals due to rounding.

While car occupancy stayed nearly constant from 1995 to 2009, most other vehicle types showed increased occupancy. Vans and sport utility vehicles have higher vehicle occupancies than cars.

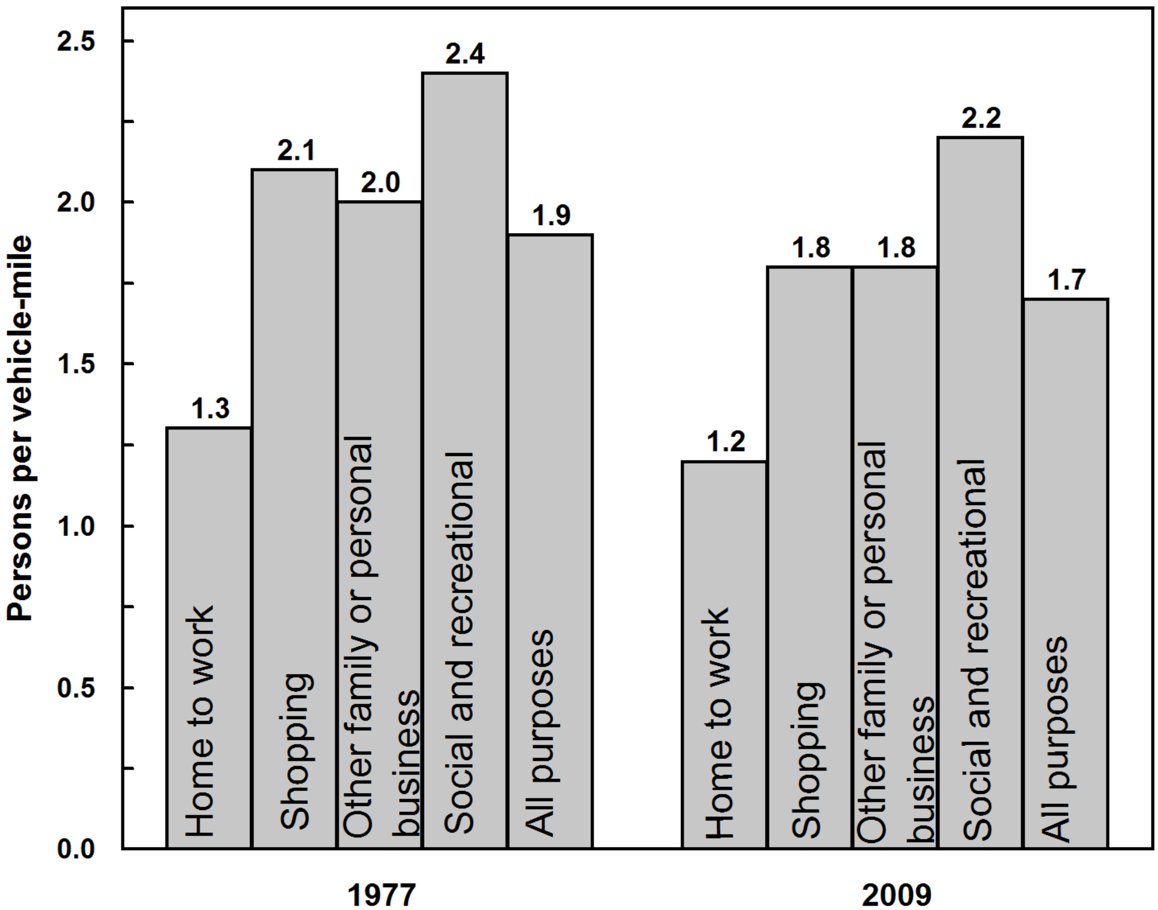
Figure 8.1. Average Vehicle Occupancy by Vehicle Type, 1995 NPTS and 2009 NHTS



Sources:
U.S. Department of Transportation, Federal Highway Administration, *1995 Nationwide Personal Transportation Survey*, Washington, DC, 1997, and *2009 National Household Travel Survey*, Washington, DC. (Additional resources: www.fhwa.dot.gov, website: 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 2009 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 2009 NHTS were generated from the website nhts.ornl.gov, March 2011. (Additional resources: www.fhwa.dot.gov, nhts.ornl.gov)

The 1990 household survey reports the highest average annual miles per vehicle and the 1983 survey reports the lowest. These data show that younger vehicles are typically driven more miles than older vehicles.

Table 8.10
Average Annual Miles per Household Vehicle by Vehicle Age

Vehicle age (years)	1983 self-reported	1990 self-reported	1995 self-reported	2001 self-reported	2009 self-reported
Under 1	8,200	19,600	15,900	15,500	13,200
1	15,200	16,800	16,800	14,300	14,600
2	16,800	16,600	15,500	14,000	13,900
3	14,500	14,700	14,400	13,100	12,700
4	13,000	13,600	14,100	12,500	12,600
5	12,100	12,900	13,500	12,000	12,800
6	11,300	13,200	13,200	11,800	12,100
7	10,000	12,400	12,800	11,600	11,900
8	9,800	12,600	12,200	10,900	11,500
9	9,000	11,500	12,200	10,800	11,300
10 and older	7,300	9,200	8,900	7,400	9,300
All household vehicles	10,400	12,500	12,200	11,100	11,300

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

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, 2001 and 2009: Generated from the 2009 NHTS datasets, version 2, February 2011. (Additional resources: nhts.ornl.gov)

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.

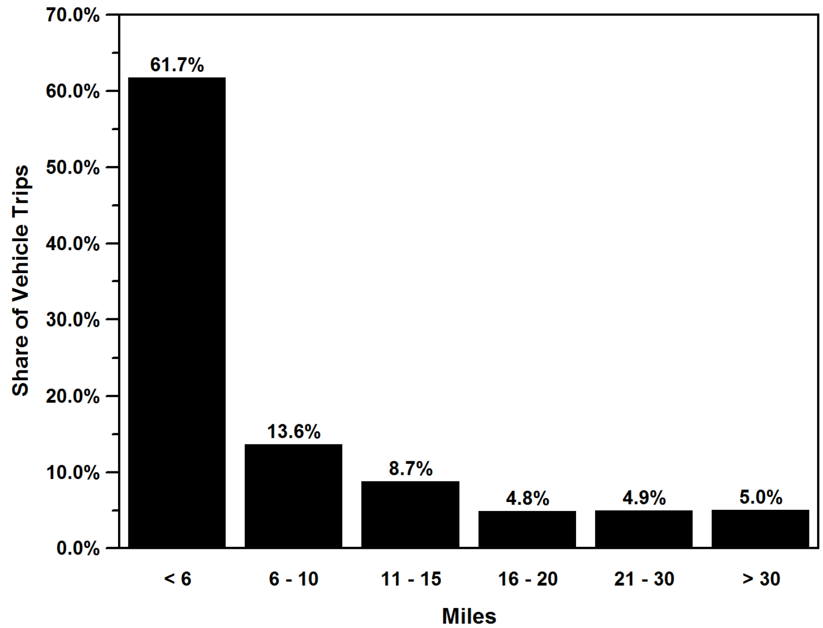
Table 8.11
Self-Reported vs. Odometer Average Annual Miles, 1995 NPTS and 2001 NHTS

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	11,000	11,800

Note: The 2009 NHTS did not collect similar data. Survey methodology on odometer reading data differs from 1995 to 2001 data.

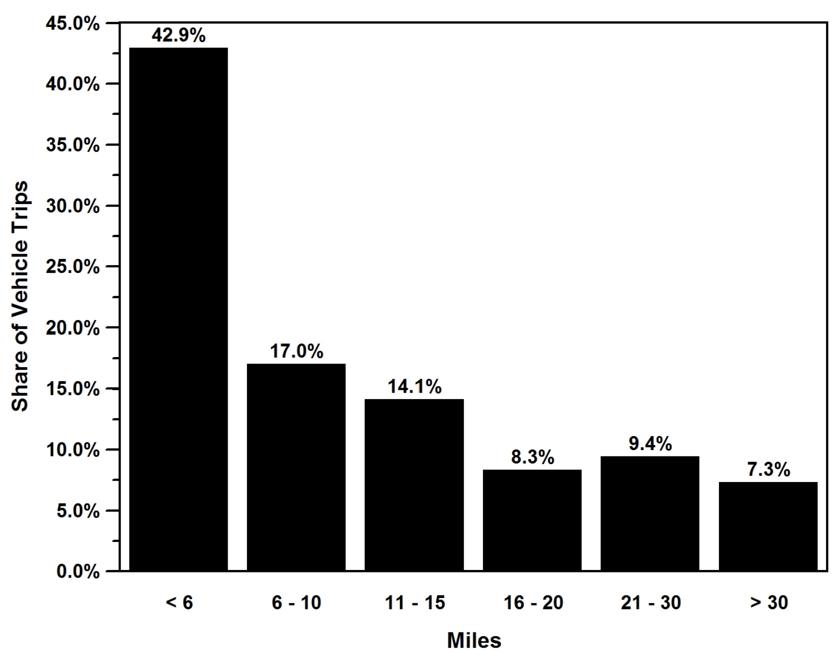
Source:
Generated from the website: nhts.ornl.gov and 2001 NHTS public use file.

Figure 8.3. Share of Vehicle Trips by Trip Distance, 2009 NHTS



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

Figure 8.4. Share of Vehicle Trips to Work by Trip Distance, 2009 NHTS



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

Nineteen percent of new vehicles (1 year old and under) travel over 20,000 miles per year. Almost half of the vehicles over 20 years old travel less than 4,000 miles in a year.

Table 8.12
Share of Vehicles by Annual Miles of Travel and Vehicle Age, 2009 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%	3%	4%	3%
1 - 2,000 miles	2%	3%	2%	3%	3%	3%	3%
2 - 4,000 miles	5%	6%	7%	7%	6%	7%	9%
4 - 6,000 miles	7%	10%	9%	8%	8%	10%	10%
6 - 8,000 miles	10%	10%	11%	11%	10%	12%	12%
8 - 10,000 miles	11%	11%	11%	11%	11%	12%	12%
10 - 12,000 miles	9%	11%	11%	11%	12%	11%	11%
12 - 15,000 miles	16%	15%	14%	15%	15%	14%	13%
15 - 20,000 miles	18%	15%	17%	17%	16%	14%	14%
20 - 30,000 miles	13%	11%	12%	11%	11%	10%	9%
>30,000 miles	6%	5%	4%	3%	4%	4%	3%
All	100%	100%	100%	100%	100%	100%	100%
	Vehicle age (years)						
	8	9	10	11-15	16-20	Over 20	
< 1,000 miles	4%	4%	4%	6%	9%	19%	
1 - 2,000 miles	4%	4%	4%	5%	7%	8%	
2 - 4,000 miles	9%	9%	10%	11%	16%	19%	
4 - 6,000 miles	11%	12%	12%	14%	14%	14%	
6 - 8,000 miles	12%	12%	11%	14%	13%	12%	
8 - 10,000 miles	13%	11%	12%	12%	10%	7%	
10 - 12,000 miles	11%	11%	11%	10%	8%	6%	
12 - 15,000 miles	13%	13%	12%	10%	8%	5%	
15 - 20,000 miles	12%	13%	14%	9%	7%	5%	
20 - 30,000 miles	9%	8%	7%	7%	4%	3%	
>30,000 miles	3%	3%	3%	3%	2%	2%	
All	100%	100%	100%	100%	100%	100%	

Source:
Generated from the Department of Transportation, Federal Highway Administration, *2009 National Household Travel Survey* website: nhts.ornl.gov. (Additional resources: nhts.ornl.gov)

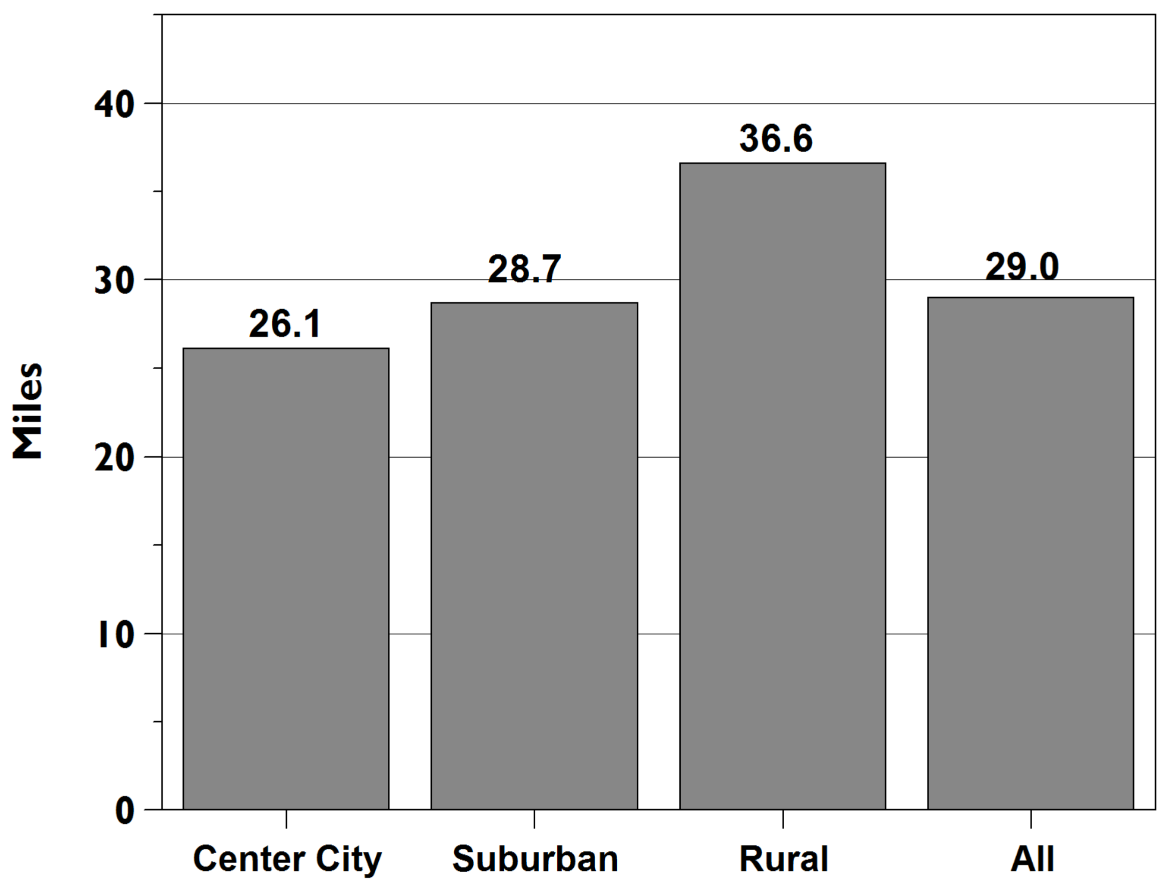
The average driver makes three trips per day with an average of 9.7 miles for each trip.

Table 8.13
Household Vehicle Trips, 2009 NHTS

	Number of daily vehicle trips (per driver)	Average vehicle trip length (miles)	Daily vehicle miles of travel (per driver)
1990	3.3	8.9	28.5
1995	3.6	9.1	32.1
2001	3.4	9.9	32.7
2009	3.0	9.7	29.0

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

Figure 8.5. Average Daily Miles Driven (per Driver), 2009 NHTS



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

Table 8.14
Daily Vehicle Miles of Travel (per Vehicle) by Number of Vehicles in the Household, 2009 NHTS

	Daily miles per vehicle	
Number of household vehicles	2001	2009
1	25.6	29.1
2	27.5	32.7
3	24.2	31.3
4	23.0	30.2
5	21.1	27.6
More than 5	18.4	27.2
All	25.2	31.1

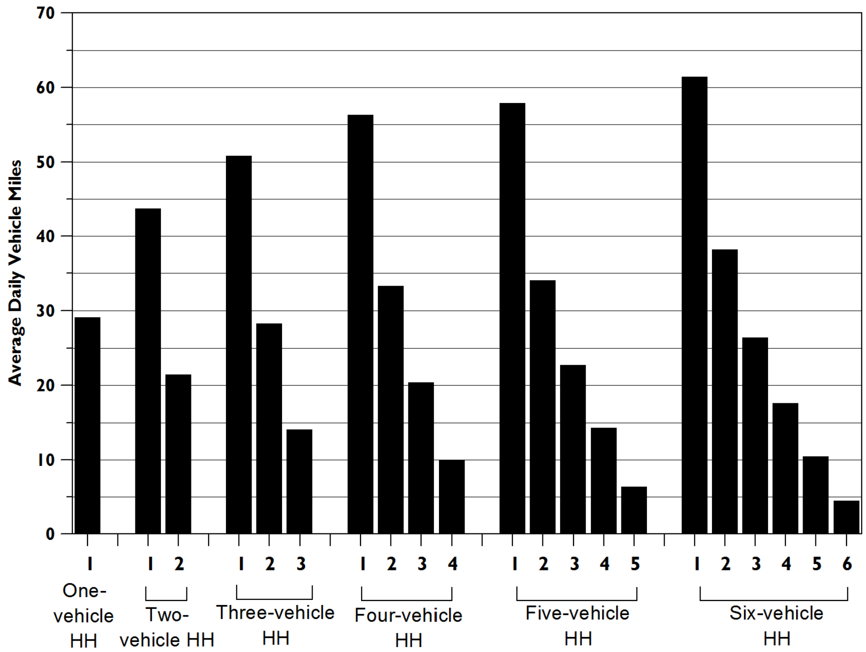
Source:
2009 National Household Travel Survey, website: nhts.ornl.gov.

Table 8.15
Daily and Annual Vehicle Miles of Travel and Average Age for Each Vehicle in a Household, 2009 NHTS

Vehicle number	Average daily miles	Average annual miles	Average age (years)
One-vehicle household			
1	29.0	10,600	9.0
Two-vehicle household			
1	43.6	15,900	7.6
2	21.4	7,800	9.0
Three-vehicle household			
1	50.7	18,500	7.9
2	28.2	10,300	9.1
3	14.0	5,100	11.8
Four-vehicle household			
1	56.2	20,500	8.5
2	33.2	12,100	8.8
3	20.3	7,400	11.4
4	9.9	3,600	13.2
Five-vehicle household			
1	57.8	21,100	8.5
2	34.0	12,400	9.4
3	22.7	8,300	12.3
4	14.2	5,200	12.7
5	6.3	2,300	16.8
Six-vehicle household			
1	61.4	22,400	10.2
2	38.1	13,900	9.8
3	26.3	9,600	12.2
4	17.5	6,400	12.5
5	10.4	3,800	14.5
6	4.4	1,600	17.9

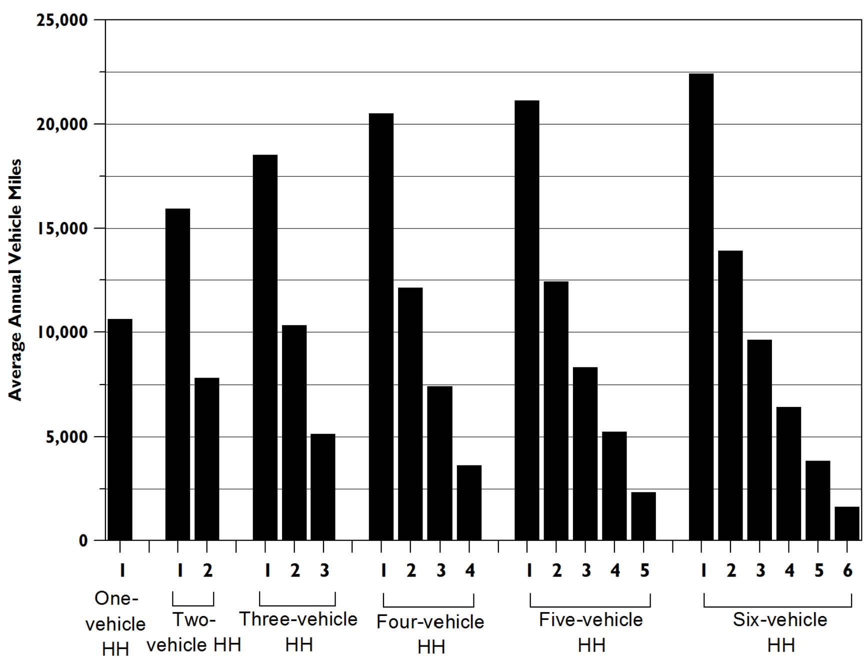
Source:
2009 National Household Travel Survey, website: nhts.ornl.gov.

Figure 8.6. Daily Vehicle Miles of Travel for Each Vehicle in a Household, 2009 NHTS



Source:
2009 National Household Travel Survey, website: nhts.ornl.gov.

Figure 8.7. Annual Vehicle Miles of Travel for Each Vehicle in a Household, 2009 NHTS



Source:
2009 National Household Travel Survey, website: 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 9.8% in 2013. 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 2013 (~5.0%). The average travel time increased by 4.1 minutes from 1980 to 2013. The American Community Survey (ACS) now collects journey-to-work data on an annual basis. It shows the average commute time as 25.8 minutes in 2013.

Table 8.16
Means of Transportation to Work, 1980, 1990, 2000, and 2013

	1980 Census		1990 Census		2000 Census		2013 ACS	
Means of transportation	Number of workers (thousands)	Share	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%	112,737	87.9%	120,357	86.1%
Drove alone	*62,193*	*64.4%*	*84,215*	*73.2%*	*97,102*	*75.7%*	*106,725*	*76.3%*
Car pooled	*19,065*	*19.7%*	*15,378*	*13.4%*	*15,635*	*12.2%*	*13,631*	*9.8%*
Public transportation	6,175	6.4%	6,068	5.3%	6,068	4.7%	7,159	5.1%
Bus or trolley bus[a]	*3,925*	*4.1%*	*3,445*	*3.0%*	*3,207*	*2.5%*	*3,670*	*2.6%*
Streetcar or trolley car[a]	[b]	[b]	*78*	*0.1%*	*73*	*0.1%*	*84*	*0.1%*
Subway or elevated	*1,529*	*1.6%*	*1,755*	*1.5%*	*1,886*	*1.5%*	*2,441*	*1.7%*
Railroad	*554*	*0.6%*	*574*	*0.5%*	*658*	*0.5%*	*763*	*0.5%*
Ferryboat	[b]	[b]	*37*	*0.0%*	*44*	*0.0%*	*42*	*0.0%*
Taxicab	167	0.2%	179	0.2%	200	0.2%	158	0.1%
Motorcycle	419	0.4%	237	0.2%	142	0.1%	295	0.2%
Bicycle	468	0.5%	467	0.4%	488	0.4%	802	0.6%
Walked only	5,413	5.6%	4,489	3.9%	3,759	2.9%	3,923	2.8%
Other means	703	0.7%	809	0.7%	901	0.7%	1,204	0.9%
Worked at home	2,180	2.3%	3,406	3.0%	4,184	3.3%	6,046	4.3%
Total workers	96,616	100.0%	115,069	100.0%	128,279	100.0%	139,787	100.0%
Average travel time (minutes)	21.7		22.4		25.5		25.8	

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, *Journey to Work: 2000*, Tables 1 and 2, 1990-2000, March 2004 (www.census.gov/population/www/socdemo/journey.html).

2013 data – U.S. Bureau of the Census, *2009-2013 American Community Survey Five-Year Estimates*, Tables B08301 and GCT0801. (Additional resources: www.census.gov)

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

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 house	77.0%	0.92	32.0	29.6
All classes other	23.0%	0.99	27.7	27.4
<1,000/sq. mile detached single house	81.6%	0.91	34.7	31.6
<1,000/sq. mile all other	18.4%	0.91	32.5	29.5
1,000-4,000/sq. mile detached single house	75.5%	0.94	27.5	26.0
1,000-4,000/sq. mile all other	24.5%	1.03	25.1	25.9
4,000-10,000/sq. mile detached single house	42.5%	0.96	26.1	25.1
4,000-10,000/sq. mile all other	57.5%	1.15	21.5	24.6
10,000-25,000/sq. mile detached single house	17.8%	1.02	18.2	18.5
10,000-25,000/sq. mile all other	82.2%	1.05	21.3	22.3
>25,000/sq. mile detached single house	9.8%	0.72	20.5	14.8
>25,000/sq. mile all other	90.2%	1.23	21.9	26.9

Source:
Generated from the *2009 National Household Survey* website: nhts.ornl.gov.

Table 8.18
Housing Unit Characteristics, 2013

	Share of occupied housing units	% with garage or carport
Type of housing unit		
New construction (< = 4 years)	2.0%	78.2%
Manufactured/mobile homes	6.0%	40.6%
Geographic location (Census Region)		
Northeast	18.2%	51.5%
Midwest	22.4%	74.5%
South	37.1%	60.1%
West	22.3%	80.1%
Tenure		
Owner	65.3%	80.4%
Renter	34.7%	39.7%
All occupied units	115,852 units	66.3%

Source:
U.S. Bureau of the Census, *2013 American Housing Survey*, Table C-02-AO. (Additional information: www.census.gov/housing/ahs)

The average commute time was 25.5 minutes in 2013. Over 64% of workers traveled less than 30 minutes to work in 2013. In 1990, 32.5% of workers commuted less than 15 minutes; in 2013 that number dropped to 27.8%.

Table 8.19
Workers by Commute Time, 1990, 2000 and 2013

Commute time	1990	2000	2013
Less than 15 minutes	32.5%	29.4%	27.8%
15–29 minutes	37.0%	36.1%	36.4%
30–39 minutes	15.2%	15.8%	16.4%
40–59 minutes	9.2%	10.7%	11.3%
60 minutes or more	6.1%	8.0%	8.1%
Average travel time (minutes)	22.4	25.5	25.5

Sources:
1990-2000 – U.S. Bureau of the Census, *Journey to Work: 2000*, Tables 1 and 2, 1990-2000, March 2004.
2013 – U.S. Bureau of the Census, *2009-2013 American Community Survey, 5-Year Estimates*, Tables S0802 and B08303. (Additional resources: www.census.gov)

Sales of bicycles with wheel sizes of 20 inches and over have grown at an average annual rate of 0.7% from 1981 to 2013. Bicycle sales experienced a large decline in 2009, which brought total sales to 14.9 million—a new low in the 18-year series. Sales in 2013 were 16.2 million.

Table 8.20
Bicycle Sales, 1981–2013
(millions)

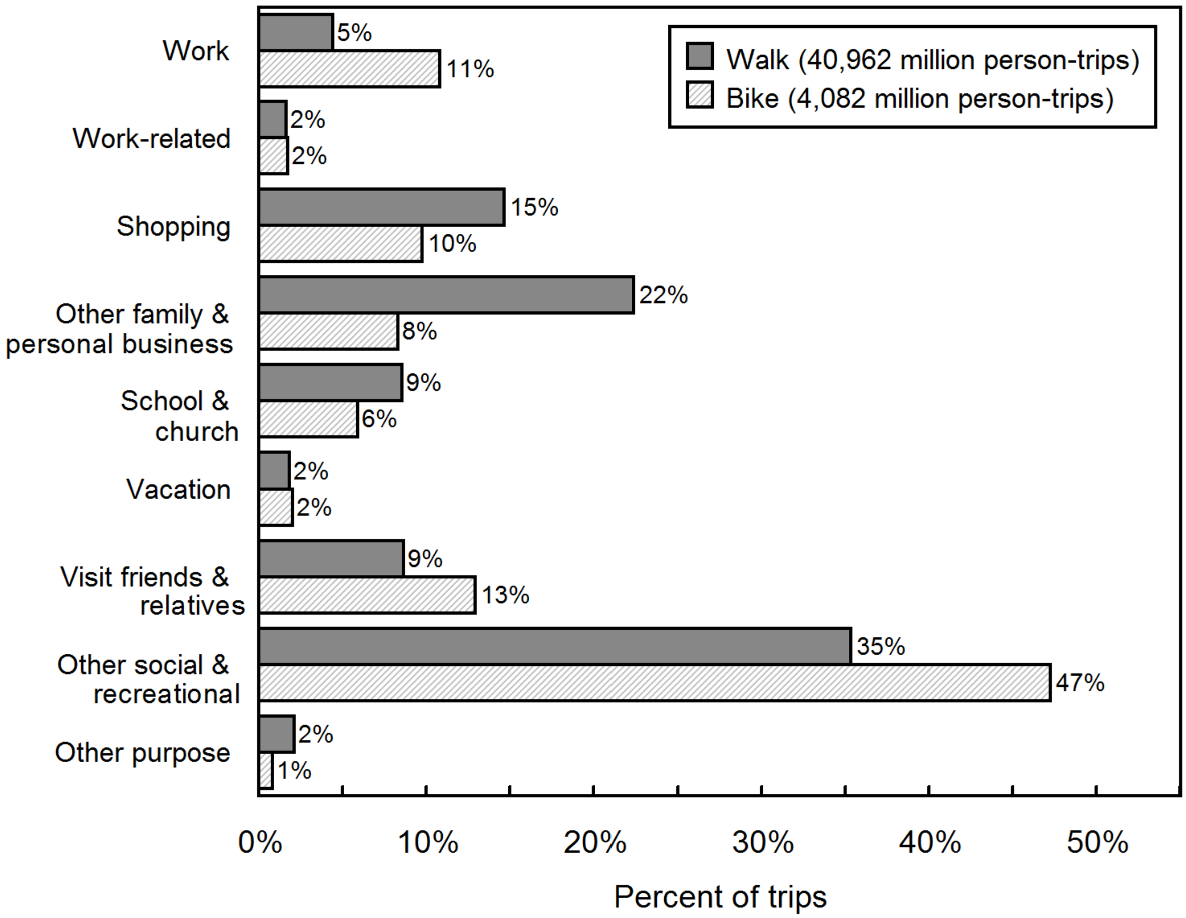
	Wheel sizes under 20 inches	Wheel sizes of 20 inches and over	All wheel sizes
1981	[a]	8.9	[a]
1982	[a]	6.8	[a]
1983	[a]	9.0	[a]
1984	[a]	10.1	[a]
1985	[a]	11.4	[a]
1986	[a]	12.3	[a]
1987	[a]	12.6	[a]
1988	[a]	9.9	[a]
1989	[a]	10.7	[a]
1990	[a]	10.8	[a]
1991	[a]	11.6	[a]
1992	3.7	11.6	15.3
1993	3.8	13.0	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
2008	5.1	13.4	18.5
2009	4.7	10.2	14.9
2010	6.3	13.5	19.8
2011	4.7	11.0	15.7
2012	5.7	13.0	18.7
2013	4.9	11.3	16.2
	Average annual percentage change		
1981–2013	[a]	0.7%	[a]
2003–2013	-1.3%	-1.3%	-1.3%

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

[a] Data are not available.

In 2009, 4.5% of walk trips and 10.9% of bike trips were to/from work. Forty-seven percent of all bike trips were for social/recreational purposes. Nearly 15% of walk trips were shopping trips.

Figure 8.8. Walk and Bike Trips by Trip Purpose, 2009 NHTS



Note: Percentages may not sum to totals due to rounding.

Source:
U.S. Department of Transportation, Federal Highway Administration, *2009 National Household Travel Survey* website: nhts.ornl.gov.

In 2009 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 website: www.bts.gov/programs/national_household_travel_survey.

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

Trip characteristic	Person trips (thousands)	Person trips (percent)	Person miles (thousands)	Person miles (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

Note: Long-distance trips were not included in the 2009 NHTS.

Source:
U.S. Bureau of Transportation Statistics and the U.S. Federal Highway Administration, *2001 National Household Transportation Survey*. (Additional resources: www.bts.gov/programs/national_household_travel_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, 2014*	*869,688*
Table 9.10	*Amtrak, 2013*	*6,810*
Table 9.11	*Commuter rail, 2013*	*11,862*
Table 9.12	*Transit rail, 2013*	*20,381*
	Freight ton-miles	(millions)
Table 9.5	*Domestic waterborne commerce, 2013*	*465,000*
Table 9.8	*Class I railroad, 2013*	*1,740,687*
	Passenger energy use	(trillion Btus)
Table 9.2	*Domestic and international air carrier, 2014*	*2,268.9*
Table 9.3	*General aviation, 2013*	*203.6*
Table 9.6	*Recreational boats, 2013*	*245.0*
Table 9.10	*Amtrak, 2013*	*14.4*
Table 9.11	*Commuter rail, 2013*	*32.5*
Table 9.12	*Transit rail, 2013*	*49.0*
	Freight energy use	(trillion Btus)
Table 9.8	*Class I railroad, 2013*	*514.9*

Nonhighway transportation modes accounted for 18.5% of total transportation energy use in 2013.

Table 9.1
Nonhighway Energy Use Shares, 1970–2013

	Share of transportation energy use					
Year	Air	Water	Pipeline	Rail	Nonhighway total	Transportation total (trillion Btu)
1970	8.5%	5.4%	6.4%	3.6%	24.0%	15,395
1971	8.1%	4.8%	6.3%	3.5%	22.8%	16,015
1972	7.7%	4.6%	6.1%	3.4%	21.9%	17,036
1973	7.7%	5.0%	5.6%	3.4%	21.7%	17,874
1974	7.3%	5.1%	5.4%	3.6%	21.5%	17,174
1975	7.3%	5.3%	4.8%	3.2%	20.7%	17,424
1976	7.2%	5.9%	4.3%	3.1%	20.6%	18,492
1977	7.1%	6.2%	4.1%	3.1%	20.4%	19,126
1978	7.1%	6.9%	3.9%	2.9%	20.8%	20,097
1979	7.6%	5.8%	4.4%	3.1%	20.9%	19,652
1980	7.6%	7.4%	4.7%	3.1%	22.8%	18,940
1981	7.8%	6.8%	4.8%	3.0%	22.4%	18,741
1982	7.9%	5.8%	4.7%	2.6%	21.1%	18,237
1983	7.8%	5.3%	4.0%	2.6%	19.8%	18,368
1984	8.5%	5.1%	4.1%	2.8%	20.5%	18,962
1985	8.7%	4.5%	3.9%	2.6%	19.8%	19,205
1986	9.0%	6.5%	3.6%	2.4%	21.5%	20,276
1987	9.1%	6.6%	3.7%	2.4%	21.9%	20,771
1988	9.3%	6.6%	4.1%	2.4%	22.4%	21,327
1989	9.1%	7.0%	4.1%	2.4%	22.6%	21,685
1990	9.5%	6.7%	4.3%	2.3%	22.8%	21,581
1991	9.0%	7.2%	4.1%	2.3%	22.6%	21,182
1992	8.9%	7.3%	3.9%	2.2%	22.3%	21,841
1993	8.9%	6.4%	4.0%	2.3%	21.6%	22,322
1994	9.0%	6.1%	4.1%	2.3%	21.6%	22,930
1995	9.1%	6.3%	4.1%	2.4%	21.9%	23,465
1996	9.2%	5.9%	4.1%	2.4%	21.6%	23,974
1997	9.5%	5.1%	4.2%	2.4%	21.2%	24,328
1998	9.2%	5.0%	3.6%	2.3%	20.2%	24,661
1999	9.6%	5.3%	3.5%	2.3%	20.6%	25,960
2000	9.7%	5.5%	3.4%	2.3%	21.0%	26,273
2001	9.2%	4.6%	3.4%	2.3%	19.6%	25,945
2002	8.4%	4.7%	3.5%	2.3%	18.9%	26,536
2003	8.5%	4.0%	3.2%	2.3%	18.0%	26,715
2004	9.0%	4.8%	3.0%	2.4%	19.2%	27,173
2005	9.2%	5.0%	3.1%	2.4%	19.6%	27,582
2006	9.0%	5.2%	3.0%	2.4%	19.7%	27,760
2007	8.6%	5.3%	3.0%	2.2%	19.2%	29,223
2008	8.4%	5.1%	3.2%	2.2%	18.9%	28,592
2009	7.8%	4.9%	3.4%	2.0%	18.2%	27,107
2010	7.9%	5.5%	3.5%	2.1%	19.0%	27,185
2011	8.1%	5.2%	3.6%	2.3%	19.2%	26,600
2012	7.9%	4.5%	3.8%	2.3%	18.5%	26,214
2013	7.8%	4.0%	4.4%	2.3%	18.5%	26,153

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 began to rise in 2010. Passenger load factor was 83% in 2014.

Table 9.2
Summary Statistics for U.S. Domestic and International Certificated Route Air Carriers (Combined Totals), 1970–2014[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 cargo 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
1990	4,724	472,236	753,211	159	62.7%	16,403	2,180.2
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	2,116.4
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	2,271.5
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	2,513.6
1998	6,220	634,933	899,029	145	70.6%	28,015	2,459.5
1999	6,558	668,626	942,311	144	71.0%	25,147	2,665.0
2000	6,946	708,926	981,080	141	72.3%	30,221	2,750.4
2001	6,814	664,849	950,519	139	69.9%	27,882	2,592.5
2002	6,834	655,215	913,898	134	71.7%	30,507	2,430.1
2003	7,367	674,160	922,440	125	73.1%	32,446	2,470.6
2004	7,479	752,341	1,000,193	134	75.2%	37,958	2,657.2
2005	7,716	795,117	1,029,316	133	77.2%	39,286	2,693.3
2006	8,220	810,086	1,027,526	125	78.8%	38,251	2,661.1
2007	8,415	842,007	1,060,093	126	79.4%	38,433	2,684.6
2008	8,142	823,783	1,040,840	128	79.1%	35,227	2,547.8
2009	7,534	779,997	975,307	129	80.0%	30,317	2,303.2
2010	7,666	809,051	991,934	129	81.6%	35,209	2,335.3
2011	7,783	825,916	1,012,597	130	81.6%	35,713	2,370.3
2012	7,727	832,733	1,012,261	131	82.3%	34,937	2,287.7
2013	7,724	847,971	1,025,569	133	82.7%	33,561	2,271.3
2014	7,739	869,688	1,048,290	135	83.0%	34,471	2,268.9
			Average annual percentage change				
1970–2014	2.6%	4.1%	3.2%	0.6%		5.2%	1.2%
2004–2014	0.3%	1.5%	0.5%	0.1%		-1.0%	-1.6%

Sources:
U.S. Department of Transportation, Bureau of Transportation Statistics, www.transtats.bts.gov. (Additional resources: www.transtats.bts.gov and www.rita.dot.gov)
1970–76 Energy Use – Department of Transportation, Civil Aeronautics Board, *Fuel Cost and Consumption*, Washington, DC, 1981, and annual.

[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) rotorcraft 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, 1970–2013

Calendar year	Total number of aircraft	Aircraft hours flown (thousands)	Energy use (trillion Btu)
1970	131,700[a]	26,030[b]	94.3
1975	168,475	30,298	110.7
1980	211,045	41,016	165.9
1981	213,226	40,704	161.2
1982	209,779	36,457	173.6
1983	213,293	35,249	134.2
1984	220,943	36,119	155.3
1985	196,500	31,456	143.9
1986	205,300	31,782	147.9
1987	202,700	30,883	139.1
1988	196,200	31,114	148.5
1989	205,000	32,332	134.1
1990	198,000	32,096	131.8
1991	196,874	29,862	120.0
1992	185,650	26,747	103.7
1993	177,120	24,455	93.6
1994	172,935	24,092	95.3
1995	188,089	26,612	106.6
1996	191,129	26,909	111.0
1997	192,414	27,713	121.1
1998	204,710	28,100	147.4
1999	219,464	31,231	172.1
2000	217,533	29,960	175.2
2001	211,446	27,017	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	243.6
2008	228,663	26,009	265.7
2009	223,877	23,763	210.3
2010	223,370	24,802	221.2
2011	220,770	24,570	227.1
2012	209,034	24,403	228.8
2013	199,927	22,876	203.6
	Average annual percentage change		
1970–2013	1.0%	-0.3%	1.8%
2003–2013	-0.5%	-1.8%	3.7%

Sources:
U.S. Department of Transportation, Federal Aviation Administration, *General Aviation Activity and Avionics Survey: Calendar Year 2013*, Tables 1.1, 1.4, 5.1, and annual. 2011 Data: *Aviation Forecasts*, Tables 28 and 29, May 2013. (Additional resources: www.faa.gov/data-research/aviation_data_statistics/general_aviation)

[a] Active fixed-wing general aviation aircraft only.
[b] Includes rotorcraft.

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 were about 2.27 billion tons in 2013, down from a peak of 2.59 billion tons in 2006.

Table 9.4
Tonnage Statistics for Domestic and International Waterborne Commerce, 1970–2013
(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%
1980	1,999	921	1,077	53.9%
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	2,527	1,499	1,029	40.7%
2006	2,588	1,565	1,023	39.5%
2007	2,564	1,543	1,022	39.9%
2008	2,477	1,521	956	38.6%
2009	2,211	1,354	857	38.8%
2010	2,335	1,441	894	38.3%
2011	2,368	1,480	888	37.5%
2012	2,307	1,422	885	38.4%
2013	2,274	1,383	891	39.2%
		Average annual percentage change		
1970–2013	0.9%	2.0%	-0.2%	
2003–2013	-0.5%	0.0%	-1.3%	

Source:
U.S. Department of the Army, Corps of Engineers, *The U.S. Waterway System, Transportation Facts and Information*, January 2015. (Additional resources: www.navigationdatacenter.us/index.htm)

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[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.

The U.S. Army Corps of Engineers Navigation Data Center collects a wealth of waterborne commerce data. Energy use data, however, have never been collected as part of this effort. The energy use data collected by the Energy Information Administration (EIA) on vessel bunkering was formerly displayed on this table. The EIA data include different uses of fuel, not just fuel for domestic waterborne commerce; therefore it was misleading to display those data together.

Table 9.5
Summary Statistics for Domestic Waterborne Commerce, 1970–2013

Year	Number of vessels[a]	Ton-miles (billions)	Tons shipped[b] (millions)	Average length of haul (miles)
1970	25,832	596	949	628.2
1975	31,666	566	944	599.9
1980	38,792	922	1,074	856.4
1985	41,672	893	1,011	883.5
1990	41,119	834	1,118	745.7
1991	39,233	848	1,074	789.9
1992	39,210	857	1,090	785.7
1993	39,064	790	1,063	742.7
1994	39,064	815	1,093	745.5
1995	39,445	808	1,086	743.6
1996	41,104	765	1,093	699.4
1997	41,419	707	1,106	639.5
1998	42,032	673	1,087	619.0
1999	41,766	656	1,056	621.1
2000	39,641	646	1,064	606.8
2001	41,588	622	1,037	599.7
2002	41,002	612	1,016	602.5
2003	39,983	606	1,010	600.3
2004	40,290	621	1,042	596.4
2005	41,354	591	1,024	577.4
2006	41,109	562	1,018	548.7
2007	40,695	553	1,016	544.2
2008	40,301	521	952	546.7
2009	40,109	477	852	559.7
2010	40,512	503	894	562.8
2011	40,521	500	888	563.5
2012	40,530	475	885	536.5
2013	39,999	465	891	521.8
		Average annual percentage change		
1970–2013	1.0%	-0.6%	-0.1%	-0.4%
2003–2013	0.0%	-2.6%	-1.2%	-1.4%

Sources:

Number of vessels 1970–92, 1995–2010 – U.S. Department of the Army, Corps of Engineers, *Waterborne Transportation Lines of the United States, 2011,* New Orleans, LA, 2012, Table 2, p. 6, 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 2011, Part 5: National Summaries*, New Orleans, LA, 2012, Table 1-4, pp. 1-6, 1-7, and annual. (Additional resources: www.navigationdatacenter.us/index.htm)

Number of vessels, ton-miles, tons shipped and average length of haul, 2011-2013 – U.S. Department of the Army, Corps of Engineers, *The U.S. Waterway System, Transportation Facts and Information Fact Card*.

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

[b] These figures are not consistent with the figures on Table 9.4 because intra-territory tons are not included in this table. Intra-territory traffic is traffic between ports in Puerto Rico and the Virgin Islands.

The data displayed in this table come from the Environmental Protection Agency's NONROAD2008a model.

Table 9.6
Recreational Boat Energy Use, 1970–2013

Year	Number of boats (thousands)	Diesel fuel	Gasoline	Total energy use
			(trillion Btu)	
1970	10,087	5.5	151.7	157.2
1971	10,137	6.5	152.6	159.2
1972	10,187	7.6	153.6	161.2
1973	10,237	8.6	154.5	163.2
1974	10,287	9.7	155.5	165.1
1975	10,337	10.7	156.4	167.1
1976	10,387	11.8	157.4	169.1
1977	10,437	12.8	158.3	171.1
1978	10,487	13.9	159.3	173.1
1979	10,537	14.9	160.2	175.1
1980	10,587	16.0	161.2	177.1
1981	10,637	17.0	162.1	179.1
1982	10,687	18.0	163.1	181.1
1983	10,737	19.1	164.0	183.1
1984	10,787	20.1	165.0	185.1
1985	10,837	21.2	165.9	187.1
1986	10,887	22.2	166.9	189.1
1987	10,937	23.3	167.8	191.1
1988	11,030	24.3	170.4	194.7
1989	11,122	25.4	172.9	198.3
1990	11,215	26.4	175.4	201.8
1991	11,327	27.5	178.7	206.2
1992	11,440	28.5	182.0	210.5
1993	11,553	29.5	185.3	214.8
1994	11,770	30.6	192.5	223.1
1995	11,988	31.6	199.7	231.3
1996	12,206	32.7	206.8	239.5
1997	12,244	33.7	207.2	240.9
1998	12,283	34.8	207.4	242.2
1999	12,321	35.8	207.1	243.0
2000	12,359	36.8	206.6	243.4
2001	12,464	37.9	206.9	244.9
2002	12,568	39.0	206.7	245.7
2003	12,673	40.2	206.0	246.2
2004	12,777	41.3	205.0	246.2
2005	12,882	42.4	203.7	246.1
2006	12,984	43.5	202.5	245.9
2007	13,086	44.6	201.2	245.8
2008	13,189	45.7	200.0	245.7
2009	13,291	46.8	198.8	245.6
2010	13,393	47.9	197.3	245.2
2011	13,497	49.0	195.9	244.9
2012	13,602	50.1	194.7	244.8
2013	13,707	51.2	193.8	245.0
		Average annual percentage change		
1970–2013	0.5%	3.6%	0.4%	0.7%
2003–2013	0.8%	2.4%	-0.6%	0.0%

Source:
U.S. Environmental Protection Agency, NONROAD2008a model, downloadable file from www.epa.gov/otaq/nonrdmdl.htm.

The Interstate Commerce Commission designates Class I railroads on the basis of annual gross revenues. In 2013, 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, 2013

Railroad	Revenue ton-miles (billions)	Percent
Burlington Northern and Santa Fe Railway Company	675	38.9%
Union Pacific Railroad Company	514	29.5%
CSX Transportation	227	13.0%
Norfolk Southern Railway	194	11.1%
Canadian National, Grand Trunk Corporation	59	3.4%
Canadian Pacific Soo Railway	40	2.3%
Kansas City Southern Railway Company	31	1.8%
Total	**1,740**	**100.0%**

Source:
Association of American Railroads, *Railroad Facts*, *2014 Edition*, Washington, DC, November 2014, p. 68. (Additional resources: www.aar.org)

Revenue ton-miles for Class I freight railroads was over 1.7 trillion in 2013. Though there are many regional and local freight railroads, the Class I freight railroads accounted for 94% of the railroad industry's freight revenue in 2013 and 69% of the industry's mileage operated. The energy intensity of Class I railroads hit an all-time low of 289 Btu/ton-mile in 2010 and continued to be below 300 Btu/ton-mile in 2013.

Table 9.8
Summary Statistics for Class I Freight Railroads, 1970–2013

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
2008	24,003	450	524	37,226	1,934	919	1,777,236	305	542.5
2009	24,045	416	436	32,115	1,668	919	1,532,214	291	446.6
2010	23,893	398	476	35,541	1,851	914	1,691,004	289	488.1
2011	24,250	381	493	36,649	1,885	917	1,729,256	298	514.6
2012	24,707	381	500	36,525	1,760	973	1,712,567	294	504.0
2013	25,033	374	504	35,253	1,758	990	1,740,687	296	514.9
				Average annual percentage change					
1970–2013	-0.2%	-3.1%	0.4%	0.4%	0.4%	1.5%	1.9%	-2.0%	-0.1%
2003–2013	1.9%	-2.2%	-0.2%	-0.1%	-0.2%	1.4%	1.2%	-1.5%	-0.4%

Source:
Association of American Railroads, *Railroad Facts*, *2014 Edition*, Washington, DC, November 2014, pp. 30, 31, 36, 37, 39, 51 and 54. (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 2012 Commodity Flow Survey, 7% of all freight ton-miles are rail intermodal shipments (truck/rail or rail/water). See Table 5.16 for details. The number of trailers and containers moved by railroads has increased more than seven-fold from 1965 to 2013. Containerization has increased in the last two decades, evidenced by the 392% increase in the number of containers from 1988 to 2013. The number of trailers moved by rail has fallen to an all-time low in 2013.

Table 9.9
Intermodal Rail Traffic, 1965–2013[a]

Year	Trailers & containers	Trailers	Containers
1965	1,664,929	[b]	[b]
1970	2,363,200	[b]	[b]
1975	2,238,117	[b]	[b]
1980	3,059,402	[b]	[b]
1981	3,150,522	[b]	[b]
1982	3,396,973	[b]	[b]
1983	4,090,078	[b]	[b]
1984	4,565,743	[b]	[b]
1985	4,590,952	[b]	[b]
1986	4,997,229	[b]	[b]
1987	5,503,819	[b]	[b]
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	7,936,172	3,492,463	4,443,709
1996	8,143,258	3,302,128	4,841,130
1997	8,698,308	3,453,907	5,244,401
1998	8,772,663	3,353,032	5,419,631
1999	8,907,626	3,207,407	5,700,219
2000	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	12,026,631	2,600,635	9,425,996
2008	11,499,978	2,478,890	9,021,088
2009	9,875,967	1,639,603	8,236,364
2010	11,283,151	1,684,684	9,598,467
2011	11,892,418	1,698,615	10,193,803
2012	12,267,416	1,518,323	10,749,093
2013	12,831,692	1,505,032	11,326,660
	Average annual percentage change		
1965–2013	4.3%	[b]	[b]
2003–2013	2.6%	-5.4%	4.4%

Source:
Association of American Railroads, *Railroad Facts*, *2014 Edition*, Washington, DC, November 2014, p. 29. (Additional resources: www.aar.org)

[a] Beginning in 1995, the Grand Trunk Western Railroad and the Soo Line Railroad Company are excluded. Beginning in 1999, the Illinois Central data are excluded. Beginning in 2002, the Wisconsin Central data are excluded.

[b] Data are not available.

The National Railroad Passenger Corporation, known as Amtrak, began operation in 1971. Amtrak revenue passenger-miles have grown at an average annual rate of 3.0% from 1971 to 2013.

Table 9.10
Summary Statistics for the National Railroad Passenger Corporation (Amtrak), 1971–2013

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
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 [b]
1994	411	1,874	34,940	305,600	5,869	276	2,282	13.4
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	37,484	266,545	5,784	218	2,516	14.5
2008	278	1,177	37,736	271,762	6,179	215	2,398	14.8
2009	274	1,214	38,300	282,764	5,914	217	2,435	14.4
2010	282	1,274	37,453	294,820	6,420	220	2,271	14.6
2011	287	1,301	37,090	296,315	6,568	213	2,214	14.5
2012	485	2,090	37,640	319,088	6,804	218	2,120	14.4
2013	418	1,447	38,410	324,949	6,810	218	2,118	14.4
				Average annual percentage change				
1971–2013	[a]	1.4%	2.0%	2.0%	3.0%	0.4%	[a]	[a]
2003–2013	-0.6%	-1.1%	0.3%	-0.2%	1.8%	-0.6%	-2.8%	-1.0%

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.

1994–2013 – 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*, *2014 Edition*, Washington, DC, 2014, p. 77; personal communication with Amtrak, Washington, DC.

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, 1984–2013

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
2008	6,617	310.2	472	11,049	23.4	2,656	29.3
2009	6,941	343.5	468	11,232	24.0	2,811	31.6
2010	6,927	345.3	464	10,874	23.4	2,897	31.5
2011	7,193	345.2	466	11,427	24.5	2,780	31.8
2012	7,059	346.4	471	11,181	23.7	2,823	31.6
2013	7,310	359.1	480	11,862	24.7	2,737	32.5
			Average annual percentage change				
1984–2013	2.0%	2.7%	2.0%	2.3%	0.2%		
2003–2013	2.1%	2.3%	1.6%	2.2%	0.6%		

Source:
American Public Transportation Association, *2015 Public Transportation Fact Book*, Washington, DC, June 2015, Appendix A. (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, 1970–2013[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
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
2008	13,346	762.8	4,001	18,941	4.7	2,521	47.8
2009	13,529	775.3	3,955	19,004	4.8	2,516	47.8
2010	13,614	759.6	4,007	18,580	4.6	2,520	46.8
2011	13,328	744.1	4,083	19,520	4.8	2,459	48.0
2012	12,455	749.5	4,192	19,835	4.7	2,398	47.6
2013	12,434	774.3	4,275	20,381	4.8	2,404	49.0
			Average annual percentage change				
1970–2013	0.4%	1.3%	1.6%	1.2%	-0.1%[g]	0.3%	1.4%
2003–2013	0.2%	1.1%	3.6%	3.1%	-0.4%	-1.6%	1.4%

Sources:
American Public Transportation Association, *2015 Public Transportation Fact Book*, Washington, DC, June 2015, Appendix A. (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 1980–2013.

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, 2014	
	Canada	*31%*
	France	*58%*
	Germany	*59%*
	Japan	*41%*
	United Kingdom	*62%*
	United States	*12%*
Table 10.11	Average price of a new car, 2013 (current dollars)	25,487
	Domestic	*23,766*
	Import	*29,827*
Table 10.12	Car operating costs, 2014	
	Variable costs (constant 2014 dollars per 10,000 miles)	*1,903*
	Fixed costs (constant 2014 dollars per 10,000 miles)	*5,775*
Table 10.16	Transportation sector share of total employment	
	2000	*8.3%*
	2014	*7.4%*

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.*

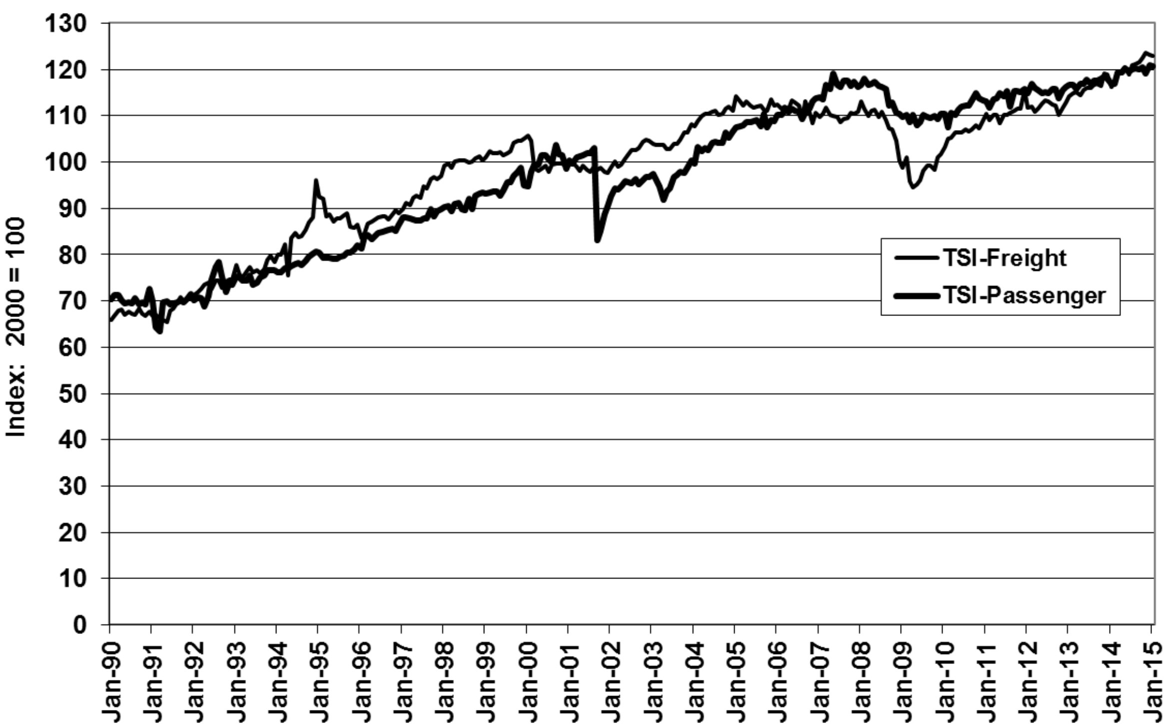
The index does not include international or coastal steamship movements, private trucking, courier services, or the United States Postal Services.

The Passenger TSI consists of:

- *local mass transit;*
- *intercity passenger rail; and*
- *passenger air transportation.*

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

Figure 10.1. Transportation Services Index, January 1990–January 2015



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

The United States prices are the lowest of these listed countries. Those in France, Japan, Korea, the United Kingdom, and Germany paid, on average, more than six dollars per gallon in 2014. Data for China and India have been discontinued by the International Energy Agency.

Table 10.1
Gasoline Prices[a] for Selected Countries, 1990–2014

	Current dollars per gallon						Average annual percentage change
	1990	1995	2000	2005	2010	2014[b]	1990–2014
China	[c]	1.03	[c]	1.70	3.71	[c]	[c]
Japan	3.16	4.43	3.65	4.28	5.73	5.85	2.6%
India	[c]	[c]	[c]	3.71	4.29	[c]	[c]
Korea	[c]	[c]	[c]	5.28	5.60	[c]	[c]
France[d]	3.63	4.26	3.80	5.46	6.74	7.49	3.1%
United Kingdom[d]	2.82	3.21	4.58	5.97	6.83	7.96	4.4%
Germany[d]	2.65	3.96	3.45	5.75	7.11	7.75	4.6%
Canada	1.87	1.53	1.86	2.89	3.79	4.40	3.6%
United States[e]	1.16	1.15	1.51	2.27	2.78	3.36	4.5%
	Constant 2014 dollars[f] per gallon						Average annual percentage change
	1990	1995	2000	2005	2010	2014[b]	1990–2014
China	[c]	1.60	[c]	2.06	4.03	[c]	[c]
Japan	5.72	6.88	5.02	5.19	6.23	5.85	0.1%
India	[c]	[c]	[c]	4.50	4.66	[c]	[c]
Korea	[c]	[c]	[c]	6.40	6.08	[c]	[c]
France[d]	6.57	6.62	5.22	6.62	7.32	7.49	0.5%
United Kingdom[d]	5.11	4.99	6.30	7.23	7.42	7.96	1.9%
Germany[d]	4.80	6.15	4.74	6.97	7.71	7.75	2.0%
Canada	2.83	2.38	2.56	3.50	4.11	4.40	1.9%
United States[e]	2.01	1.79	2.08	2.75	3.02	3.56	2.4%

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.

Source:
International Energy Agency, *Energy Prices and Taxes, Fourth Quarter, 2014*, Paris, France, 2015. (Additional resources: www.iea.org)

[a] Prices represent the retail prices (including taxes) for regular unleaded gasoline, except for France, Germany and the United Kingdom which are premium unleaded gasoline.
[b] Average of monthly 2014 prices.
[c] Data are not available.
[d] Premium gasoline.
[e] These estimates are international comparisons only and do not necessarily correspond to gasoline price estimates in other sections of the book.
[f] Adjusted by the U.S. Consumer Price Inflation Index.

Of these selected countries, the United Kingdom had the highest diesel fuel price average in 2014, while the United States had the lowest. In fact, all countries listed except the United States had diesel prices over $5 per gallon in 2014.

Table 10.2
Diesel Fuel Prices[a] for Selected Countries, 1998–2014

	Current dollars per gallon						Average annual percentage change
	1990	2000	2005	2010	2012	2014[b]	1990–2014
China	[c]	[c]	1.69	3.65	[c]	[c]	[c]
Japan	1.75	2.85	3.44	4.86	6.03	5.10	4.6%
Korea	[c]	2.05	3.98	4.92	6.07	[c]	[c]
France	1.78	2.95	4.81	5.74	6.79	5.41	4.7%
United Kingdom	2.04	4.66	6.25	6.97	8.51	6.95	5.2%
Germany	2.72	2.79	5.01	6.15	7.25	5.74	3.2%
United States[d]	0.99	1.50	2.40	2.99	3.97	3.83	5.8%
	Constant 2014 dollars[e] per gallon						Average annual percentage change
	1990	2000	2005	2010	2012	2014[b]	1990–2014
China	[c]	[c]	2.05	3.97	[c]	[c]	[c]
Japan	3.17	3.92	4.18	5.28	6.22	5.10	2.0%
Korea	[c]	2.82	4.83	5.34	6.26	[c]	[c]
France	3.22	4.05	5.83	6.23	7.01	5.41	2.2%
United Kingdom	3.70	6.40	7.58	7.57	8.77	6.95	2.7%
Germany	4.93	3.84	6.07	6.67	7.47	5.74	0.6%
United States[d]	1.79	2.06	2.90	3.25	4.09	3.83	3.2%

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.

Source:
International Energy Agency, *Energy Prices and Taxes, Fourth Quarter, 2014*, Paris, France, 2015. (Additional resources: www.iea.org)

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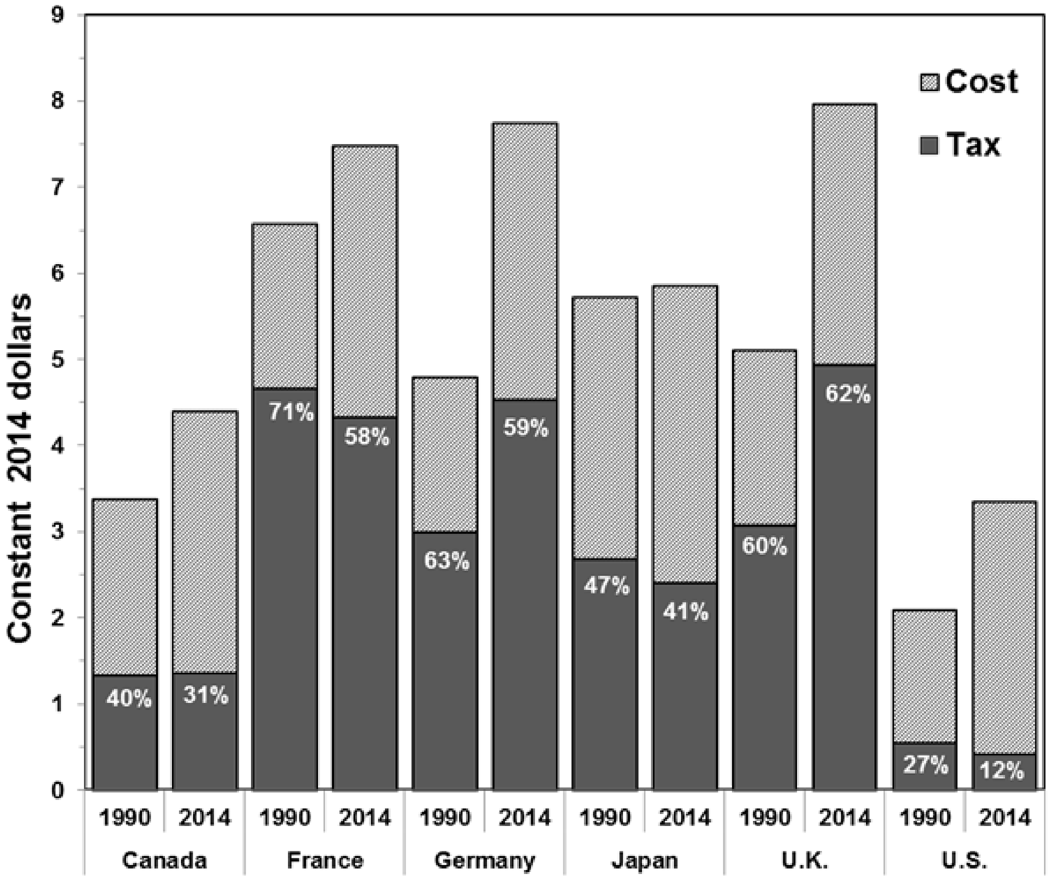
[a] Prices represent the retail prices (including taxes) for car diesel fuel for non-commercial (household) use.
[b] Average monthly 2014 prices.
[c] Data are not available.
[d] These estimates are for international comparisons only and do not necessarily correspond to gasoline price estimates in other sections of the book.
[e] Adjusted by the U.S. Consumer Price Inflation Index.

In 2014 close to 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.

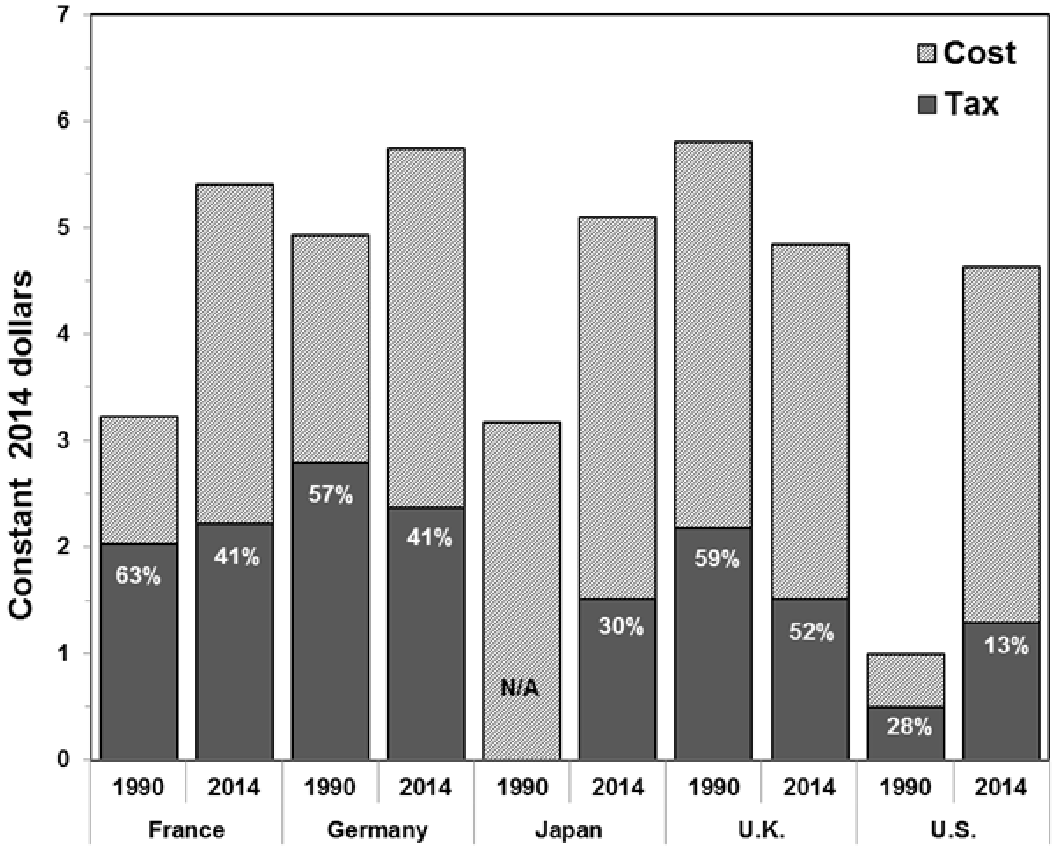
Figure 10.2. Gasoline Prices for Selected Countries, 1990 and 2014



Source:
Table 10.1 and International Energy Agency, *Energy Prices & Taxes, Fourth Quarter, 2014,* Paris, France, 2015. (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 2014



Note: Data for Canada are not available.

Source:
Table 10.2 and International Energy Agency, *Energy Prices & Taxes, Fourth Quarter, 2014,* Paris, France, 2015. (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 2014 dollars) increased by 137% from 2000 to 2014, while the average price of a gallon of gasoline increased 59% in this same time period.

Table 10.3
Prices for a Barrel of Crude Oil and a Gallon of Gasoline, 1978–2014

	Crude oil[a] (dollars per barrel)		Gasoline[b] (cents per gallon)		Ratio of gasoline to crude oil
Year	Current	Constant 2014[c]	Current	Constant 2014[c]	
1978	12.5	45.2	65.2	236.7	219.8
1980	28.1	80.6	122.1	350.8	182.7
1985	26.8	58.9	119.6	263.1	187.8
1986	14.6	31.4	93.1	201.1	268.7
1987	17.9	37.3	95.7	199.4	224.5
1988	14.7	29.4	96.3	192.7	275.7
1989	18.0	34.3	106.0	202.4	247.7
1990	22.2	40.2	121.7	220.4	230.0
1991	19.1	33.1	119.6	207.9	263.5
1992	18.4	31.1	119.0	200.8	271.2
1993	16.4	26.9	117.3	192.2	300.2
1994	15.6	24.9	117.4	187.5	316.3
1995	17.2	26.8	120.5	187.2	293.7
1996	20.7	31.2	128.8	194.3	261.2
1997	19.0	28.1	129.1	190.4	284.8
1998	12.5	18.2	111.5	161.9	374.0
1999	17.5	24.9	122.1	173.5	292.9
2000	28.3	38.9	156.3	214.9	232.3
2001	23.0	30.7	153.1	204.7	280.2
2002	24.1	31.7	144.1	189.6	251.1
2003	28.5	36.7	163.8	210.7	241.1
2004	37.0	46.3	192.3	241.0	218.4
2005	50.2	60.9	233.8	283.4	195.5
2006	60.2	70.7	263.5	309.4	183.7
2007	67.9	77.6	284.9	325.3	176.1
2008	94.7	104.2	331.7	364.7	147.0
2009	59.3	65.4	240.1	264.94	170.1
2010	76.7	83.3	283.6	307.9	155.3
2011	101.9	107.2	357.7	376.5	147.5
2012	100.9	104.1	369.5	381.0	153.8
2013	100.5	102.1	358.4	364.2	149.8
2014	92.0	92.0	342.5	342.5	156.4
		Average annual percentage change			
1978–2014	5.7%	2.0%	4.7%	1.1%	
2004–2014	9.5%	7.1%	5.9%	3.6%	

Sources:
Crude oil – U.S. Department of Energy, Energy Information Administration, *Monthly Energy Review,* March 2015, Washington, DC, Table 9.1.
Gasoline – U.S. Department of Energy, Energy Information Administration, *Monthly Energy Review,* March 2015, 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.

The price of diesel fuel was lower than gasoline in constant dollars prior to 2005 but since that time the price of diesel fuel has increased to become higher than gasoline.

Table 10.4
Retail Prices for Motor Fuel, 1978–2014
(cents per gallon, including tax)

Year	Diesel fuel[a] Current	Diesel fuel[a] Constant 2014[c]	Average for all gasoline types[b] Current	Average for all gasoline types[b] Constant 2014[c]
1978	[d]	[d]	65	237
1980	101	290	122	351
1985	122	268	120	263
1986	94	203	93	201
1987	96	200	96	199
1988	95	190	96	193
1989	102	195	106	202
1990	107	194	122	220
1991	91	158	120	208
1992	106	179	119	201
1993	98	161	117	192
1994	111	178	117	188
1995	111	172	121	187
1996	124	186	129	194
1997	120	177	129	190
1998	104	152	112	162
1999	112	159	122	174
2000	149	205	156	215
2001	140	187	153	205
2002	132	174	144	190
2003	151	194	164	211
2004	181	227	192	241
2005	240	291	234	283
2006	271	318	264	309
2007	289	329	285	325
2008	380	418	332	365
2009	247	272	240	265
2010	299	325	284	308
2011	384	404	358	377
2012	397	409	370	381
2013	392	399	358	364
2014	383	383	343	343
	Average annual percentage change			
1978–2014	4.0%[e]	0.8%[e]	4.7%	1.0%
2004–2014	7.8%	5.4%	6.0%	3.6%

Sources:
Gasoline – U.S. Department of Energy, Energy Information Administration, *Monthly Energy Review*, March 2015, 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. 2005–2014 data from EIA website. (Additional resources: www.eia.doe.gov)

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[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 2014.

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, 1978–2014
(cents per gallon, excluding tax)

Year	Propane[a] Current	Propane[a] Constant 2014[b]	No 2. diesel fuel Current	No 2. diesel fuel Constant 2014[b]
1978	33.5	121.6	37.7	136.9
1979	35.7	116.4	58.5	190.8
1980	48.2	138.5	81.8	235.0
1981	56.5	147.1	99.5	259.1
1982	59.2	145.2	94.2	231.1
1983	70.9	168.5	82.6	196.3
1984	73.7	167.9	82.3	187.5
1985	71.7	157.8	78.9	173.6
1986	74.5	160.9	47.8	103.2
1987	70.1	146.1	55.1	114.8
1988	71.4	142.9	50.0	100.1
1989	61.5	117.4	58.5	111.7
1990	74.5	134.9	72.5	131.3
1991	73.0	126.9	64.8	112.6
1992	64.3	108.5	61.9	104.4
1993	67.3	110.3	60.2	98.6
1994	53.0	84.7	55.4	88.5
1995	49.2	76.4	56.0	87.0
1996	60.5	91.3	68.1	102.8
1997	55.2	81.4	64.2	94.7
1998	40.5	58.8	49.4	71.7
1999	45.8	65.1	58.4	83.0
2000	60.3	82.9	93.5	128.5
2001	50.6	67.6	84.2	112.6
2002	41.9	55.1	76.2	100.3
2003	57.7	74.2	94.4	121.5
2004	83.9	105.1	124.3	155.8
2005	108.9	132.0	178.6	216.5
2006	135.8	159.5	209.6	246.1
2007	148.9	170.0	226.7	258.8
2008	189.2	208.0	315.0	346.4
2009	122.0	134.6	183.4	202.4
2010	148.1	160.8	213.4	231.7
2011	170.9	179.9	311.7	328.0
2012	113.9	117.4	320.2	330.2
2013	102.8	104.5	312.2	317.3
2014	109.7	109.7	292.3	292.3
		Average annual percentage change		
1978–2014	3.3%	-0.3%	5.9%	2.1%
2004–2014	2.7%	0.4%	8.9%	6.5%

Source:
U.S. Department of Energy, Energy Information Administration, Petroleum Data Analysis Tools, *Refiner Petroleum Product Prices by Sales Type*, April 2015, Washington, DC. (Additional resources: www.eia.doe.gov)

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

Prices of finished aviation gasoline (current dollars) dropped in 2009 but then began to climb. In 2012 both finished aviation gasoline and kerosene-type jet fuel reached their all-time high.

Table 10.6
Refiner Sales Prices for Aviation Gasoline and Jet Fuel, 1978–2014
(cents per gallon, excluding tax)

	Finished aviation gasoline		Kerosene-type jet fuel	
Year	Current	Constant 2014[a]	Current	Constant 2014[a]
1978	51.6	187.4	38.7	140.5
1979	68.9	224.7	54.7	178.4
1980	108.4	311.4	86.8	249.4
1981	130.3	339.3	102.4	266.7
1982	131.2	321.9	96.3	236.2
1983	125.5	298.3	87.8	208.7
1984	123.4	281.2	84.2	191.8
1985	120.1	264.2	79.6	175.1
1986	101.1	218.4	52.9	114.3
1987	90.7	189.0	54.3	113.2
1988	89.1	178.3	51.3	102.7
1989	99.5	190.0	59.2	113.0
1990	112.0	202.9	76.6	138.7
1991	104.7	182.0	65.2	113.3
1992	102.7	173.3	61.0	102.9
1993	99.0	162.2	58.0	95.0
1994	95.7	152.9	53.4	85.3
1995	100.5	156.1	54.0	83.9
1996	111.6	168.4	65.1	98.2
1997	112.8	166.4	61.3	90.4
1998	95.7	139.0	45.2	65.6
1999	105.9	150.5	54.3	77.2
2000	130.6	179.5	89.9	123.6
2001	132.3	176.9	77.5	103.6
2002	128.8	169.5	72.1	94.9
2003	149.3	192.1	87.2	112.2
2004	181.9	228.0	120.7	151.3
2005	223.1	270.4	173.5	210.3
2006	268.2	314.9	199.8	234.6
2007	284.9	325.3	216.5	247.2
2008	327.3	359.9	305.2	335.6
2009	244.2	269.5	170.4	188.0
2010	302.8	328.7	220.1	239.0
2011	380.3	400.2	305.4	321.4
2012	397.1	409.5	310.4	320.1
2013	393.2	399.6	297.9	302.7
2014	398.6	398.6	277.2	277.2
		Average annual percentage change		
1978–2014	5.8%	2.1%	5.6%	1.9%
2004–2014	8.2%	5.7%	8.7%	6.2%

Source:
U.S. Department of Energy, Energy Information Administration, Petroleum Data Analysis Tools, *Refiner Petroleum Product Prices by Sales Type*, April 2015, Washington, DC. (Additional resources: www.eia.doe.gov)

[a] Adjusted by the Consumer Price Inflation Index.

The federal government taxes highway motor fuel and uses the money to pay for roadway upkeep and improvement, as well as other related expenditures. Compressed natural gas (CNG) and liquefied petroleum gas (LPG) have the lowest taxes, while diesel fuel and liquefied natural gas (LNG) have the highest.

Table 10.7
Federal Excise Taxes on Motor Fuels, 2013

Fuel	Cents per gallon	Effective Date
Gasoline	18.4	October 1, 1997
Diesel and kerosene	24.4	October 1, 1997
Gasohol[a]	18.4	January 1, 2005
CNG	18.3[c]	October 1, 2006
LNG	24.3	October 1, 2006
LPG	18.3	October 1, 2006
Other alternative fuels[b]	18.4	October 1, 1997

Source:
U.S. Department of Transportation, Federal Highway Administration, *Highway Statistics 2013*, Washington, DC, August 2014, 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 liquids used as a motor fuel.
[c] Compressed natural gas is 18.3 cents per energy equivalent of a gallon of gasoline.

These states have laws and incentives for alternative fuels production and/or use.

Table 10.8
Federal and State Alternative Fuel Incentives, 2015

State	Biodiesel	Ethanol	Natural Gas	Liquefied petroleum gas (LPG)	Electric vehicles (EVs)	Neighborhood electric vehicles (NEVs)	Hydrogen fuel cells	Aftermarket conversions
Federal	35	30	29	29	24	3	26	6
Alabama	4	3	4	5	4	0	2	0
Alaska	1	2	1	1	1	1	1	1
Arizona	6	5	14	14	14	1	11	0
Arkansas	5	4	8	5	2	0	2	2
California	16	14	27	18	46	3	26	7
Colorado	9	9	16	11	13	1	6	3
Connecticut	3	4	5	3	8	0	5	3
Delaware	2	2	2	5	2	1	1	0
Dist. of Columbia	2	3	4	4	4	0	4	1
Florida	8	7	5	6	8	1	2	1
Georgia	5	5	6	4	8	0	4	2
Hawaii	7	9	4	4	9	2	5	0
Idaho	3	1	2	3	1	1	2	0
Illinois	15	14	8	8	14	1	6	4
Indiana	14	14	15	11	9	2	6	6
Iowa	9	11	5	3	4	1	3	1
Kansas	7	12	5	4	1	1	1	2
Kentucky	10	11	9	5	4	1	1	1
Louisiana	6	6	9	7	4	1	1	3
Maine	6	5	4	3	4	3	2	0
Maryland	2	3	3	3	12	2	1	1
Massachusetts	5	4	5	3	8	1	3	1
Michigan	3	2	3	2	7	0	2	0
Minnesota	6	10	3	4	9	3	3	0
Mississippi	4	4	7	5	2	0	1	2
Missouri	7	7	7	8	6	1	6	0
Montana	6	6	3	3	1	2	1	1
Nebraska	3	4	5	3	2	1	1	1
Nevada	5	3	8	8	9	1	7	0
New Hampshire	5	2	4	4	2	2	2	1
New Jersey	3	3	5	3	4	1	2	1
New Mexico	11	7	6	5	6	1	7	1
New York	4	5	9	3	7	1	6	2
North Carolina	12	11	8	7	12	0	6	1
North Dakota	11	8	3	2	1	1	2	0
Ohio	5	5	9	6	5	0	4	1
Oklahoma	8	10	14	8	5	1	6	7
Oregon	10	9	9	8	12	1	6	3
Pennsylvania	4	4	4	3	5	0	3	2
Rhode Island	3	2	3	2	8	2	4	1
South Carolina	10	8	6	7	6	2	9	1
South Dakota	6	7	2	2	0	0	0	0
Tennessee	8	8	7	5	3	1	2	0
Texas	6	6	14	9	8	1	5	4
Utah	2	1	12	7	8	0	3	3
Vermont	5	4	4	4	6	1	5	0
Virginia	16	11	16	9	12	1	10	3
Washington	17	14	9	7	20	1	5	3
West Virginia	5	4	9	6	4	1	4	2
Wisconsin	12	9	7	8	6	1	7	0
Wyoming	0	1	6	1	1	0	0	2
Totals	**377**	**353**	**392**	**308**	**381**	**54**	**240**	**87**

Source:
U.S. Department of Energy, Energy Efficiency and Renewable Energy, Alternative Fuels Data Center. Data downloaded April 2015. (Additional resources: www.eere.energy.gov/afdc/laws/matrix/tech)

Table 10.9
Federal and State Advanced Technology Incentives, 2015

State	Hybrid electric vehicles (HEV) or plug-in hybrid vehicles (PHEVs)	Fuel economy or efficiency	Idle reduction	Other[a]
Federal	9	13	7	8
Alabama	2	1	3	0
Alaska	0	1	1	0
Arizona	6	0	2	1
Arkansas	0	0	1	1
California	38	6	4	11
Colorado	11	0	2	1
Connecticut	6	1	2	3
Delaware	1	2	2	0
Dist. of Columbia	2	3	1	0
Florida	5	1	1	0
Georgia	3	0	2	1
Hawaii	9	1	1	0
Idaho	2	1	0	0
Illinois	11	3	5	0
Indiana	8	3	4	4
Iowa	0	0	0	0
Kansas	0	1	1	0
Kentucky	3	1	0	0
Louisiana	2	1	0	0
Maine	2	2	3	1
Maryland	10	0	2	1
Massachusetts	8	0	2	1
Michigan	5	0	0	0
Minnesota	7	1	3	2
Mississippi	2	1	1	0
Missouri	2	0	1	0
Montana	0	1	0	0
Nebraska	0	0	1	0
Nevada	5	0	1	0
New Hampshire	2	1	4	1
New Jersey	4	5	1	3
New Mexico	2	1	1	0
New York	7	3	3	5
North Carolina	9	1	4	1
North Dakota	0	0	0	0
Ohio	0	0	2	0
Oklahoma	1	0	2	2
Oregon	7	1	3	1
Pennsylvania	2	1	4	1
Rhode Island	7	2	3	5
South Carolina	9	1	3	1
South Dakota	0	0	0	1
Tennessee	3	2	0	0
Texas	5	1	3	1
Utah	4	4	3	1
Vermont	4	1	3	1
Virginia	6	2	2	2
Washington	8	4	4	3
West Virginia	2	0	2	1
Wisconsin	4	0	2	0
Wyoming	1	0	1	0
Totals	**246**	**74**	**103**	**65**

Source:
U.S. Department of Energy, Energy Efficiency and Renewable Energy, Alternative Fuels Data Center. Data downloaded April 2015. (Additional resources: www.eere.energy.gov/afdc/laws/matrix/tech)

[a] Includes Clean Fuel Initiatives and Pollution Prevention.

The average price of a new car in 2013 ($25,487) was very close to the average price in 1916 ($23,099) when adjusted for inflation. Average new car prices were at their lowest in 1940 ($12,920). Since 1914 the highest average price was in the year 1999 ($28,932).

Table 10.10
Average Price of a New Car, 1913–2013

Year	2013 Constant dollars	Year	2013 Constant dollars	Year	2013 Constant dollars	Year	2013 Constant dollars
1913	$33,670	1939	$13,898	1965	$20,430	1991	$26,468
1914	$34,844	1940	$12,920	1966	$20,414	1992	$27,623
1915	$28,971	1941	$13,087	1967	$22,431	1993	$27,199
1916	$23,099	1942	$13,255	1968	$21,136	1994	$28,142
1917	$21,337	1943	$13,422	1969	$22,578	1995	$27,452
1918	$19,575	1944	$13,590	1970	$21,266	1996	$27,879
1919	$19,380	1945	$13,757	1971	$21,524	1997	$27,887
1920	$19,184	1946	$13,925	1972	$21,618	1998	$28,928
1921	$20,358	1947	$14,093	1973	$21,260	1999	$28,932
1922	$21,533	1948	$14,759	1974	$20,980	2000	$28,465
1923	$19,575	1949	$17,199	1975	$21,434	2001	$28,231
1924	$17,618	1950	$17,625	1976	$22,182	2002	$28,314
1925	$17,422	1951	$17,925	1977	$22,350	2003	$27,427
1926	$17,226	1952	$19,417	1978	$22,792	2004	$27,216
1927	$17,031	1953	$19,441	1979	$21,970	2005	$27,446
1928	$16,835	1954	$19,089	1980	$21,413	2006	$27,301
1929	$16,639	1955	$18,984	1981	$22,834	2007	$26,841
1930	$16,443	1956	$19,532	1982	$23,875	2008	$25,363
1931	$18,401	1957	$21,698	1983	$24,807	2009	$25,144
1932	$20,358	1958	$22,953	1984	$25,504	2010	$26,605
1933	$19,184	1959	$23,002	1985	$25,630	2011	$26,382
1934	$18,009	1960	$22,134	1986	$26,892	2012	$25,968
1935	$16,052	1961	$21,076	1987	$27,450	2013	$25,487
1936	$14,094	1962	$20,952	1988	$27,435		
1937	$14,486	1963	$20,721	1989	$26,999		
1938	$14,877	1964	$20,824	1990	$26,811		

Note: These data are based on an average car and do not include prices for pickups, vans, or sport utility vehicles. Estimations were used for years 1941-1946.

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 (2015), National Income and Product Accounts.

In current dollars, import cars, on average, were less expensive than domestic cars until 1982. Since then, import prices have almost tripled, while domestic prices have more than doubled (current dollars).

Table 10.11
Average Price of a New Car (Domestic and Import), 1970–2013

	Domestic[a]		Import		Total	
Year	Current dollars	Constant 2013 dollars[b]	Current dollars	Constant 2013 dollars[b]	Current dollars	Constant 2013 dollars[b]
1970	3,708	22,263	2,648	15,899	3,542	21,266
1975	5,084	22,014	4,384	18,983	4,950	21,434
1980	7,609	21,512	7,482	21,153	7,574	21,413
1981	8,912	22,840	8,896	22,799	8,910	22,834
1982	9,865	23,815	9,957	24,037	9,890	23,875
1983	10,516	24,596	10,868	25,419	10,606	24,807
1984	11,079	24,841	12,336	27,659	11,375	25,504
1985	11,589	25,091	12,853	27,827	11,838	25,630
1986	12,319	26,184	13,670	29,056	12,652	26,892
1987	12,922	26,499	14,470	29,673	13,386	27,450
1988	13,418	26,423	15,221	29,973	13,932	27,435
1989	13,936	26,181	15,510	29,138	14,371	26,999
1990	14,489	25,825	16,640	29,659	15,042	26,811
1991	15,192	25,984	16,327	27,926	15,475	26,468
1992	15,644	25,976	18,593	30,872	16,636	27,623
1993	15,976	25,756	20,261	32,664	16,871	27,199
1994	16,930	26,612	21,989	34,565	17,903	28,142
1995	16,864	25,778	23,202	35,466	17,959	27,452
1996	17,468	25,936	26,205	38,908	18,777	27,879
1997	17,532	25,447	27,718	40,231	19,213	27,887
1998	18,501	26,441	28,695	41,010	20,241	28,928
1999	19,006	26,576	27,472	38,414	20,691	28,932
2000	19,561	26,463	26,008	35,184	21,041	28,465
2001	20,004	26,313	25,809	33,949	21,462	28,231
2002	20,431	26,457	25,612	33,166	21,865	28,314
2003	19,961	25,272	26,136	33,090	21,663	27,427
2004	20,509	25,292	25,942	31,992	22,069	27,216
2005	21,565	25,723	26,622	31,755	23,009	27,446
2006	22,139	25,583	27,061	31,270	23,626	27,301
2007	22,264	25,014	27,463	30,856	23,890	26,841
2008	22,192	24,012	25,903	28,027	23,441	25,363
2009	22,084	23,980	25,223	27,389	23,156	25,144
2010	23,770	25,394	27,232	29,093	24,903	26,605
2011	24,132	24,992	28,329	29,339	25,474	26,382
2012	24,130	24,483	29,114	29,540	25,593	25,968
2013	23,766	23,766	29,827	29,827	25,487	25,487
			Average annual percentage change			
1970–2013	4.4%	0.2%	5.8%	1.5%	4.7%	0.4%
2003–2013	1.8%	-0.6%	1.3%	-1.0%	1.6%	-0.7%

Note: These data are based on an average car and do not include prices for pickups, vans, or sport utility vehicles. Estimations were used for years 1941-1946.

Source:
U.S. Department of Commerce, Bureau of Economic Analysis, *Average Transaction Price per New Car*, Washington, DC, 2015. (Additional resources: www.bea.gov)

[a] Includes all vehicles produced in the United States regardless of manufacturer.
[b] Adjusted by the Consumer Price Inflation Index.

The total cost of operating a 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 was 16.9% in 2014 which is down from 18.4% in 2013.

Table 10.12
Car Operating Cost per Mile, 1985–2014

	Constant 2014 dollars per 10,000 miles[a]			Total cost per mile[b] (constant 2014 cents[a])	Percentage gas and oil of total cost
Model year	Variable cost	Fixed cost	Total cost		
1985	1,633	4,535	6,167	61.67	19.9%
1986	1,408	4,983	6,391	63.91	15.1%
1987	1,396	4,851	6,248	62.48	14.7%
1988	1,581	6,063	7,644	76.44	13.6%
1989	1,527	5,575	7,102	71.02	14.2%
1990	1,521	5,898	7,419	74.19	13.2%
1991	1,686	6,198	7,884	78.84	14.6%
1992	1,519	6,385	7,904	79.04	12.6%
1993	1,507	6,098	7,605	76.05	12.7%
1994	1,454	6,128	7,581	75.81	11.8%
1995	1,491	6,221	7,713	77.13	11.7%
1996	1,448	6,327	7,775	77.75	10.9%
1997	1,593	6,413	8,006	80.06	12.2%
1998	1,554	6,576	8,130	81.30	11.1%
1999	1,506	6,622	8,128	81.28	9.8%
2000	1,677	6,494	8,172	81.72	11.6%
2001	1,818	6,177	7,995	79.95	13.2%
2002	1,553	6,414	7,967	79.67	9.7%
2003	1,685	6,284	7,969	79.69	11.6%
2004	1,579	7,059	8,639	86.39	9.4%
2005	1,709	6,560	8,269	82.69	12.0%
2006	1,773	5,503	7,276	72.76	15.3%
2007	1,656	5,441	7,096	70.96	14.3%
2008	1,865	5,936	7,801	78.01	16.4%
2009	1,702	6,098	7,799	77.99	14.3%
2010	1,816	6,209	8,025	80.25	15.4%
2011	1,867	6,164	8,031	80.31	16.2%
2012	2,025	5,925	7,950	79.50	18.4%
2013	2,075	5,886	7,961	79.61	18.4%
2014	1,903	5,775	7,678	76.78	16.9%
		Average annual percentage change			
1985–2014	0.5%	0.8%	0.8%	0.8%	
2004–2014	1.9%	-2.0%	-1.2%	-1.2%	

Source:
Ward's Communications, *Motor Vehicle Facts and Figures 2014*, Southfield, Michigan, 2014, p. 55, and annual. Original data from AAA "Your Driving Costs." (Additional resources: newsroom.aaa.com)

[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 2014 model year cars, the fixed cost is over $16 per day.

Table 10.13
Fixed Car Operating Costs per Year, 1975–2014
(constant 2014 dollars)[a]

Model year	Insurance[b]	License, registration & taxes	Depreciation	Finance charge	Total	Average fixed cost per day
1975	1,685	132	3,401	c	5,219	14.30
1977	2,024	289	3,309	c	5,622	15.39
1978	1,540	269	3,246	c	5,054	13.83
1979	1,575	293	3,072	c	5,905	16.17
1980	1,408	236	2,982	c	5,841	16.00
1981	1,328	229	3,352	c	6,185	16.95
1982	1,101	132	3,327	c	5,883	16.12
1983	1,117	231	3,085	c	5,690	15.59
1984	1,151	242	2,750	c	5,345	14.65
1985	1,023	242	2,777	1,175	5,217	14.30
1986	1,099	281	2,851	1,376	5,607	15.36
1987	1,115	267	3,113	1,096	5,591	15.32
1988	1,147	278	3,570	1,131	6,126	16.79
1989	1,231	275	3,853	1,123	6,482	17.76
1990	1,219	299	4,269	1,232	7,019	19.24
1991	1,231	292	4,352	462	6,337	17.36
1992	1,328	294	4,585	1,343	7,549	20.69
1993	1,219	292	4,636	1,098	7,245	19.86
1994	1,228	310	4,696	1,035	7,270	19.92
1995	1,216	315	4,774	1,066	7,371	20.19
1996	1,275	324	4,783	1,083	7,466	20.46
1997	1,249	319	4,826	1,133	7,527	20.62
1998	1,307	328	4,886	1,181	7,702	21.10
1999	1,378	321	4,883	1,177	7,759	21.26
2000	1,334	307	4,801	1,167	7,608	20.84
2001	1,325	278	4,743	1,158	7,503	20.56
2002	1,334	265	4,897	1,090	7,585	20.78
2003	1,418	264	4,809	957	7,448	20.41
2004	2,009	520	4,740	929	8,197	22.46
2005	1,561	472	4,702	896	7,631	20.91
2006	1,087	628	3,983	841	6,540	17.92
2007	1,125	614	3,873	837	6,449	17.66
2008	1,037	609	3,652	833	6,131	16.80
2009	1,077	626	3,819	860	6,381	17.48
2010	1,119	635	3,858	875	6,488	17.77
2011	1,019	626	3,924	866	6,435	17.63
2012	1,032	629	3,654	872	6,188	16.95
2013	1,046	621	3,629	862	6,157	16.87
2014	1,023	641	3,510	847	6,021	16.50
			Average annual percentage change			
1975–2014	-1.3%	4.1%	0.1%	c	0.4%	0.4%
2004–2014	-6.5%	2.1%	-3.0%	-0.9%	-3.0%	-3.0%

Source:
Ward's Communications, *Motor Vehicle Facts and Figures 2014*, Southfield, Michigan, 2014, p. 55 and annual. Original data from AAA "Your Driving Costs." (Additional resources: newsroom.aaa.com)

[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 – 2003; $100 deductible 2004-2013. Collision: $100 deductible through 1992; $500 deductible for 1993 – on. Property Damage & Liability: coverage = $100,000/$300,000.
[c] Data are not available.

Table 10.14
Personal Consumption Expenditures, 1970–2014
(billion dollars)

Year	Personal consumption expenditures: Current	Personal consumption expenditures: Constant 2014[a]	Transportation personal consumption expenditures: Current	Transportation personal consumption expenditures: Constant 2014[a]	Transportation PCE as a percent of PCE
1970	647.7	3,087.5	80.8	385.2	12.5%
1980	1,754.6	4,292.7	241.7	591.3	13.8%
1990	3,825.6	6,214.7	455.7	740.3	11.9%
2000	6,792.4	8,994.9	811.2	1,074.2	11.9%
2005	8,794.1	10,366.4	983.2	1,159.0	11.2%
2006	9,304.0	10,640.4	1,016.8	1,162.9	10.9%
2007	9,750.5	10,861.5	1,058.3	1,178.9	10.9%
2008	10,013.6	10,938.7	1,040.4	1,136.5	10.4%
2009	9,847.0	10,674.8	891.3	966.2	9.1%
2010	10,202.2	10,914.4	968.3	1,035.9	9.5%
2011	10,689.3	11,203.1	1,081.2	1,133.2	10.1%
2012	11,083.1	11,411.4	1,130.5	1,164.0	10.2%
2013	11,484.3	11,651.2	1,158.6	1,175.4	10.1%
2014	11,930.3	11,930.3	1,191.0	1,191.0	10.0%

Note: Transportation PCE includes the following categories: transportation, motor vehicles and parts, and gasoline and oil.

Source:
U.S. Department of Commerce, Bureau of Economic Analysis, National Income and Product Accounts, Table 2.3.5, www.bea.gov

Table 10.15
Consumer Price Indices, 1970–2014
(1970 = 1.000)

Year	Consumer price index	Transportation consumer price index[b]	New car consumer price index	Used car 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	2.676
1990	3.369	3.213	2.286	3.769	5.557
2000	4.438	4.088	2.689	4.994	9.537
2005	5.034	4.637	2.597	4.468	12.184
2008	5.549	5.215	2.527	4.293	13.758
2009	5.529	4.780	2.554	4.070	13.462
2010	5.620	5.157	2.599	4.587	14.017
2011	5.797	5.663	2.672	4.776	14.566
2012	5.917	5.796	2.716	4.818	15.144
2013	6.004	5.798	2.745	4.804	15.700
2014	6.101	5.758	2.755	4.779	16.290

Sources:
Bureau of Labor Statistics, Consumer Price Index Table 1A for 2014, 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.gov)

[a] Adjusted by the GNP price deflator.
[b] Transportation Consumer Price Index includes new and used cars, gasoline, car 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 7.4% of total employment in 2014.

Table 10.16
Transportation-Related Employment, 2000 and 2014[a]
(thousands)

	2000	2014	Percent change
Truck transportation (includes drivers)	1,405.8	1,415.8	0.7%
Transit and ground transportation	372.1	465.4	25.1%
Air transportation	614.4	442.1	-28.0%
Rail transportation	231.7	235.3	1.6%
Water transportation	56.0	67.2	20.0%
Pipeline transportation	46.0	47.0	2.2%
Motor vehicle and parts - retail	1,846.9	1,861.4	0.8%
Motor vehicles and parts - wholesale	355.7	331.4	-6.8%
Gasoline stations - retail	935.7	881.0	-5.8%
Automotive repair and maintenance	888.1	868.5	-2.2%
Automotive equipment rental and leasing	208.3	187.8	-9.8%
Manufacturing	2,143.9	1,616.0	-24.6%
Cars and light trucks	*237.4*	171.9	-27.6%
Heavy-duty trucks	*54.0*	27.5	-49.1%
Motor vehicle bodies and trailers	*182.7*	140.8	-22.9%
Motor vehicle parts	*839.5*	536.6	-36.1%
Aerospace products and parts	*516.7*	488.4	-5.5%
Railroad rolling stock & other transportation equipment	*72.7*	58.9	-19.0%
Ship & boat building	*154.1*	138.5	-10.1%
Tires	*86.8*	53.4	-38.5%
Oil and gas pipeline construction	72.2	139.2	92.8%
Highway street and bridge construction	340.1	294.6	-13.4%
Scenic & sightseeing	27.5	30.6	11.3%
Support activities for transportation	537.4	625.2	16.3%
Couriers and messengers	605.0	574.1	-5.1%
Travel arrangement and reservation services	298.6	195.7	-34.5%
Total transportation-related employment	**10,985.4**	10,278.3	-6.4%
Total nonfarm employment	132,019.0	139,042.0	5.3%
Transportation-related to total employment	8.3%	7.4%	

Source:
Bureau of Labor Statistics website query system: www.bls.gov/data/, (Additional resources: www.bls.gov)

[a] Not seasonally adjusted.

The total number of employees involved in the manufacture of motor vehicles decreased by over 73% from 1990 to 2014 and by more than 82% for those involved in the manufacture of motor vehicle parts. Beginning in 2008, the share of production workers fell below 80% for manufacturers of both vehicles and parts.

Table 10.17
U.S. Employment for Motor Vehicles and Motor Vehicle Parts Manufacturing, 1990–2014[a]

Year	All employees (thousands)	Production workers (thousands)	Share of production workers to total employees
	Motor vehicles		
1990	271.4	243.4	89.7%
1991	258.4	234.8	90.9%
1992	259.9	234.0	90.0%
1993	263.7	234.8	89.0%
1994	281.5	250.9	89.1%
1995	294.7	273.7	92.9%
1996	285.3	271.2	95.1%
1997	286.8	273.6	95.4%
1998	283.6	254.8	89.8%
1999	291.3	254.3	87.3%
2000	291.4	251.0	86.1%
2001	278.7	236.4	84.8%
2002	265.4	220.8	83.2%
2003	264.6	217.1	82.0%
2004	255.9	208.0	81.3%
2005	247.6	198.6	80.2%
2006	236.5	191.8	81.1%
2007	220.0	177.3	80.6%
2008	191.6	151.1	78.9%
2009	146.4	114.2	78.0%
2010	152.6	120.7	79.1%
2011	157.9	124.7	79.0%
2012	167.6	134.7	80.4%
2013	181.5	150.1	82.7%
2014	199.3	165.3	82.9%
	Motor vehicle parts		
1990	653.0	527.4	80.8%
1991	638.9	514.7	80.6%
1992	661.2	537.0	81.2%
1993	677.8	554.7	81.8%
1994	735.6	606.9	82.5%
1995	786.9	647.7	82.3%
1996	799.9	657.4	82.2%
1997	808.9	662.4	81.9%
1998	818.2	660.3	80.7%
1999	837.1	674.2	80.5%
2000	839.5	676.7	80.6%
2001	774.7	624.9	80.7%
2002	733.6	590.9	80.5%
2003	707.8	567.6	80.2%
2004	692.1	561.6	81.1%
2005	678.1	553.9	81.7%
2006	654.7	533.7	81.5%
2007	607.9	488.9	80.4%
2008	543.7	430.6	79.2%
2009	413.7	317.8	76.8%
2010	418.9	323.3	77.2%
2011	445.5	345.0	77.4%
2012	482.8	365.3	75.7%
2013	508.7	385.2	75.7%
2014	536.6	415.7	77.5%

Source:
Tabulated from the U.S. Department of Labor, Bureau of Labor Statistics, www.bls.gov, April 2015.

[a] Not seasonally adjusted.

Chapter 11
Greenhouse Gas Emissions

Summary Statistics from Tables/Figures in this Chapter

Source			
Table 11.1	Carbon dioxide emissions (million metric tonnes)	1990	2014
	United States	*4,989*	*5,361*
	OECD Europe	*4,149*	*4,050*
	China	*2,293*	*9,595*
	Russia	*2,393*	*1,633*
	Japan	*1,054*	*1,245*
	Non-OECD Europe and Eurasia	*4,246*	*2,726*
	India	*573*	*1,808*
Table 11.5	Transportation share of U.S. carbon dioxide emissions from fossil fuel consumption		
	1990		*31.8%*
	2005		*33.2%*
	2013		*33.6%*
Table 11.7	Motor gasoline share of transportation carbon dioxide emissions		61.9%
Table 11.11	Average annual carbon footprint (metric tons of CO_2)		
	Cars		*6.1*
	Light trucks		*8.4*

The U.S. accounted for 23.2% of the World's carbon dioxide emissions in 1990 and 16.2% in 2005 and 2014. Nearly half (42%) of the U.S. carbon emissions are from oil use.

Table 11.1
World Carbon Dioxide Emissions, 1990, 2005, and 2014

	1990		2005		2014	
Country/Region	million metric tons	Percent of emissions from oil use	million metric tons	Percent of emissions from oil use	million metric tons	Percent of emissions from oil use
OECD[a] Americas						
United States	4,989	44%	5,985	44%	5,361	42%
Canada	471	48%	620	49%	552	52%
Mexico/Chile	302	77%	461	66%	534	60%
Total	5,762	46%	7,066	46%	6,447	44%
OECD[a] Europe	4,149	45%	4,488	49%	4,050	45%
OECD[a] Asia						
Japan	1,054	65%	1,241	52%	1,245	44%
Australia/New Zealand	298	38%	438	55%	441	36%
Other	243	59%	494	30%	594	38%
Total	1,595	59%	2,173	47%	2,280	41%
Non-OECD Europe & Eurasia						
Russia	2,393	33%	1,548	25%	1,633	24%
Other	1,853	32%	1,120	26%	1,093	34%
Total	4,246	32%	2,668	25%	2,726	28%
Non-OECD Asia						
China	2,293	15%	5,490	16%	9,595	14%
India	573	28%	1,182	27%	1,808	25%
Other	811	57%	1,665	53%	1,953	48%
Total	3,677	26%	8,337	25%	13,356	21%
Other Non-OECD						
Middle East	704	70%	1,333	59%	1,924	56%
Africa	659	46%	978	43%	1,105	44%
Central & South America	695	76%	1,011	72%	1,298	70%
Total	2,058	64%	3,322	58%	4,327	57%
Total World	21,487	42%	28,054	40%	33,186	35%

Source:
U.S. Department of Energy, Energy Information Administration, *International Energy Statistics Databases*, Washington, DC, May 2015. (Additional resources: www.eia.doe.gov)

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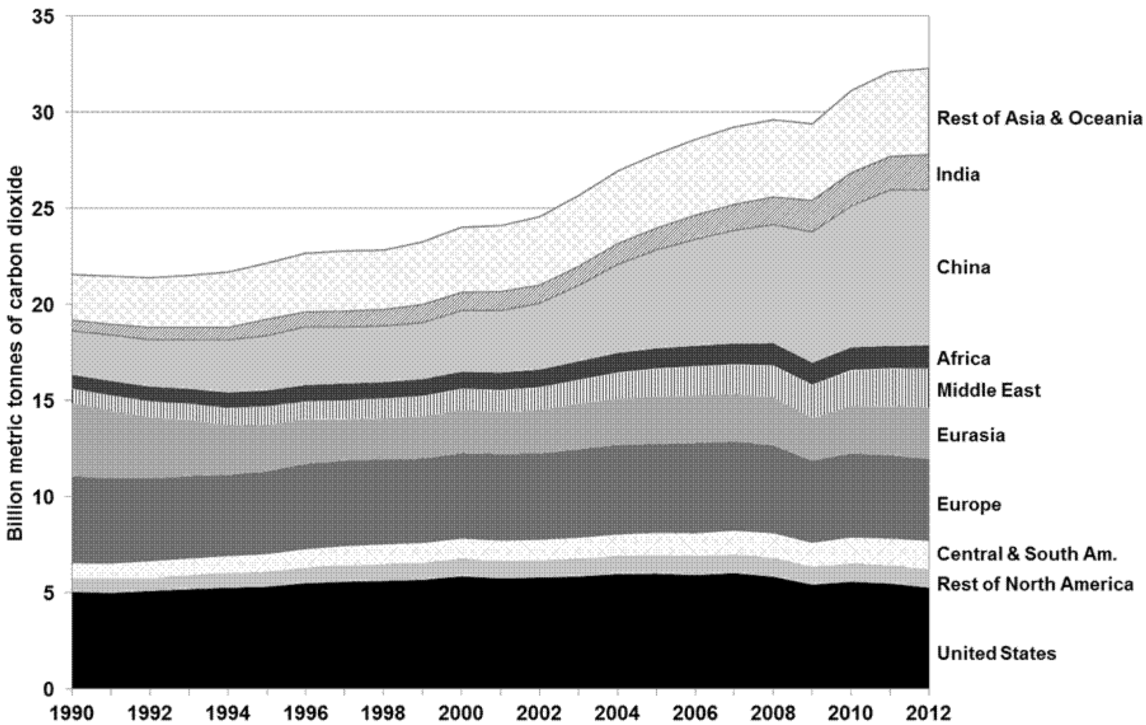
[a] OECD is the Organization for Economic Cooperation and Development. See Glossary for included countries.

Since 1990, China shows the greatest increase of carbon dioxide (CO_2) emissions. The Americas, Europe and Eurasia have about the same (CO_2) emissions in 2012 as in 1990.

Figure 11.1. World Carbon Dioxide Emissions, 1990–2012



Source:
U.S. Department of Energy, Energy Information Administration, *International Energy Statistics*, Total Carbon Dioxide Emissions from the Consumption of Energy, www.eia.doe.gov/cfapps/ipdbproject/IEDIndex3.cfm, July 2015. (Additional resources: www.eia.doe.gov)

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
Carbon Dioxide (CO_2)	5-200[a]	1	1
Methane (CH_4)[b]	12.4	86	34
Tetrafluoroethane (HFC-134a)	13.4	3,790	1,550
Trichlorofluoromethane (CFC-11)	45	7,020	5,350
Nitrous Oxide (N_2O)	121	268	298
Perfluoromethane (CF_4)	50,000	4,950	7,350

Note: Includes climate-carbon feedbacks.

Source:
Myhre, G., D. Shindell, F.-M. Breon, W. Collins, J. Fuglestvedt, J. Huang, D. Koch, J.-F. Lamarque, D. Lee, B. Mendoza, T. Nakajima, A. Robock, G. Stephens, T. Takemura and H. Zhang, 2013: Anthropogenic and Natural Radiative Forcing. In: *Climate Change 2013: The Physical Science Basis*. Contribution of Working Group 1 to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change [Stocker, R.F., D. Qin, G.-K. Plattner, M. Tignor, S.K. Allen, J. Boschung, A. Nauels, Y. Zia, V. Bex and P.M. Midgley (eds)]. Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA.

[a] No single lifetime can be defined for carbon dioxide due to different rates of uptake by different removal processes.

[b] These values do not include carbon dioxide from methane oxidation. Perturbation lifetime is used in the calculation of metrics.

Carbon dioxide emissions in 2013 were 7% higher than in 1990, but down from the highest annual emissions of this data series in 2007. Carbon dioxide accounts for the majority (82%) of greenhouse gases.

Table 11.3
U.S. Emissions of Greenhouse Gases, Based on Global Warming Potential, 1990–2013
(million metric tonnes carbon dioxide equivalent[a])

Year	Carbon dioxide	Methane	Nitrous oxide	High GWP gases[b]	Total
1990	5,090.0	745.3	329.8	101.9	6,267.0
1991	5,034.9	748.8	354.7	92.9	6,231.3
1992	5,141.5	753.4	345.4	97.4	6,337.7
1993	5,254.0	743.6	366.6	98.0	6,462.2
1994	5,344.6	758.4	352.6	101.9	6,557.5
1995	5,410.0	750.1	371.3	122.3	6,653.7
1996	5,598.3	750.7	393.7	134.6	6,877.3
1997	5,671.8	731.3	376.4	143.3	6,922.8
1998	5,712.2	720.7	358.0	159.3	6,950.2
1999	5,784.8	715.6	353.0	157.2	7,010.6
2000	5,956.6	715.9	334.9	159.0	7,166.4
2001	5,852.6	706.0	352.8	146.2	7,057.6
2002	5,895.4	703.2	346.7	154.4	7,099.7
2003	5,935.4	707.1	334.0	144.7	7,121.2
2004	6,049.1	698.1	355.4	152.2	7,254.8
2005	6,076.1	707.9	355.5	152.7	7,292.2
2006	5,995.1	720.2	353.7	154.1	7,223.1
2007	6,082.9	724.2	376.8	163.4	7,347.3
2008	5,887.6	727.8	364.0	162.8	7,142.2
2009	5,453.2	709.5	355.8	156.7	6,675.2
2010	5,654.2	667.2	359.9	167.1	6,848.4
2011	5,525.5	660.7	371.5	175.1	6,732.8
2012	5,316.3	647.6	365.3	173.8	6,503.0
2013	5,470.6	636.3	355.0	176.6	6,638.5

Note: This greenhouse gas emissions inventory includes fossil fuel combustion, use of fluorinated gases and other transportation categories.

Source:
U.S. Environmental Protection Agency, *Inventory of U. S. Greenhouse Gas Emissions and Sinks: 1990-2013.* April 15, 2015, EPA430-R-15-004, www.epa.gov/climatechange/Downloads/ghgemissions/US-GHG-Inventory-2015-Main-Text.pdf

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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.

The transportation sector accounts for the largest share of total greenhouse gas emissions, due to the high share of carbon dioxide emissions. The industrial sector accounts for nearly the same amount of total greenhouse gas emissions as the transportation sector.

Table 11.4
Total U.S. Greenhouse Gas Emissions by End-Use Sector, 2013
(million metric tonnes carbon dioxide equivalent[a])

	Carbon dioxide	Methane	Nitrous oxide	Hydroflurocarbons, perflurocarbons, sulfur hexafluoride	Total greenhouse gas emissions
Residential	1,074.7	5.2	10.5	38.9	1,129.3
Commercial	937.6	132.8	13.8	42.6	1,126.8
Agricultural	122.3	240.6	286.4	0.2	649.5
Industrial	1,604.8	256.0	27.5	34.4	1,922.7
Transportation	1,731.2	1.7	16.8	60.5	1,810.2
Transportation share of total	31.6%	0.3%	4.7%	34.3%	27.3%
Total greenhouse gas emissions	5,470.6	636.3	355.0	176.6	6,638.5

Note: Totals may not sum due to rounding.

Source:
U.S. Environmental Protection Agency, *Draft Inventory of U.S. Greenhouse Gas Emissions and Sinks, 1990-2013*. April 2015. (Additional resources: www.epa.gov/climatechange/emissions/usinventoryreport.html)

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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).

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 Fuel Consumption by End-Use Sector, 1990–2013[a]
(million metric tonnes of carbon dioxide)

	End use sector				Transportation	CO_2 from
	Residential	Commercial	Industrial	Transportation	percentage	all sectors
1990	931.4	755.4	1,529.2	1,496.8	31.8%	4,712.8
1991	949.1	762.1	1,497.0	1,450.6	31.1%	4,658.8
1992	945.2	758.0	1,557.0	1,499.8	31.5%	4,760.0
1993	998.0	782.3	1,565.1	1,535.4	31.5%	4,880.8
1994	988.8	794.7	1,588.3	1,580.4	31.9%	4,952.2
1995	994.6	812.3	1,586.6	1,613.2	32.2%	5,006.7
1996	1,055.3	843.2	1,644.1	1,657.7	31.9%	5,200.3
1997	1,045.1	882.9	1,662.2	1,673.6	31.8%	5,263.8
1998	1,049.5	901.1	1,639.4	1,710.2	32.3%	5,300.2
1999	1,070.4	912.7	1,619.0	1,764.7	32.9%	5,366.8
2000	1,133.1	972.1	1,643.6	1,809.3	32.6%	5,558.1
2001	1,124.8	980.6	1,578.4	1,793.7	32.7%	5,477.5
2002	1,151.6	978.7	1,553.1	1,834.7	33.2%	5,518.1
2003	1,181.5	989.3	1,572.1	1,827.2	32.8%	5,570.1
2004	1,179.6	1,007.7	1,597.9	1,872.4	33.1%	5,657.6
2005	1,214.1	1,026.7	1,564.4	1,892.5	33.2%	5,697.7
2006	1,151.8	1,007.2	1,564.1	1,889.2	33.7%	5,612.3
2007	1,204.5	1,047.3	1,562.9	1,894.7	33.2%	5,709.4
2008	1,190.2	1,039.3	1,499.5	1,800.3	32.6%	5,529.3
2009	1,122.6	976.7	1,329.5	1,724.8	33.5%	5,153.6
2010	1,174.8	993.2	1,416.5	1,736.5	32.6%	5,321.0
2011	1,117.9	959.1	1,398.8	1,715.8	33.0%	5,191.6
2012	1,008.4	897.4	1,377.0	1,704.6	34.2%	4,987.4
2013	1,070.2	933.3	1,399.8	1,722.4	33.6%	5,125.7
	Average annual percentage change					
1990–2013	0.6%	0.9%	-0.4%	0.6%		0.4%
2003–2013	-1.1%	-0.6%	-1.2%	-0.6%		-0.8%

Note: The CO_2 from all sectors does not match Table 11.3 since it is only from fossil fuel consumption and does not include the use of fluorinated gases and other transportation categories.

Source:
U.S. Environmental Protection Agency, *Inventory of U.S. Greenhouse Gas Emissions and Sinks, 1990-2013*. April 15, 2015. (Additional resources: www.epa.gov/climatechange/Downloads/ghgemissions/US-GHG-Inventory-2015-Main-Text.pdf)

[a] Includes energy from petroleum, coal, and natural gas. Electric utility emissions are distributed across consumption sectors.

This report has typically displayed carbon and carbon dioxide data from the Environmental Protection Agency (EPA). However, the Energy Information Administration's (EIA's) Monthly Energy Review *also includes carbon dioxide emission data. The differences in the two data series have been about 3-4%, but as high as 7% in 1991. According to EIA, the difference in the data comes from differences in carbon factors and other adjustments.*

Table 11.6
Transportation Sector Carbon Dioxide Emissions from Energy Consumption, 1973-2014
(million metric tons of carbon dioxide)

Year	Energy Information Administration's *Monthly Energy Review*	Environmental Protection Agency's Greenhouse Gas Inventory Report	Percentage difference
1973	1,315.2	[a]	[a]
1975	1,291.6	[a]	[a]
1980	1,400.2	[a]	[a]
1985	1,421.2	[a]	[a]
1986	1,472.1	[a]	[a]
1987	1,519.0	[a]	[a]
1988	1,579.0	[a]	[a]
1989	1,591.2	[a]	[a]
1990	1,587.7	1,505.6	5.2%
1991	1,567.9	1,458.2	7.0%
1992	1,591.6	1,507.6	5.3%
1993	1,607.2	1,543.4	4.0%
1994	1,647.4	1,588.7	3.6%
1995	1,681.3	1,621.4	3.6%
1996	1,725.2	1,665.6	3.5%
1997	1,744.2	1,682.0	3.6%
1998	1,782.0	1,719.1	3.5%
1999	1,828.0	1,773.7	3.0%
2000	1,872.5	1,817.9	2.9%
2001	1,852.0	1,801.1	2.7%
2002	1,892.5	1,842.2	2.7%
2003	1,892.1	1,833.0	3.1%
2004	1,958.6	1,878.1	4.1%
2005	1,985.6	1,898.0	4.4%
2006	2,013.7	1,894.6	5.9%
2007	2,021.0	1,899.9	6.0%
2008	1,897.9	1,805.1	4.9%
2009	1,831.6	1,728.9	5.6%
2010	1,849.0	1,741.5	5.8%
2011	1,817.5	1,720.5	5.3%
2012	1,780.2	1,709.1	4.0%
2013	1,808.7	1,727.2	4.5%
2014	1,832.3	[a]	[a]

Sources:
U.S. Department of Energy, Energy Information Administration, *Monthly Energy Review*, July 2015, Washington, DC, Table 12.5.
U.S. Environmental Protection Agency, U.S. Greenhouse Gas Inventory Report: 1990-2013, April 2015, Washington, DC, Table 2-12.

[a] Data are not available.

Most U.S. transportation sector carbon dioxide emissions come from petroleum fuels (97%). Motor gasoline has been responsible for about two-thirds of U.S. carbon dioxide emissions over the last twenty years.

Table 11.7
U.S. Carbon Emissions from Fossil Fuel Combustion in the Transportation End-Use Sector, 1990–2013
(million metric tonnes of carbon dioxide equivalent)

	Motor gasoline	LPG[a]	Jet fuel	Distillate fuel	Residual fuel	Aviation gas	Natural gas	Electricity[b]	Total
1990	983.5	1.4	184.2	262.9	22.6	3.1	36.0	3.0	1,496.7
1991	969.7	1.3	215.2	266.2	77.0	2.9	32.9	3.0	1,568.2
1992	992.8	1.2	213.4	281.9	80.3	2.8	32.2	3.0	1,607.6
1993	1,010.9	1.2	215.1	298.5	67.7	2.7	34.2	3.0	1,633.3
1994	1,022.9	2.1	223.9	318.6	66.3	2.6	37.6	3.1	1,677.1
1995	1,042.4	1.1	222.1	333.5	68.4	2.7	38.4	3.1	1,711.7
1996	1,063.6	1.0	235.6	348.6	63.9	2.6	39.1	3.1	1,757.5
1997	1,075.6	0.9	238.9	364.4	53.4	2.7	41.4	3.1	1,780.4
1998	1,107.5	1.1	242.4	378.2	50.6	2.5	35.3	3.2	1,820.8
1999	1,128.0	0.9	250.0	396.8	50.0	2.7	35.8	3.2	1,867.4
2000	1,136.2	0.7	257.0	408.9	66.6	2.5	35.6	3.4	1,910.9
2001	1,149.6	0.8	246.1	406.0	44.0	2.4	34.9	3.6	1,887.4
2002	1,174.8	0.9	239.9	420.0	50.8	2.3	37.0	3.5	1,929.2
2003	1,177.4	1.1	234.5	430.0	42.9	2.1	33.2	4.3	1,925.5
2004	1,194.3	1.2	242.9	448.3	55.5	2.2	31.9	4.5	1,980.8
2005	1,183.9	1.7	189.3	458.1	19.3	2.4	33.1	4.7	1,892.5
2006	1,172.0	1.7	242.6	479.1	68.0	2.3	33.1	4.5	2,003.3
2007	1,166.3	1.4	241.0	484.5	74.6	2.2	35.2	5.1	2,010.3
2008	1,109.4	2.5	229.2	460.7	69.5	2.0	36.7	4.7	1,914.7
2009	1,101.7	1.7	154.1	409.0	13.9	1.8	37.9	4.5	1,724.6
2010	1,092.7	1.8	151.5	425.5	20.4	1.9	38.1	4.5	1,736.4
2011	1,069.0	2.1	146.6	433.7	19.4	1.9	38.9	4.3	1,715.9
2012	1,064.9	2.3	143.4	431.3	15.8	1.7	41.3	3.9	1,704.6
2013	1,065.8	2.5	147.1	437.6	15.0	1.5	48.8	4.0	1,722.3
				Average annual percentage change					
1990-2013	0.4%	2.6%	-1.0%	2.2%	-1.8%	-3.1%	1.3%	1.3%	0.6%
2003-2013	-1.0%	8.6%	-4.6%	0.2%	-10.0%	-3.3%	3.9%	-0.7%	-1.1%

Source:
U.S. Environmental Protection Agency, *Inventory of U.S. Greenhouse Gas Emissions and Sinks, 1990-2013*. April 15, 2015. (Additional resources: www.epa.gov/climatechange/Downloads/ghgemissions/US-GHG-Inventory-2015-Main-Text.pdf)

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[a] Liquified petroleum gas.
[b] Share of total electric utility carbon dioxide emissions weighted by sales to the transportation sector.

Highway vehicles are responsible for the majority of greenhouse gas emissions in the transportation sector.

Table 11.8
Transportation Carbon Dioxide Emissions by Mode, 1990–2013
(Million metric tonnes of carbon dioxide equivalent)

Year	Passenger Vehicles	Heavy Trucks	Highway Total	Water	Air	Rail	Pipeline	Total
1990	952.2	238.3	1,190.5	44.3	187.3	38.5	36.0	1,496.6
1991	937.2	233.0	1,170.2	39.5	171.7	36.4	32.9	1,450.7
1992	968.8	243.4	1,212.2	48.5	169.4	37.4	32.2	1,499.7
1993	988.4	256.5	1,244.9	47.1	170.9	38.3	34.1	1,535.3
1994	1,002.3	273.4	1,275.7	47.7	178.1	41.2	37.5	1,580.2
1995	1,015.6	284.1	1,299.7	57.8	174.9	42.7	38.2	1,613.3
1996	1,038.1	296.4	1,334.5	53.7	187.1	43.4	38.9	1,657.6
1997	1,051.7	310.6	1,362.3	39.4	187.2	43.6	41.2	1,673.7
1998	1,083.0	324.0	1,407.0	33.4	190.9	44.0	35.0	1,710.3
1999	1,116.5	342.7	1,459.2	29.3	195.1	45.5	35.5	1,764.6
2000	1,113.9	356.9	1,470.8	60.2	197.4	45.5	35.2	1,809.1
2001	1,124.8	354.6	1,479.4	42.0	192.0	45.8	34.4	1,793.6
2002	1,150.6	367.9	1,518.5	46.7	187.6	45.4	36.4	1,834.6
2003	1,164.4	364.9	1,529.3	36.8	181.4	47.1	32.5	1,827.1
2004	1,182.9	380.3	1,563.2	39.6	188.8	49.7	31.1	1,872.4
2005	1,166.0	407.6	1,573.6	44.6	191.8	50.3	32.2	1,892.5
2006	1,154.5	417.8	1,572.3	47.6	184.6	52.3	32.3	1,889.1
2007	1,124.5	448.6	1,573.1	54.2	181.7	51.7	34.2	1,894.9
2008	1,066.7	430.0	1,496.7	45.0	175.1	47.9	35.6	1,800.3
2009	1,062.2	390.7	1,452.9	38.3	155.9	40.7	36.7	1,724.5
2010	1,054.5	403.9	1,458.4	44.1	153.4	43.5	37.1	1,736.5
2011	1,035.5	403.2	1,438.7	45.9	148.5	45.1	37.8	1,716.0
2012	1,031.7	404.2	1,435.9	39.6	145.1	43.7	40.3	1,704.6
2013	1,032.0	410.8	1,442.8	38.8	148.6	44.4	47.7	1,722.3
			Average annual percentage change					
1990-2013	0.4%	2.4%	0.8%	-0.6%	-1.0%	0.6%	1.2%	0.6%
2003-2013	-1.2%	1.2%	-0.6%	0.5%	-2.0%	-0.6%	3.9%	-0.6%

Note: Emissions from U.S. Territories are not included. Passenger vehicles includes cars, light trucks and motorcycles. Heavy trucks includes medium and heavy trucks and buses.

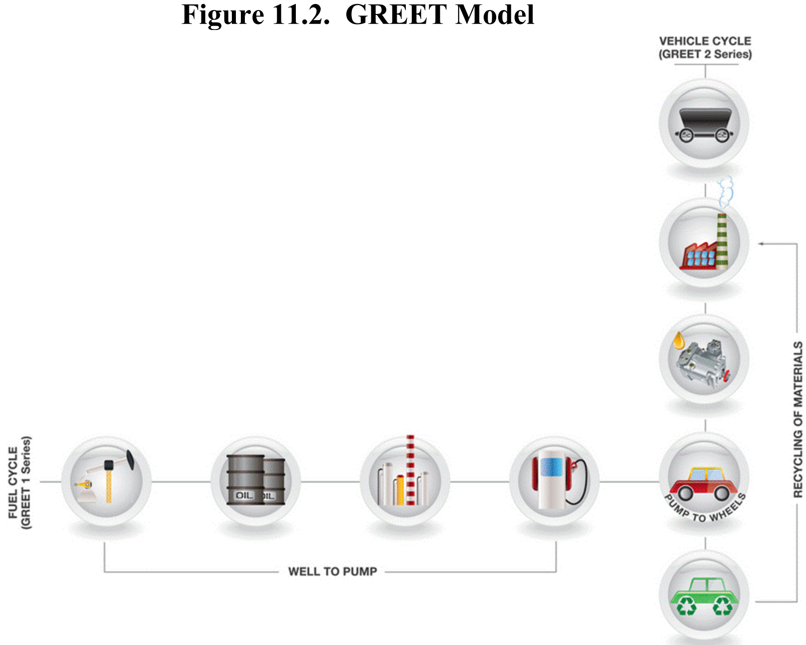
Source:
U.S. Environmental Protection Agency, *Draft Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990–2013*, Table 3-12, April 2015. (Additional resources: www.epa.gov/climatechange/ghgemissions/usinventoryreport.html)

The Greenhouse Gases, Regulated Emissions, and Energy Use in Transportation (GREET) Model

greet.es.anl.gov

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 2013 version for fuel-cycle analysis and GREET 2 2013 version for vehicle-cycle analysis.

Figure 11.2. GREET Model



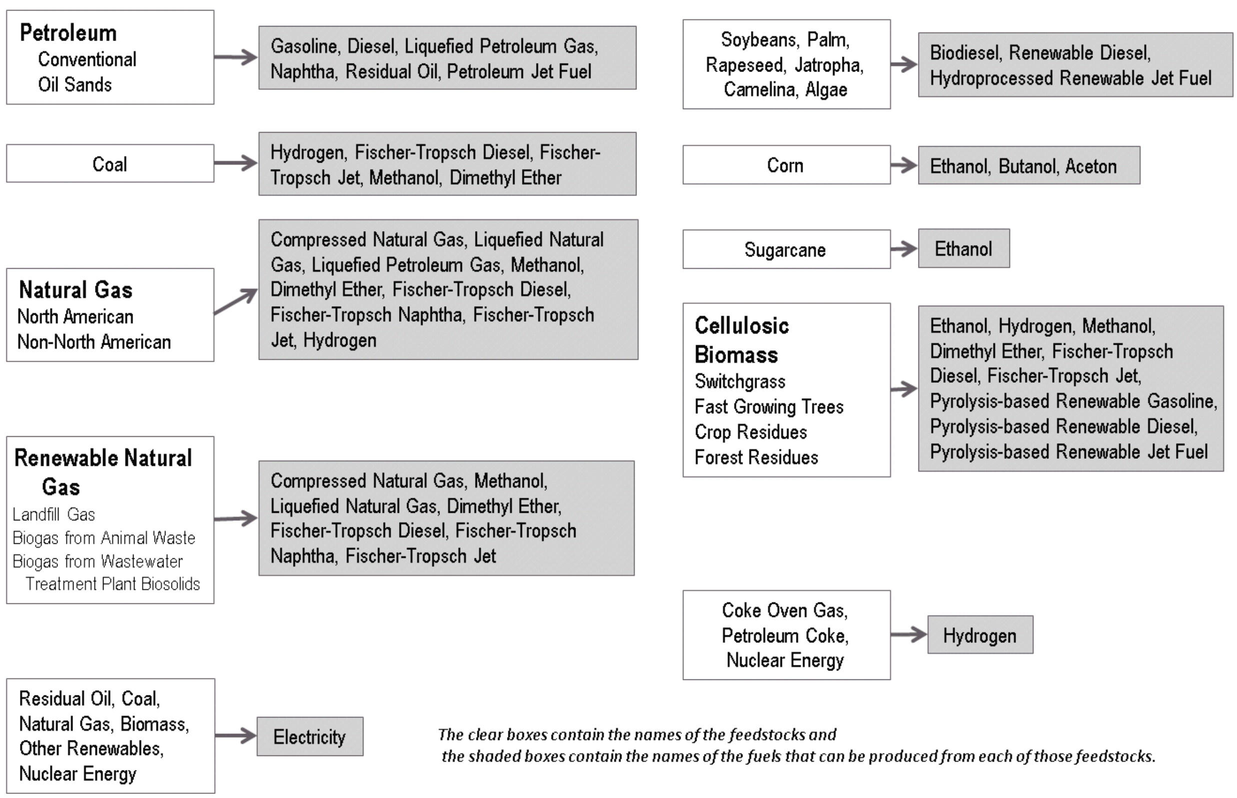
For a given vehicle and fuel system, GREET separately calculates the following:

- 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 80 vehicle/fuel systems. These vehicle/fuel systems cover all major vehicle technologies in the market and R&D arena: conventional spark-ignition engine vehicles; spark-ignition, direct-injection engine vehicles; compression-ignition, direct-injection engine vehicles; hybrid electric vehicles; plug-in hybrid electric vehicles; battery-powered electric vehicles; and ffuel-cell vehicles.

Recently, GREET was expanded to include air and marine modes as well.

Figure 11.3. GREET Model Feedstocks and Fuels



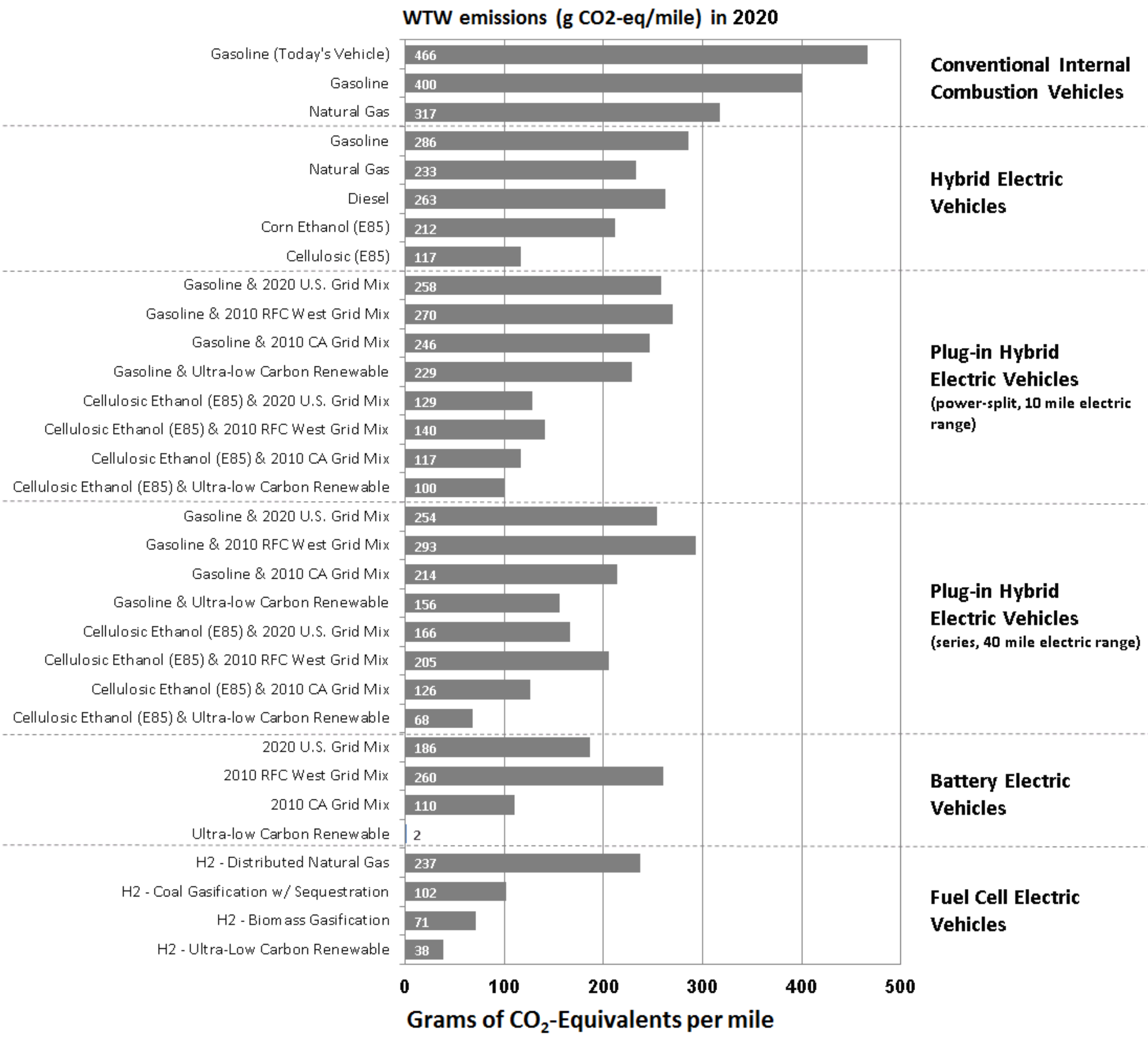
To address technology improvements over time, GREET simulates vehicle/fuel systems over the period from 1990 to 2035, in five-year intervals.

For additional information about the GREET model, see the GREET website, or contact:

Michael Q. Wang
Argonne National Laboratory
9700 South Cass Avenue, ES/362
Argonne, IL 60439-4815
phone: 630-252-2819
fax: 630-252-3443
email: mqwang@anl.gov

These are results from the GREET model (see preceding pages for description). For electricity, three different grid mixes are compared—the U.S., California, and RFC West. California's (CA) grid mix was chosen due to the high renewable energy mix in that state. The RFC West is an electricity grid subregion that includes Indiana, Ohio, West Virginia, and parts of Illinois, Pennsylvania, Virginia, Kentucky, and Wisconsin. The RFC West uses a high amount of coal to produce electricity.

Figure 11.4. Well-to-Wheel Emissions for Various Fuels and Vehicle Technologies



Note: H2 = hydrogen.

Source: Argonne National Laboratory, GREET 1 2013 Model.

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

Note: The Environmental Protection Agency publishes tailpipe emissions in the *Light-Duty Automotive Technology, Carbon Dioxide Emissions, and Fuel Economy Trends: 1975 through 2014*, www.epa.gov/otaq/fetrends.htm.

The production-weighted average annual carbon footprint for cars and car SUVs declined by an average of 2% annually between 1975 and 2014.

Table 11.9
Production-Weighted Annual Carbon Footprint of New Domestic and Import Cars
Model Years 1975–2014[a]
(metric tons of CO_2)

Model Year	Car	Car SUV
1975	12.6	15.2
1980	8.5	11.6
1981	7.9	11.5
1982	7.6	8.6
1983	7.7	8.2
1984	7.6	8.8
1985	7.4	8.4
1986	7.1	8.9
1987	7.1	8.7
1988	7.0	8.8
1989	7.2	8.9
1990	7.3	9.0
1991	7.2	9.3
1992	7.3	9.5
1993	7.2	9.9
1994	7.3	9.4
1995	7.2	9.5
1996	7.3	9.2
1997	7.3	8.8
1998	7.3	9.3
1999	7.4	9.1
2000	7.4	9.5
2001	7.4	9.0
2002	7.3	8.8
2003	7.3	8.5
2004	7.3	8.5
2005	7.2	8.4
2006	7.3	8.3
2007	7.0	8.2
2008	7.0	8.0
2009	6.7	7.7
2010	6.5	7.4
2011	6.5	7.2
2012	6.1	7.2
2013	6.0	6.9
2014	5.9	7.0
	Average annual percentage change	
1975–2014	-1.9%	-2.0%
2004–2014	-2.1%	-1.9%

Source:
Calculated using fuel economy from the U.S. Environmental Protection Agency, *Light-Duty Automotive Technology, Carbon Dioxide Emissions, and Fuel Economy Trends: 1975 Through 2014*, October 2014. See page 11-12 for details. (Additional resources: www.epa.gov/fueleconomy/fetrends/1975-2014/420r14023a.pdf)

[a] Annual carbon footprint is based on 15,000 miles of annual driving. Includes tailpipe plus upstream emissions.

The production-weighted average annual footprint of pickups, vans, and truck SUVs decreased from 1975 to 2014. Truck SUVs experienced the greatest decline.

Table 11.10
Production-Weighted Annual Carbon Footprint of New Domestic and Import Trucks
Model Years 1975–2014[a]
(metric tons of CO_2)

Model Year	Pickup	Van	Truck SUV
1975	14.2	15.2	15.3
1980	10.2	12.0	12.8
1985	9.3	10.2	10.2
1986	9.0	9.7	9.9
1987	8.9	9.6	9.8
1988	9.3	9.5	9.9
1989	9.5	9.5	10.2
1990	9.7	9.5	10.3
1991	9.3	9.4	10.1
1992	9.7	9.4	10.4
1993	9.6	9.3	10.4
1994	9.7	9.5	10.6
1995	10.0	9.4	10.6
1996	9.9	9.2	10.4
1997	10.0	9.3	10.5
1998	10.0	9.1	10.5
1999	10.4	9.3	10.5
2000	10.2	9.1	10.6
2001	10.6	9.4	10.3
2002	10.7	9.1	10.4
2003	10.5	8.9	10.3
2004	10.7	8.8	10.3
2005	10.7	8.8	10.1
2006	10.5	8.7	9.9
2007	10.5	8.7	9.6
2008	10.3	8.5	9.3
2009	10.0	8.4	8.8
2010	10.0	8.4	8.6
2011	9.8	8.1	8.5
2012	9.9	7.9	8.5
2013	9.7	8.0	8.1
2014	9.4	8.0	8.0
	Average annual percentage change		
1975–2014	-1.1%	-1.6%	-1.6%
2004–2014	-1.3%	-0.9%	-2.5%

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

Source:
Calculated using fuel economy from the U.S. Environmental Protection Agency, *Light-Duty Automotive Technology, Carbon Dioxide Emissions, and Fuel Economy Trends: 1975 Through 2014*, October 2014. See page 11-12 for details. (Additional resources: www.epa.gov/fueleconomy/fetrends/1975-2014/420r14023a.pdf)

[a] Annual carbon footprint is based on 15,000 miles of annual driving. Includes tailpipe plus upstream emissions.

Between 1975 and 2014, the production-weighted average annual carbon footprint for light vehicles dropped dramatically. Cars experienced the greatest decrease at 51.5% while the carbon footprint for light trucks decreased by 42.0%.

Table 11.11
Average Annual Carbon Footprint by Vehicle Classification, 1975 and 2014[a]
(metric tons of CO_2)

	Production share		Carbon footprint		Percent change
Fuel	1975	2014	1975	2014	1975 - 2014
Cars					
Car	80.6%	51.3%	12.6	5.9	-52.9%
Car SUV	0.1%	10.0%	15.2	7.0	-54.0%
Total cars	80.7%	61.3%	12.6	6.1	-51.5%
Light trucks					
Van	4.5%	3.9%	15.2	8.0	-47.3%
Truck SUV	1.7%	23.3%	15.3	8.0	-47.7%
Pickup	13.1%	11.5%	14.2	9.4	-33.7%
Total light trucks	19.3%	38.7%	14.5	8.4	-42.0%

Source:
Calculated using fuel economy from the U.S. Environmental Protection Agency, *Light-Duty Automotive Technology, Carbon Dioxide Emissions, and Fuel Economy Trends: 1975 Through 2014*, October 2014. See page 11-12 for details. (Additional resources: www.epa.gov/fueleconomy/fetrends/1975-2014/420r14023a.pdf)

[a] Annual carbon footprint is based on 15,000 miles of annual driving. Includes tailpipe and upstream emissions.

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. The other fuels listed come from the Energy Information Administration.

Table 11.12
Direct Carbon Dioxide Emissions from a Gallon of Fuel[a]

	Grams per gallon	Kilograms per gallon	Pounds per gallon
Gasoline	8,887	8.9	19.6
Diesel	10,180	10.2	22.4
E85	1,340	1.3	3.0
B20	8,120	8.1	17.9
LPG	5,805	5.8	12.8
Propane	5,740	5.8	12.7
Aviation gasoline	8,320	8.3	18.3
Jet fuel	9,751	9.6	21.5
Kerosene	9,751	9.8	21.5
Residual fuel	11,791	11.8	26.0

Sources:
Gasoline and Diesel: U.S. Environmental Protection Agency, "Greenhouse Gas Emissions from a Typical Passenger Vehicle," December 2011. (Additional resources: www.epa.gov/otaq)
All others: Energy Information Administration, Voluntary Reporting of Greenhouse Gases Program, Fuel and Energy Source Codes and Emission Coefficients.

[a] Direct emissions are from the "tank-to-wheels" process. No upstream emissions are included.

Chapter 12
Criteria Air Pollutants

Summary Statistics from Tables in this Chapter

Source		
Table 12.1	Transportation's share of U.S. emissions, 2014	
	CO	*53.6%*
	NO_X	*57.7%*
	VOC	*23.4%*
	PM-2.5	*5.7%*
	PM-10	*2.4%*
	SO_2	*2.1%*

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, 2014
(millions of short tons/percentage)

Sector	CO	NOx	VOC	PM-10	PM-2.5	SO_2
Highway vehicles	**22.26**	**4.49**	**2.16**	**0.30**	**0.17**	**0.02**
	32.9%	*36.2%*	*12.6%*	*1.5%*	*2.8%*	*0.6%*
Other off-highway	**14.04**	**2.67**	**1.85**	**0.19**	**0.18**	**0.08**
	20.7%	*21.5%*	*10.8%*	*0.9%*	*2.9%*	*1.5%*
Transportation total	**36.30**	**7.16**	**4.01**	**0.49**	**0.35**	**0.10**
	53.6%	*57.7%*	*23.4%*	*2.4%*	*5.7%*	*2.1%*
Stationary source fuel combustion	**4.60**	**3.59**	**0.63**	**0.98**	**0.84**	**4.09**
	6.8%	*28.9%*	*3.7%*	*4.7%*	*14.0%*	*82.1%*
Industrial processes	**1.97**	**1.18**	**7.07**	**0.94**	**0.40**	**0.59**
	2.9%	*9.5%*	*41.3%*	*4.6%*	*6.6%*	*11.3%*
Waste disposal and recycling total	**1.11**	**0.08**	**0.13**	**0.19**	**0.17**	**0.02**
	1.6%	*0.7%*	*0.8%*	*0.9%*	*2.7%*	*0.3%*
Miscellaneous	**23.78**	**0.40**	**5.29**	**18.02**	**4.49**	**0.20**
	35.1%	*3.2%*	*30.8%*	*87.4%*	*71.0%*	*4.2%*
Total of all sources	**67.76**	**12.41**	**17.13**	**20.62**	**6.25**	**5.00**
	100.0%	*100.0%*	*100.0%*	*100.0%*	*100.0%*	*100.0%*

Note: CO = Carbon monoxide. NO_x = Nitrogen oxides. VOC = Volatile organic compounds. PM-10 = Particulate matter less than 10 microns. PM-2.5 = Particulate matter less than 2.5 microns. SO_2 = Sulfur dioxide.

Source:
U. S. Environmental Protection Agency, National Emission Inventory Air Pollutant Emission Trends website www.epa.gov/ttn/chief/trends. (Additional resources: www.epa.gov/oar/oaqps)

The transportation sector accounted for almost 54% of the nation's carbon monoxide (CO) emissions in 2014. 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, 1970–2014[a]
(million short tons)

Source category	1970	1980	1990	2000	2010	2014	Percent of total, 2014
Highway vehicles	163.23	143.83	110.26	68.06	28.24	22.26	32.9%
Other off-highway	11.37	16.69	21.45	24.18	15.35	14.04	20.7%
Transportation total	174.60	160.52	131.71	92.24	43.59	36.30	53.6%
Stationary fuel combustion total	4.63	7.30	5.51	4.78	4.52	4.60	6.8%
Industrial processes total	9.84	6.95	4.77	2.63	1.90	1.97	2.9%
Waste disposal and recycling total	7.06	2.30	1.08	1.85	1.20	1.11	1.6%
Miscellaneous total	7.91	8.34	11.12	12.96	22.56	23.78	35.1%
Total of all sources	**204.04**	**185.41**	**154.19**	**114.46**	**73.77**	**67.76**	**100.0%**

Source:
U. S. Environmental Protection Agency, National Emission Inventory Air Pollutant Emission Trends website www.epa.gov/ttn/chief/trends. (Additional resources: www.epa.gov/oar/oaqps)

[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 less than a fifth of what it was in 1970. This is despite the fact that there were many more light vehicles on the road in 2005. Between 2005 and 2011 the Environmental Protection Agency updated their source from the MOBILE 6.2 emissions model to the MOVES emission model. MOVES results typically show higher emissions, especially for heavy trucks.

Table 12.3
Emissions of Carbon Monoxide from Highway Vehicles, 1970–2011[a]
(million short tons)

Source category	1970	1980	1990	1995	2000	2005	2011[b]	Percent of total, 2011
Gasoline powered								
Light vehicles & motorcycles	119.14	98.21	67.24	46.54	36.40	24.19	[c]	[c]
Light trucks[d]	22.27	28.83	32.23	29.81	27.04	21.19	[c]	[c]
Subtotal light vehicles	*141.41*	*127.04*	*99.47*	*76.35*	*63.44*	*45.38*	*25.34*	*92.6%*
Heavy vehicles	21.27	15.35	8.92	5.96	3.42	1.97	0.86	3.1%
Subtotal gasoline vehicles	*162.68*	*142.39*	*108.39*	*82.31*	*66.86*	*47.35*	*26.20*	*95.8%*
Diesel powered								
Light vehicles	0.01	0.03	0.04	0.02	0.01	0.01	[c]	[c]
Light trucks[d]	0.06	0.05	0.03	0.02	0.01	0.01	[c]	[c]
Subtotal light vehicles	*0.07*	*0.08*	*0.07*	*0.04*	*0.02*	*0.02*	*0.38*	*1.4%*
Heavy vehicles	0.49	1.36	1.81	1.53	1.19	0.85	0.77	2.8%
Subtotal diesel vehicles	*0.56*	*1.43*	*1.87*	*1.57*	*1.20*	*0.87*	*1.15*	*4.2%*
Total								
Highway vehicle total	**163.23**	**143.83**	**110.26**	**83.88**	**68.06**	**48.22**	**27.36**	**100.0%**
Percent diesel	0.3%	1.0%	1.7%	1.9%	1.8%	1.8%	4.2%	

Source:
U. S. Environmental Protection Agency, National Emission Inventory Air Pollutant Emission Trends website www.epa.gov/ttn/chief/trends. (Additional resources: www.epa.gov/oar/oaqps)

[a] The sums of subcategories may not equal total due to rounding.
[b] These data are not directly comparable to the older data due to the change in source from the MOBILE emissions model to the MOVES emissions model.
[c] Data are not available.
[d] Less than 8,500 pounds.

The transportation sector accounted for almost 60% of the nation's nitrogen oxide (NOx) emissions in 2014, 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, 1970–2014[a]
(million short tons)

Source category	1970	1980	1990	2000	2010	2014	Percent of total, 2014
Highway vehicles	12.62	11.49	9.59	8.39	5.70	4.49	36.2%
Other off-highway	2.65	3.35	3.78	4.17	3.32	2.67	21.5%
Transportation total	15.27	14.84	13.37	12.56	9.02	7.16	57.7%
Stationary fuel combustion total	10.06	11.32	10.89	8.82	4.33	3.59	28.9%
Industrial processes total	0.78	0.56	0.80	0.81	1.12	1.18	9.5%
Waste disposal and recycling total	0.44	0.11	0.09	0.13	0.09	0.08	0.7%
Miscellaneous total	0.33	0.25	0.37	0.28	0.30	0.40	3.2%
Total of all sources	**26.88**	**27.08**	**25.52**	**22.60**	**14.86**	**12.41**	**100.0%**

Source:
U. S. Environmental Protection Agency, National Emission Inventory Air Pollutant Emission Trends website www.epa.gov/ttn/chief/trends. (Additional resources: www.epa.gov/oar/oaqps)

[a] The sums of subcategories may not equal total due to rounding.

Diesel-powered vehicles were responsible for nearly one-half (45.8%) of highway vehicle nitrogen oxide emissions in 2011, while light gasoline vehicles were responsible for the rest. Between 2005 and 2011 the Environmental Protection Agency updated their source from the MOBILE 6.2 emissions model to the MOVES emission model. MOVES results typically show higher emissions, especially for heavy trucks.

Table 12.5
Emissions of Nitrogen Oxides from Highway Vehicles, 1970–2011[a]
(million short tons)

Source category	1970	1980	1990	1995	2000	2005	2011[b]	Percent of total, 2011
				Gasoline powered				
Light vehicles & motorcycles	8.54	6.63	4.26	3.05	2.31	1.63	[c]	[c]
Light trucks[d]	1.54	1.58	1.50	1.46	1.44	1.56	[c]	[c]
Subtotal light vehicles	10.08	8.21	5.76	4.51	3.75	3.19	*3.09*	*52.6%*
Heavy vehicles	0.72	0.62	0.57	0.52	0.45	0.38	0.09	1.5%
Subtotal gasoline vehicles	10.81	8.83	6.33	5.03	4.20	3.57	*3.18*	*54.2%*
				Diesel powered				
Light vehicles	0.00	0.03	0.04	0.02	0.01	0.00	[c]	[c]
Light trucks[d]	0.07	0.05	0.02	0.01	0.01	0.01	[c]	[c]
Subtotal light vehicles	0.07	0.08	0.06	0.03	0.02	0.01	*0.13*	*2.2%*
Heavy vehicles	1.76	2.59	3.19	3.82	4.18	2.81	2.56	43.6%
Subtotal diesel vehicles	1.83	2.66	3.26	3.85	4.19	2.82	*2.69*	*45.8%*
				Total				
Highway vehicle total	**12.64**	**11.49**	**9.59**	**8.88**	**8.39**	**6.39**	**5.87**	**100.0%**
Percent diesel	14.5%	23.1%	34.0%	43.4%	49.9%	44.1%	45.8%	

Source:
U. S. Environmental Protection Agency, National Emission Inventory Air Pollutant Emission Trends website www.epa.gov/ttn/chief/trends. (Additional resources: www.epa.gov/oar/oaqps)

[a] The sums of subcategories may not equal total due to rounding.
[b] These data are not directly comparable to the older data due to the change in source from the MOBILE emissions model to the MOVES emissions model.
[c] Data are not available.
[d] Less than 8,500 pounds.

The transportation sector accounted for over 23% of the nation's volatile organic compound (VOC) emissions in 2014, 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, 1970–2014[a]
(million short tons)

Source category	1970	1980	1990	2000	2010	2014	Percent of total, 2014
Highway vehicles	16.91	13.87	9.39	5.33	2.77	2.16	12.6%
Off-highway	1.62	2.19	2.66	2.64	2.30	1.85	10.8%
Transportation total	18.53	16.06	12.05	7.97	5.07	4.01	23.4%
Stationary fuel combustion total	0.72	1.05	1.01	1.18	0.61	0.63	3.7%
Industrial processes total	12.33	12.10	9.01	7.21	6.96	7.07	41.3%
Waste disposal and recycling total	1.98	0.76	0.99	0.42	0.15	0.13	0.8%
Miscellaneous total	1.10	1.13	1.06	0.73	5.06	5.29	30.8%
Total of all sources	**34.66**	**31.10**	**24.12**	**17.51**	**17.85**	**17.13**	**100.0%**

Source:
U. S. Environmental Protection Agency, National Emission Inventory Air Pollutant Emission Trends website www.epa.gov/ttn/chief/trends. (Additional resources: www.epa.gov/oar/oaqps)

[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 90% of highway vehicle emissions of volatile organic compounds. VOC emissions from highway vehicles in 2011 were about one-quarter of the 1990 level. Between 2005 and 2011 the Environmental Protection Agency updated their source from the MOBILE 6.2 emissions model to the MOVES emission model. MOVES results typically show higher emissions, especially for heavy trucks.

Table 12.7
Emissions of Volatile Organic Compounds from Highway Vehicles, 1970–2011[a]
(thousand short tons)

Source category	1970	1980	1990	1995	2000	2005	2011[b]	Percent of total, 2011
				Gasoline powered				
Light vehicles & motorcycles	11,996	9,304	5,690	3,768	2,903	2,111	[c]	[c]
Light trucks[d]	2,776	2,864	2,617	2,225	1,929	1,629	[c]	[c]
Subtotal light vehicles	14,772	12,168	8,307	5,993	4,832	3,740	2,345	88.8%
Heavy vehicles	1,679	1,198	633	421	256	171	40	1.5%
Subtotal gasoline vehicles	16,451	13,366	8,940	6,414	5,088	3,911	2,386	90.3%
				Diesel powered				
Light vehicles	8	16	18	9	3	2	[c]	[c]
Light trucks[d]	41	28	15	10	4	6	[c]	[c]
Subtotal light vehicles	49	44	33	19	7	8	43	1.6%
Heavy vehicles	411	459	415	315	230	159	213	8.1%
Subtotal diesel vehicles	460	503	448	335	238	167	256	9.7%
				Total				
Highway vehicle total	**16,911**	**13,869**	**9,388**	**6,749**	**5,326**	**4,078**	**2,642**	100.0%
Percent diesel	2.7%	3.6%	4.8%	5.0%	4.5%	4.1%	9.7%	

Source:
U. S. Environmental Protection Agency, National Emission Inventory Air Pollutant Emission Trends website www.epa.gov/ttn/chief/trends. (Additional resources: www.epa.gov/oar/oaqps)

[a] The sums of subcategories may not equal total due to rounding.
[b] These data are not directly comparable to the older data due to the change in source from the MOBILE emissions model to the MOVES emissions model.
[c] Data are not available.
[d] Less than 8,500 pounds.

The transportation sector accounted for more than 2% of the nation's particulate matter (PM-10) emissions in 2014. For details on the highway emissions of PM-10, see Table 12.9.

Table 12.8
Total National Emissions of Particulate Matter (PM-10), 1970–2014[a]
(million short tons)

Source category	1970	1980	1990	2000	2010	2014	Percent of total, 2014
Highway vehicles	0.48	0.43	0.39	0.23	0.28	0.30	1.5%
Off-highway	0.16	0.26	0.33	0.32	0.23	0.19	0.9%
Transportation total	0.64	0.69	0.72	0.55	0.51	0.49	2.4%
Stationary fuel combustion total	2.87	2.45	1.20	1.47	0.98	0.98	4.7%
Industrial processes total	7.67	2.75	1.04	0.71	1.05	0.94	4.6%
Waste disposal and recycling total	1.00	0.27	0.27	0.36	0.21	0.19	0.9%
Miscellaneous total	0.84	0.85	24.54	20.65	18.08	18.02	87.4%
Total of all sources	**13.02**	**7.01**	**27.77**	**23.74**	**20.83**	**20.62**	**100.0%**

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.

Source:
U. S. Environmental Protection Agency, National Emission Inventory Air Pollutant Emission Trends website www.epa.gov/ttn/chief/trends. (Additional resources: www.epa.gov/oar/oaqps)

[a] Fine particle matter less than 10 microns. The sums of subcategories may not equal total due to rounding.

In 2011, diesel-powered vehicles were responsible for about half of highway vehicle emissions of particulate matter (PM-10); in 1990 diesels were responsible for 73.4%. Between 2005 and 2011 the Environmental Protection Agency updated their source from the MOBILE 6.2 emissions model to the MOVES emission model. MOVES results typically show higher emissions, especially for heavy trucks.

Table 12.9
Emissions of Particulate Matter (PM-10) from Highway Vehicles, 1970–2011[a]
(thousand short tons)

Source category	1970	1980	1990	1995	2000	2005	2011[b]	Percent of total, 2011
Gasoline powered								
Light vehicles & motorcycles	249	141	56	53	51	46	[c]	[c]
Light trucks[d]	74	49	31	32	31	35	[c]	[c]
Subtotal light vehicles	323	190	87	85	82	81	199	53.8%
Heavy vehicles	44	30	17	13	10	8	3	0.9%
Subtotal gasoline vehicles	367	220	104	98	92	89	203	54.7%
Diesel powered								
Light vehicles	2	9	11	4	1	1	[c]	[c]
Light trucks[d]	19	12	5	3	1	1	[c]	[c]
Subtotal light vehicles	21	21	16	7	2	2	10	2.6%
Heavy vehicles	92	191	268	199	135	92	159	42.8%
Subtotal diesel vehicles	113	212	284	206	137	94	168	45.3%
Total								
Highway vehicle total	480	432	387	304	230	183	371	100.0%
Percent diesel	23.5%	49.1%	73.4%	67.8%	59.6%	51.4%	45.3%	

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.

Source:
U. S. Environmental Protection Agency, National Emission Inventory Air Pollutant Emission Trends website www.epa.gov/ttn/chief/trends. (Additional resources: www.epa.gov/oar/oaqps)

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[a] The sums of subcategories may not equal total due to rounding.
[b] These data are not directly comparable to the older data due to the change in source from the MOBILE emissions model to the MOVES emissions model.
[c] Data are not available.
[d] Less than 8,500 pounds.

The transportation sector accounted for almost 6% of the nation's particulate matter (PM-2.5) emissions in 2014. 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), 1990–2014
(million short tons)

Source category	1990	1995	2000	2005	2010	2014	Percent of total, 2014
Highway vehicles	0.32	0.25	0.17	0.31	0.20	0.17	2.8%
Off-highway	0.30	0.31	0.30	0.29	0.21	0.18	2.9%
Transportation total	0.62	0.56	0.47	0.60	0.41	0.35	5.7%
Stationary fuel combustion total	0.91	0.90	1.29	1.13	0.84	0.84	14.0%
Industrial processes total	0.56	0.50	0.50	0.53	0.42	0.40	6.6%
Waste disposal and recycling total	0.23	0.25	0.33	0.27	0.18	0.17	2.7%
Miscellaneous total	5.23	4.73	4.69	3.07	4.15	4.49	71.0%
Total of all sources	**7.55**	**6.94**	**7.28**	**5.60**	**6.00**	**6.25**	**100.0%**

Source:
U. S. Environmental Protection Agency, National Emission Inventory Air Pollutant Emission Trends website www.epa.gov/ttn/chief/trends. (Additional resources: www.epa.gov/oar/oaqps)

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. Between 2005 and 2011 the Environmental Protection Agency updated their source from the MOBILE 6.2 emissions model to the MOVES emission model. MOVES results typically show higher emissions, especially for heavy trucks.

Table 12.11
Emissions of Particulate Matter (PM-2.5) from Highway Vehicles, 1990–2011[a]
(thousand short tons)

Source category	1990	1995	2000	2005	2011[b]	Percent of total, 2011
Gasoline powered						
Light vehicles & motorcycles	35	30	27	23	c	c
Light trucks[d]	21	20	18	18	c	c
Subtotal light vehicles	*56*	*50*	*45*	*41*	*685*	*34.7%*
Heavy vehicles	11	9	7	6	15	0.8%
Subtotal gasoline vehicles	*67*	*59*	*52*	*47*	*700*	*35.4%*
Diesel powered						
Light vehicles	9	4	1	1	c	c
Light trucks[d]	4	2	1	1	c	c
Subtotal light vehicles	*13*	*6*	*2*	*2*	*67*	*3.4%*
Heavy vehicles	243	179	119	79	1,208	61.2%
Subtotal diesel vehicles	*256*	*185*	*121*	*81*	*1,275*	*64.6%*
Total						
Highway vehicle total	**323**	**244**	**173**	**128**	**1,975**	**100.0%**
Percent diesel	79.3%	75.8%	69.9%	63.3%	64.6%	

Source:
U. S. Environmental Protection Agency, National Emission Inventory Air Pollutant Emission Trends website www.epa.gov/ttn/chief/trends. (Additional resources: www.epa.gov/oar/oaqps)

[a] The sums of subcategories may not equal total due to rounding.
[b] These data are not directly comparable to the older data due to the change in source from the MOBILE emissions model to the MOVES emissions model. The 2011 data include condensable plus filterable PM-2.5.
[c] Data are not available.
[d] Less than 8,500 pounds.

EMISSION STANDARDS

The U.S. Environmental Protection Agency (EPA) regulates emissions from mobile sources including vehicles, engines, and motorized equipment that produce exhaust and evaporative emissions. Mobile sources contribute to four main air pollutants: carbon monoxide, hydrocarbons, nitrogen oxides, and particulate matter. The EPA not only sets standards for the vehicles, engines, and equipment, but also the fuels that they use. Tables 12.12 through Table 12.29 contain summaries of the current standards.

Acronyms Used on Tables 12.15 through Table 12.29

bhp	Brake horsepower-hour
CI	Compression-ignition
CO	Carbon Monoxide
DE	Diesel engine
g	Gram
g/kN	Grams per kilonewton
g/mi	Grams per mile
GVW	Gross vehicle weight
HC	Hydrocarbons
HCHO	Formaldehyde
HLDT	Heavy light-duty truck
Hp-hr	Horsepower-hour
kW	Kilowatt
kW-hr	Kilowatt-hour
LDT	Light-duty truck
LDV	Light-duty vehicle
LEV	Low-emission vehicle
LLDT	Light light-duty truck
LVW	Loaded vehicle weight
MDPV	Medium-duty passenger vehicle (8,500-10,000 lbs. GVWR)
NMHC	Non-methane hydrocarbon
NMOG	Non-methane organic gases
NOx	Nitrogen oxides
PM	Particulate matter
ppm	Parts per million
rPR	Rated pressure ratio
SI	Spark-ignition
SULEV	Super-ultra-low-emission vehicle
ULEV	Ultra-low-emission vehicle
ZEV	Zero-emission vehicle

The Environmental Protection Agency issued final Tier 3 emission standards in 2014. The combined emissions of non-methane organic gases (NMOG) and nitrogen oxides (NOx) that new gasoline engines are allowed to produce from 2017 to 2025 are regulated in these new standards. These standards apply to a corporate average, meaning that some vehicles produced in those model years will emit more than the standard, while others will emit less, so long as the average for each Original Equipment Manufacturer (OEM) product offerings meets the standard.

Table 12.12
Tier 3 Non-Methane Organic Gases and Nitrogen Oxide Standards
(milligrams per mile)

Model Year	Light-duty vehicles and LDT1	LDT2, 3, 4, and medium-duty passenger vehicles	Class 2b trucks	Class 3 trucks
2016	[a]	[a]	333[b]	548[b]
2017	86	101	310[b]	508[b]
2018	79	92	278	451
2019	72	83	253	400
2020	65	74	228	349
2021	58	65	203	298
2022	51	56	178	247
2023	44	47	178	247
2024	37	38	178	247
2025 and later	30	30	178	247

Notes: Standards are for the Federal Test Procedure. Different standards apply for the Supplemental Federal Test Procedure. For vehicles over 6,000 lbs. gross vehicle weight rating (GVWR), the standards apply beginning in MY 2018.
LDT1 = Light trucks less than 6,000 lbs. GVWR and less than 3,750 lbs. loaded vehicle weight (LVW).
LDT2, 3, 4 = Light trucks less than 8,500 lbs. GVWR and more than 3, 750 lbs. LVW.
Class 2b trucks = trucks 8,501-10,000 lbs. GVWR.
Class 3 trucks = trucks 10,001-14,000 lbs. GVWR.

Source:
Federal Register Vol. 79, No. 81, Monday, April 28, 2014.

[a] Not applicable.
[b] Voluntary standard.

Table 12.13
Tier 3 Particulate Matter Emission Standards for Light Gasoline Vehicles, MY 2017 and Beyond
(milligrams per mile)

Model Year	Certification standard (milligrams per mile)	In-use standard (milligrams per mile)	Phase-in (percent of U.S. sales)
2017	3	6	20[a]
2018	3	6	20
2019	3	6	40
2020	3	6	70
2021	3	6	100
2022-on	3	3	100

Note: Standards are for the Federal Test Procedure. The standards apply to all light-duty vehicles, light-duty trucks, and medium-duty passenger vehicles. For vehicles over 6,000 lbs. gross vehicle weight rating, the standards apply beginning in MY 2018.

Source:
Federal Register Vol. 79, No. 81, Monday, April 28, 2014.

Table 12.14
Tier 3 Evaporative Emission Standards
(grams per test)

Vehicle class	Highest hot soak + diurnal level (over both 2-day and 3-day diurnal tests)
Light-duty vehicles and LDT1	0.3
LDT2	0.4
LDT3, LT4, and medium-duty passenger vehicles	0.5
Heavy-duty gasoline vehicles	0.6

Note: LDT1 = Light trucks less than 6,000 lbs. gross vehicle weight rating (GVWR) and less than 3,750 lbs. loaded vehicle weight (LVW).
LDT2 = Light trucks less than 6,000 lbs. GVWR and less than 3,750 lbs. LVW.
LDT3, 4 = Light trucks less than 8,500 lbs. GVWR and more than 3,750 lbs. LVW.
Heavy-duty gasoline vehicles = trucks over 10,000 lbs. GVWR.

Source:
Federal Register Vol. 79, No. 81, Monday, April 28, 2014.

[a] Manufacturers comply with 20% of their light-duty truck fleet under 6,000 lbs. gross vehicle weight, alternatively with 10% of their total light-duty vehicle, light-duty trucks and medium-duty passenger vehicle fleet.

These exhaust emission standards were phased-in from 2004 to 2010.

Table 12.15
Light-Duty Vehicle, Light-Duty Truck, and Medium-Duty Passenger Vehicle – Tier 2 Exhaust Emission Standards

	Standard	Emission limits at 50,000 miles					Emission limits at full useful life (120,000 miles)[a]				
		NOx (g/mi)	NMOG (g/mi)	CO (g/mi)	PM (g/mi)	HCHO (g/mi)	NOx (g/mi)	NMOG (g/mi)	CO (g/mi)	PM (g/mi)	HCHO (g/mi)
Federal	Bin 1	-	-	-	-	-	0	0	0	0	0
	Bin 2	-	-	-	-	-	0.02	0.01	2.1	0.01	0.004
	Bin 3	-	-	-	-	-	0.03	0.055	2.1	0.01	0.011
	Bin 4	-	-	-	-	-	0.04	0.07	2.1	0.01	0.011
	Bin 5	0.05	0.075	3.4	-	0.015	0.07	0.09	4.2	0.01	0.018
	Bin 6	0.08	0.075	3.4	-	0.015	0.1	0.09	4.2	0.01	0.018
	Bin 7	0.11	0.075	3.4	-	0.015	0.15	0.09	4.2	0.02	0.018
	Bin 8	0.14	0.100 / 0.125[c]	3.4	-	0.015	0.2	0.125 / 0.156	4.2	0.02	0.018
	Bin 9[b]	0.2	0.075 / 0.140	3.4	-	0.015	0.3	0.090 / 0.180	4.2	0.06	0.018
	Bin 10[b]	0.4	0.125 / 0.160	3.4 / 4.4	-	0.015 / 0.018	0.6	0.156 / 0.230	4.2 / 6.4	0.08	0.018 / 0.027
	Bin 11[b]	0.6	0.195	5	-	0.022	0.9	0.28	7.3	0.12	0.032

Note: Tests Covered: Federal Test Procedure (FTP), cold carbon monoxide, highway, and idle. Definitions of acronyms are on page 12-13.

Source:
40 CR 86 Subpart S. (Additional resources: www.epa.gov/otaq/standards)

[a] In lieu of intermediate useful life standards (50,000 miles) or to gain additional nitrogen oxides credit, manufacturers may optionally certify to the Tier 2 exhaust emission standards with a useful life of 150,000 miles.
[b] Bins 9-11 expired in 2006 for light-duty vehicles and light light-duty trucks and 2008 for heavy light-duty trucks and medium-duty passenger vehicles.
[c] Pollutants with two numbers have a separate certification standard (1st number) and in-use standard (2nd number).

Table 12.16
Light-Duty Vehicle, Light-Duty Truck, and Medium-Duty Passenger Vehicle – Tier 2 Evaporative Emission Standards

	Vehicle type	Model year	3 Day diurnal + hot soak (g/test)	Supplemental 2 day diurnal + hot soak (g/test)	Running loss (g/mi)
	LDV/LLDTs[a]	2004	0.95	1.20	0.05
	HLDTs[b]	2004	1.20	1.50	0.05
	MDPVs[a, b]	2004	1.40	1.75	0.05
Federal	LDV[a]	2009	0.50	0.65	0.05
	LLDT[a]	2009	0.65	0.85	0.05
	HLDT[b]	2010	0.90	1.15	0.05
	MDPV[a, b]	2010	1.00	1.25	0.05

Note: Multi-fuel vehicle phase-in applies. Definitions of acronyms are on page 12-13.

Source:
40 CR 86 Subpart S. (Additional resources: www.epa.gov/otaq/standards)

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[a] For liquefied petroleum gas-fueled light-duty vehicles (LDV), light-duty trucks (LDT), and medium-duty passenger vehicles (MDPV): 0.15 grams hydrocarbon per gallon (0.04 grams per liter) of fuel dispensed.

[b] Refueling standards for heavy light-duty trucks (HLDT) are subject to phase-in requirements. MDPVs must also comply with the phase-in requirement and must be grouped with HLDTs to determine phase-in compliance.

Table 12.17
Heavy-Duty Highway Compression-Ignition Engines and Urban Buses – Exhaust Emission Standards

	Year	HC (g/bhp-hr)	NMHC (g/bhp-hr)	NMHC + NOx (g/bhp-hr)	NOx (g/bhp-hr)	PM (g/bhp-hr)	CO (g/bhp-hr)	Idle CO (percent Exhaust gas flow)	Smoke[a] (percentage)	Useful life (hours/years/miles)
Federal[b]	1974-78	-	-	16	-	-	40	-	20 / 15 / 50	-
	1979-84	1.5	-	10	-	-	25	-	20 / 15 / 50	-
	1985-87	1.3	-	-	10.7	-	15.5	-	20 / 15 / 50	LHDDE: - / 8 / 110,000 MHDDE: - / 8 / 185,000 HHDDE: - / 8 / 290,000
	1988-89	1.3[d]	-	-	10.7	0.6	15.5	0.5[c]	20 / 15 / 50	1990-97 and 1998+ for HC, CO, and PM: LHDDE: - / 8 / 110,000 MHDDE: - / 8 / 185,000 HHDDE: - / 8 / 290,000 1994+ urban buses for PM only: LHDDE: - / 10 / 110,000 1998+ for NOx: LHDDE: - / 10 / 110,000 MHDDE: - / 10 / 185,000 HHDDE: - / 10 / 290,000
	1990	1.3[d]	-	-	6.0	0.6	15.5	0.5[c]	20 / 15 / 50	
	1991-93	1.3	-	-	5.0 [ABT]	0.25 [ABT] 0.10[e]	15.5	0.5[c]	20 / 15 / 50	
	1994-97	1.3	-	-	5.0 [ABT]	0.1 [ABT] 0.07[f],0.05[g]	15.5	0.5[c]	20 / 15 / 50	
	1998-2003	1.3	-	-	4.0 [ABT]	0.1 [ABT] 0.05[g]	15.5	0.5[c]	20 / 15 / 50	
	2004-2006[h]	-	-	2.4 (or 2.5 with a limit of 0.5 on NMHC)[o] [ABT[i,j]]	-	0.1 0.05[g]	15.5	0.5	20 / 15 / 50	For all pollutants:[p] LHDDE: - / 10 / 110,000 MHDDE: - / 10 / 185,000 HHDDE: 22,000 / 10 / 435,000
	2007+[h,k,l,m,n]	-	0.14[o]	2.4 (or 2.5 with a limit of 0.5 on NMHC) [ABT]	0.2[o]	0.01	15.5	0.5	20 / 15 / 50	

Note: The test procedures are the EPA Transient Test Procedure and the EPA Smoke Test Procedure. Definitions of acronyms are on page 12-13.

Sources:
40 CFR 86.099-11 Emission standards for 1999 and later model year diesel heavy-duty engines and vehicles.
40 CFR 86.004-11 Emission standards for 2004 and later model year diesel heavy-duty engines and vehicles.
40 CFR 86.007-11 Emission standards and supplemental requirements for 2007 and later model year diesel heavy-duty engines and vehicles. (Additional resources: www.epa.gov/otaq/standards)

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[a] Percentages apply to smoke opacity at acceleration/lug/peak modes.

[b] Standards for 1990 apply only to diesel-fueled heavy-duty engines (HDE). Standards for 1991+ apply to both diesel- and methanol-fueled HDEs. Standards that apply to urban buses specifically are footnoted.

[c] This standard applies to the following fueled engines for the following model years: methanol - 1990+, natural gas and liquefied petroleum gas (LPG) - 1994+.

[d] For petroleum-fueled engines, the standard is for hydrocarbons (HC). For methanol-fueled engines, the standard is for total hydrocarbon equivalent (THCE).

[e] Certification standard for urban buses for 1993.

[f] Certification standard for urban buses from 1994-95.

[g] Certification standard for urban buses from 1996 and later. The in-use standard is 0.07.

[h] Load Response Test certification data submittal requirements take effect for heavy-duty diesel engines beginning in model year 2004. The following requirements take effect with the 2007 model year: steady-state test requirement and Not-to-Exceed (NTE) test procedures for testing of in-use engines. On-board diagnostic requirements applicable to heavy-duty diesel vehicles and engines up to 14,000 pounds gross vehicle weight rating (GVWR) phase in from the 2005 through 2007 model years.

Table 12.17 (continued)
Heavy-Duty Highway Compression-Ignition Engines and Urban Buses – Exhaust Emission Standards

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[i] The modified averaging, banking, and trading program for 1998 and later model year engines applies only to diesel cycle engines. Credits generated under the modified program may be used only in 2004 and later model years.

[j] For heavy-duty diesel engines, there are three options to the measurement procedures currently in place for alternative fueled engines: (1) use a THC measurement in place of an non-methane hydrocarbon (NMHC) measurement; (2) use a measurement procedure specified by the manufacturer with prior approval of the Administrator; or (3) subtract two percent from the measured THC value to obtain an NMHC value. The methodology must be specified at time of certification and will remain the same for the engine family throughout the engines' useful life. For natural gas vehicles, EPA allows the option of measuring NMHC through direct quantification of individual species by gas chromatography.

[k] Starting in 2006, refiners must begin producing highway diesel fuel that meets a maximum sulfur standard of 15 parts per million (ppm).

[l] Subject to a Supplemental Emission Test (1.0 x Federal Test Procedure [FTP] standard (or Family Emission Limit [FEL]) for nitrogen oxides [NOx], NMHC, and particulate matter [PM]) and a NTE test (1.5 x FTP standard [or FEL] for NOx, NMHC, and PM).

[m] EPA adopted the lab-testing and field-testing specifications in 40 CFR Part 1065 for heavy-duty highway engines, including both diesel and Otto-cycle engines. These procedures replace those previously published in 40 Code of Federal Regulations (CFR) Part 86, Subpart N. Any new testing for 2010 and later model years must be done using the 40 CFR Part 1065 procedures.

[n] Two-phase in-use NTE testing program for heavy-duty diesel vehicles. The program begins with the 2007 model year for gaseous pollutants and 2008 for PM. The requirements apply to diesel engines certified for use in heavy-duty vehicles (including buses) with GVWRs greater than 8,500 pounds. However, the requirements do not apply to any heavy-duty diesel vehicle that was certified using a chassis dynamometer, including medium-duty passenger vehicles with GVWRs of between 8,500 and 10,000 pounds.

[o] NOx and NMHC standards will be phased in together between 2007 and 2010. The phase-in will be on a percent-of-sales basis: 50 percent from 2007 to 2009 and 100 percent in 2010.

[p] Note that for an individual engine, if the useful life hours interval is reached before the engine reaches 10 years or 100,000 miles, the useful life shall become 10 years or 100,000 miles, whichever occurs first, as required under Clean Air Act section 202(d).

Table 12.18
Heavy-Duty Highway Spark-Ignition Engines – Exhaust Emission Standards

	Engine or vehicle	Year	Gross vehicle weight (lbs)	HC[a] (g/bhp-hr)	NMHC[b] (g/bhp-hr)	NOx (g/bhp-hr)	NOx + NMHC[c] (g/bhp-hr)	PM (g/bhp-hr)	CO (g/bhp-hr)	Idle CO (% exhaust gas flow)	Formaldehyde	Useful life (years / miles)
Federal	Heavy duty engines[d]	Prior to Control	-	12.7	-	-	6.86	-	155	-	-	5 / 50,000
		1970-73	-	275 ppm	-	-	-	-	1.50%	-	-	
		1974-78	-	-	-	16	-	-	40	-	-	
		1979-84	-	1.5	-	10	-	-	25	-	-	
		1985-86	-	1.9	-	-	10.6	-	37.1	-	-	
		1987	≤ 14,000	1.1	-	-	10.6	-	14.4	0.5	-	
			> 14,000	1.9	-	-	10.6	-	37.1		-	
		1988-90	≤ 14,000	1.1	-	-	6.0	-	14.4	-	-	
			> 14,000	1.9	-	-	6.0	-	37.1	-	-	
		1990[e]	≤ 14,000	1.1	-	-	6.0	-	14.4	0.5[j]	-	8 / 110,000[k]
			> 14,000	1.9	-	-	6.0	-	37.1		-	
		1991-97[f]	≤ 14,000	1.1[g]	-	-	5.0	-	14.4		-	
			> 14,000	1.9[h]	-	-	5.0	-	37.1		-	
		1998-2004[f]	≤ 14,000	1.1[g]	-	-	4.0[i]	-	14.4		-	
			> 14,000	1.9[h]	-	-		-	37.1		-	
		2005-2007[f]	≤ 14,000	1.1[g]	-	1.0[l]	-	-	14.4		-	10 / 110,000
			> 14,000	1.9[h]	-		-	-	37.1		-	
		2008+	All	-	0.14	0.2	-	0.01	14.4			
	Complete heavy-duty vehicles[n, q]	2005-2007	8,500 - 10,000	-	0.280[m]	-	0.9	-	7.3		-	11 / 110,000
			10,000 - 14,000	-	0.330[m]	-	1.0	-	8.1		-	
		2008+[p]	8,500 - 10,000	-	0.195[o]	-	0.2	0.02	7.3		0.032	
			10,000 - 14,000	-	0.230[o]	-	0.4	0.02	8.1		0.04	

Note: Definitions of acronyms are on page 12-13.

Sources:
40 CFR 86.1816-05, 86.1816-08 Emission standards for complete heavy-duty vehicles
40 CFR 86.1806-01, 86.1806-04, 86.1806-05 Onboard diagnostics requirements
40 CFR 86.1817-05, 86.1817-08 Complete heavy-duty vehicle averaging, banking, and trading program
40 CFR 86.091-10 Heavy-duty engine averaging, banking, and trading program for 1991 and later - Not available in the e-CFR
40 CFR Part 86 Subpart B Vehicle test procedures (Additional resources: www.epa.gov/otaq/standards)

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[a] For methanol-fueled engines, the standard is for total hydrocarbon equivalent (THCE).

[b] For methanol and alcohol fueled vehicles the standard is for non-methane hydrocarbon equivalent (NMHCE).

[c] For methanol fueled engines the standard is for nitrogen oxides (NOx) plus NMHCE.

[d] Standards for heavy-duty engines are expressed in grams per brake horsepower-hour (g/bhp-hr). Starting with the 1998 model year, crankcase emissions are not allowed.

[e] Standards for 1990 apply to gasoline and methanol-fueled engines.

[f] Standards for 1991 and later apply to gasoline and methanol engines and are optional for natural gas and Liquefied Petroleum Gas-fueled engines through the 1996 model year.

[g] For natural gas fueled engines the standard is 0.9 g/bhp-hr non-methane hydrocarbon (NMHC).

Table 12.18 (continued)
Heavy-Duty Highway Spark-Ignition Engines – Exhaust Emission Standards

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[h] For natural gas fueled engines the standard is 1.7 g/bhp-hr NMHC.

[i] The NOx standard is 5.0 for all natural gas-fueled engines.

[j] This standard applies to the following engines utilizing aftertreatment technology (except for methanol) for the following model years: gasoline/1990+; natural gas and LPG/1991+; methanol/1990+. Starting in 2005, engines certified to on-board diagnostics requirements are not required to meet the idle carbon monoxide (CO) standard.

[k] Useful life is expressed in years or miles, whichever comes first. Useful life for the 1998 and later NOx standard and for all 2004 standards is 10 years or 110,000 miles, whichever comes first.

[l] Manufacturers can choose this standard or one of the following options: (1) a standard of 1.5 g/bhp-hr NMHC+NOX that applies to the 2004 through 2007 model years, with complete heavy-duty vehicle standards taking effect in 2005; or (2) a standard of 1.5 g/bhp-hr NMHC + NOX that would apply to the 2003 through 2007 heavy-duty engines and optionally to 2003 through 2006 complete heavy-duty vehicles.

[m] Standard is expressed as non-methane organic gas, but compliance can optionally be shown using measurement of NMHC or total hydrocarbon (THC).

[n] Complete heavy-duty vehicles have the primary load-carrying container or device attached. Incomplete heavy-duty vehicles are certified to heavy-duty engine standards. Standards for complete heavy-duty vehicles are expressed in grams per mile (g/mi). Starting in 2005 (or 2003 or 2004 depending on the selected phase in option; see footnote l), complete heavy-duty vehicles under 14,000 lbs gross vehicle weight are tested on chassis-based rather than engine-based procedures and must meet these complete heavy-duty vehicle standards.

[o] Although expressed as NMHC, compliance can optionally be shown using measurement of NMOG or THC.

[p] At least 50 percent of a manufacturer's sales must meet these standards in 2008, with 100 percent required in 2009.

[q] Gross vehicle weight ranges are more accurately specified as follows: $8{,}500 \leq \text{GVW} \leq 10{,}000$ and $10{,}000 < \text{GVW} < 14{,}000$.

Table 12.19
Heavy-Duty Highway Compression-Ignition and Spark-Ignition Engines – Evaporative Emission Standards

<table>
<tr><th></th><th>Engine type</th><th>Year</th><th>Gross vehicle weight (lbs)</th><th>Conventional diurnal + hot soak (g/test)[a]</th><th>Three-diurnal test sequence (g/test)[b]</th><th>Supplemental two-diurnal test sequence (g/test)[c]</th><th>Running loss (gpm)[c]</th><th>Spitback (g/test)[c]</th><th>Useful life[d]</th></tr>
<tr><td rowspan="10">Federal</td><td rowspan="6">SI</td><td rowspan="2">1991-95</td><td>≤ 14,000</td><td>3.0</td><td>-</td><td>-</td><td>-</td><td>-</td><td rowspan="2">8 / 110,000</td></tr>
<tr><td>> 14,000[e]</td><td>4.0</td><td>-</td><td>-</td><td>-</td><td>-</td></tr>
<tr><td rowspan="2">1996-2007 (Enhanced)[f]</td><td>≤ 14,000</td><td>-</td><td>3.0</td><td>3.5</td><td rowspan="4">0.05</td><td>1.0</td><td rowspan="2">10 / 120,000</td></tr>
<tr><td>> 14,000[e]</td><td>-</td><td>4.0</td><td>4.5</td><td>-</td></tr>
<tr><td rowspan="2">2008+ (Enhanced)</td><td>8500-14,000</td><td>-</td><td>1.4</td><td>1.75</td><td>1.0</td><td rowspan="2">11 / 110,000</td></tr>
<tr><td>> 14,000[e]</td><td>-</td><td>1.9</td><td>2.3</td><td>-</td></tr>
<tr><td rowspan="4">CI</td><td rowspan="2">1996-97</td><td>≤ 14,000</td><td>-</td><td>3.0</td><td>-</td><td>-</td><td>-</td><td rowspan="4">MHDDE: 8 / 185,000
HHDDE: 8 / 290,000
MHDDE: 8 / 185,000
HHDDE: 8 / 290,000</td></tr>
<tr><td>> 14,000[e]</td><td>-</td><td>4.0</td><td>-</td><td>-</td><td>-</td></tr>
<tr><td rowspan="2">1998+ (Enhanced)[g]</td><td>≤ 14,000</td><td>-</td><td>3.0</td><td>3.5</td><td rowspan="2">0.05</td><td>1.0</td></tr>
<tr><td>> 14,000[e]</td><td>-</td><td>4.0</td><td>4.5</td><td>-</td></tr>
</table>

Note: Definitions of acronyms are on page 12-13.

Sources:
40 CFR 86.099-11 Emission standards for 1999 and later model year diesel heavy-duty engines and vehicles.
40 CFR 86.004-11 Emission standards for 2004 and later model year diesel heavy-duty engines and vehicles.
CFR 86.007-11 Emission standards and supplemental requirements for 2007 and later model year diesel heavy-duty engines and vehicles. (Additional resources: www.epa.gov/otaq/standards)

[a] Applies to gasoline and methanol engines. Standard is hydrocarbon (HC) for gasoline engines, total hydrocarbon equivalent (THCE) for methanol engines.

[b] For spark-ignition (SI) engines, standard applies to gasoline, methanol, natural gas, and liquefied petroleum gas engines. For compression-ignition (CI) engines, standard applies to methanol, natural gas, and liquefied petroleum gas engines. Standard is THCE for methanol engines, HC for others.

[c] For SI engines, standard applies to gasoline and methanol engines. For CI engines, standard applies to methanol engines. Standard is THCE for methanol engines, HC for others.

[d] Useful life is expressed in years or miles, whichever comes first.

[e] Vehicles over 26,000 pounds gross vehicle weight may demonstrate compliance with an engineering design evaluation in lieu of testing.

[f] A new enhanced evaporative test procedure applies, which is considerably more stringent than the previous test procedure despite the fact that the standard values do not change from prior years. Gasoline and methanol engines are phased in at the following rates of a manufacturer's sales for the specified model year: 1996: 20 percent; 1997: 40 percent; 1998: 90 percent; 1999: 100 percent.

[g] A new enhanced evaporative test procedure applies, which is considerably more stringent than the previous test procedure despite the fact that the standard values do not change from prior years. Methanol-fueled vehicles are phased in at a rate of 90 percent of a manufacturer's production in 1998 and 100 percent in 1999.

Table 12.20
California New Car, Light Truck and Medium Truck Emission Certification Standards, Model Year 2015-On

Vehicle type	Vehicle emission category	Non-methane organic gases + nitrogen oxides (g/mi)	Carbon monoxide (g/mi)	Formaldehyde (mg/mi)	Particulates (g/mi)
All passenger cars;	LEV160	0.16	4.2	4	0.01
LDTs 8,500 lbs. GVW or less	ULEV125	0.125	2.1	4	0.01
	ULEV70	0.07	1.7	4	0.01
All MDPVs	ULEV50	0.05	1.7	4	0.01
	SULEV30	0.03	1.0	4	0.01
Vehicles in this category are tested at their loaded vehicle weight	SULEV20	0.02	1.0	4	0.01
MDVs	LEV395	0.395	6.4	6	0.12
8,501-10,000 lbs GVW	ULEV340	0.34	6.4	6	0.06
	ULEV250	0.25	6.4	6	0.06
Vehicles in this category are tested at their adjusted loaded vehicle weight	ULEV200	0.2	4.2	6	0.06
	SULEV170	0.17	4.2	6	0.06
	SULEV150	0.15	3.2	6	0.06
MDVs	LEV630	0.63	7.3	6	0.12
10,000-14,000 lbs GVW	ULEV570	0.57	7.3	6	0.06
	ULEV400	0.4	7.3	6	0.06
Vehicles in this category are tested at their adjusted loaded vehicle weight	ULEV270	0.27	4.2	6	0.06
	SULEV230	0.23	4.2	6	0.06
	SULEV200	0.2	3.7	6	0.06

Note: Definitions of acronyms are on page 12-13.

Source:
California LEV III Regulations with amendments effective January 1, 2015, www.arb.ca.gov/msprog/levprog/cleandoc/cleancomplete%201ev-ghg%20regs%201-15.pdf. (Additional resources: www.arb.ca.gov)

These exhaust emission standards apply to commercial aircraft engines.

Table 12.21
Aircraft – Exhaust Emission Standards

	Year	Pressure ratio (PR)	Applicability[a]	HC (g/kN)	NOx	CO (g/kN)	Smoke
Federal[b]	1974+	-	T8	-	-	-	30
	1976+	-	TF with rO[c] ≥ 129 kN	-	-	-	$83.6(rO)^{-0.274}$
	1978+	-	T3[d]	-	-	-	25
	1983+	-	TF with rO < 26.7 kN	-	-	-	$83.6(rO)^{-0.274}$ NTE max of SN=50
	1984+	-	T3, T8, TF with rO ≥ 26.7 kN	19.6	-	-	$83.6(rO)^{-0.274}$ NTE max of SN=50
		-	TSS	$140(.92)^{rPR}$	-	-	$83.6(rO)^{-0.274}$ NTE max of SN=50
		-	TSS with rO ≥ 26.7 kN	$140(.92)^{rPR}$	-	-	$83.6(rO)^{-0.274}$ NTE max of SN=50
		-	TP with rO ≥ 1,000 kW	-	-	-	$187(rO)^{-0.168}$
	1997+	-	T3, T8, TF with rO > 26.7 kN	19.6	40+2(rPR)	118	$83.6(rO)^{-0.274}$ NTE max of SN=50
		-	T3, T8, TF newly certified with rO > 26.7 kN	19.6	32+1.6(rPR)	118	$83.6(rO)^{-0.274}$ NTE max of SN=50
	2000+	-	T3, T8, TF newly manufactured with rO > 26.7 kN	19.6	32+1.6(rPR)	118	$83.6(rO)^{-0.274}$ NTE max of SN=50
	2005+	PR ≤ 30	T3, T8, TF newly certified with rO > 89 kN	-	19+1.6(rPR)	-	-
			T3, T8, TF newly certified with 26.7 kN < rO ≤ 89 kN	-	37.572+1.6(rPR)-0.2087(rO)	-	-
		30 < PR < 62.5	T3, T8, TF newly certified with rO>89 kN	-	7+2.0(rPR)	-	-
			T3, T8, TF newly certified with 26.7kN < r0 ≤ 89kN	-	42.71+1.4286(rPR)-0.4013(rO)+0.00642(rPR)(rO)	-	-
		PR ≤ 62.5	T3, T8, TF	-	32+1.6(rPR)	-	-

Note: The test procedures are the International Civil Aviation Organization (ICAO) Smoke Emission Test Procedure and the ICAO Gaseous Emissions Test Procedure. There is no useful life or warranty period for purposes of compliance with aircraft emissions standards. Definitions of acronyms are on page 12-13.

Source:
40 CFR Part 87, Aircraft emission standards, test procedures, certification requirements (Additional resources: www.epa.gov/otaq/standards)

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[a] T8=all aircraft gas turbine engines of the JT8D model family
TF=all turbofan and turbojet aircraft engines except engines of Class T3, T8, and TSS
T3=all aircraft gas turbine engines of the JT3D model family
TSS=all aircraft gas turbine engines for aircraft operations at supersonic flight speeds
TP=all aircraft turboprop engines

[b] Federal standards apply to planes operating in the United States, regardless of where they were manufactured.

[c] Rated output (rO) is the maximum power/thrust available for takeoff.

[d] T3 engines are no longer manufactured but are in the existing fleet.

These standards apply to construction and agricultural equipment, such as excavators, paving equipment, tractors, combines, bulldozers, and skidders.

Table 12.22
Nonroad Compression-Ignition Engines – Exhaust Emission Standards

	Rated power (kW)	Tier	Model year	NMHC (g/kW -hr)	NMHC + NOx (g/kW -hr)	NOx (g/kW -hr)	PM (g/kW -hr)	CO (g/kW -hr)	Smoke[a] percentage	Useful life (hours/years)[b]
Federal	kW < 8	1	2000-2004	--	10.5	--	1.0	8.0	20 / 15 / 50	3,000 / 5
		2	2005-2007	--	7.5	--	0.80	8.0		
		4	2008+	--	7.5	--	0.40[c]	8.0		
	8 ≤ kW < 19	1	2000-2004	--	9.5	--	0.80	6.6		3,000 / 5
		2	2005-2007	--	7.5	--	0.80	6.6		
		4	2008+	--	7.5	--	0.40	6.6		
	19 ≤ kW < 37	1	1999-2003	--	9.5	--	0.80	5.5		5,000 / 7[d]
		2	2004-2007	--	7.5	--	0.60	5.5		
		4	2008-2012	--	7.5	--	0.30	5.5		
			2013+	--	4.7	--	0.03	5.5		
	37 ≤ kW < 56	1	1998-2003	--	--	9.2	--	--		8,000 / 10
		2	2004-2007	--	7.5	--	0.40	5.0		
		3[e]	2008-2011	--	4.7	--	0.40	5.0		
		4 (Option 1)[f]	2008-2012	--	4.7	--	0.30	5.0		
		4 (Option 2)[f]	2012	--	4.7	--	0.03	5.0		
		4	2013+	--	4.7	--	0.03	5.0		
	56 ≤ kW < 75	1	1998-2003	--	--	9.2	--	--		
		2	2004-2007	--	7.5	--	0.40	5.0		
		3	2008-2011	--	4.7	--	0.40	5.0		
		4	2012-2103[g]	--	4.7	--	0.02	5.0		
			2014+[h]	0.19	--	0.4	0.02	5.0		
	75 ≤ kW < 130	1	1997-2002	--	--	9.2	--	--		
		2	2003-2006	--	6.6	--	0.3	5.0		
		3	2007-2011	--	4.0	--	0.3	5.0		
		4	2012-2013[g]	--	4.0	--	0.02	5.0		
			2014+	0.19	--	0.4	0.02	5.0		
	130 ≤ kW < 225	1	1996-2002	1.3[i]	--	9.2	0.54	11.4		
		2	2003-2005	--	6.6	--	0.20	3.5		
		3	2006-2010	--	4.0	--	0.20	3.5		
		4	2011-2013[g]	--	4.0	--	0.02	3.5		
			2014+[h]	0.19	--	0.4	0.02	3.5		
	225 ≤ kW < 450	1	1996-2000	1.3[i]	--	9.2	0.54	11.4		
		2	2001-2005	--	6.4	--	0.20	3.5		
		3	2006-2010	--	4.0	--	0.20	3.5		
		4	2011-2013[g]	--	4.0	--	0.02	3.5		
			2014+[h]	0.19	--	0.4	0.02	3.5		
	450 ≤ kW < 560	1	1996-2001	1.3[i]	--	9.2	0.54	11.4		
		2	2002-2005	--	6.4	--	0.20	3.5		
		3	2006-2010	--	4.0	--	0.20	3.5		
		4	2011-2013[g]	--	4.0	--	0.02	3.5		
			2014+[h]	0.19	--	0.4	0.02	3.5		
	560 ≤ kW < 900	1	2000-2005	1.3[i]	--	9.2	0.54	11.4		
		2	2006-2010	--	6.4	--	0.20	3.5		
		4	2011-2014	0.4	--	3.5	0.10	3.5		
			2015+[h]	0.19	--	3.5[j]	0.04[k]	3.5		

Table 12.22 (continued)
Nonroad Compression-Ignition Engines – Exhaust Emission Standards

	Rated power (kW)	Tier	Model year	NMHC (g/kW-hr)	NMHC + NOx (g/kW-hr)	NOx (g/kW-hr)	PM (g/kW-hr)	CO (g/kW-hr)	Smoke[a] percentage	Useful life (hours/years)[b]
Federal	kW > 900	1	2000-2005	1.3[i]	--	9.2	0.54	11.4	20 / 15 / 50	8,000 / 10
		2	2006-2010	--	6.4	--	0.20	3.5		
		4	2011-2014	0.4	--	3.5[j]	0.10	3.5		
			2015+[h]	0.19	--	3.5[j]	0.04[k]	3.5		

Note: Definitions of acronyms are on page 12-13.

Source:
40 CFR 98.112 = Exhaust emission standards
40 CFR 1039.101 = Exhaust emission standards for after 2014 model year
40 CFR 1039.102 = Exhaust emission standards for model year 2014 and earlier
40 CFR 1039 Subpart F = Exhaust emissions transient and steady state test procedures
40 CFR Part 86 Subpart I = Smoke emission test procedures
40 CFR Part 1065 = Test equipment and emissions measurement procedures (Additional resources: www.epa.gov/otaq/standards)

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[a] Smoke emissions may not exceed 20 percent during the acceleration mode, 15 percent during the lugging mode, and 50 percent during the peaks in either mode. Smoke emission standards do not apply to single-cylinder engines, constant-speed engines, or engines certified to a PM emission standard of 0.07 grams per kilowatt-hour (g/kW-hr) or lower. Smoke emissions are measured using procedures in 40 CFR Part 86 Subpart I.

[b] Useful life and warranty period are expressed hours and years, whichever comes first.

[c] Hand-startable air-cooled direct injection engines may optionally meet a PM standard of 0.60 g/kW-hr. These engines may optionally meet Tier 2 standards through the 2009 model years. In 2010 these engines are required to meet a PM standard of 0.60 g/kW-hr.

[d] Useful life for constant speed engines with rated speed 3,000 revolutions per minute (rpm) or higher is 5 years or 3,000 hours, whichever comes first.

[e] These Tier 3 standards apply only to manufacturers selecting Tier 4 Option 2. Manufacturers selecting Tier 4 Option 1 will be meeting those standards in lieu of Tier 3 standards.

[f] A manufacturer may certify all their engines to either Option 1 or Option 2 sets of standards starting in the indicated model year. Manufacturers selecting Option 2 must meet Tier 3 standards in the 2008-2011 model years.

[g] These standards are phase-out standards. Not more than 50 percent of a manufacturer's engine production is allowed to meet these standards in each model year of the phase out period. Engines not meeting these standards must meet the final Tier 4 standards.

[h] These standards are phased in during the indicated years. At least 50 percent of a manufacturer's engine production must meet these standards during each year of the phase in. Engines not meeting these standards must meet the applicable phase-out standards.

[i] For Tier 1 engines the standard is for total hydrocarbons.

[j] The NOx standard for generator sets is 0.67 g/kW-hr.

[k] The PM standard for generator sets is 0.03 g/kW-hr.

These standards apply to gasoline and propane industrial equipment such as forklifts, generators, airport service equipment, compressors and ice-grooming machines.

Table 12.23
Nonroad Large Spark-Ignition Engines – Exhaust and Evaporative Emission Standards

<table>
<tr><th rowspan="2"></th><th rowspan="2">Tier</th><th rowspan="2">Year</th><th colspan="2">General duty-cycle standards</th><th colspan="2">Alternative standards for severe-duty engines</th><th colspan="2">Field testing standards</th><th rowspan="2">Useful life (years/hours)</th></tr>
<tr><th>HC+NOx[a] (g/kW-hr)</th><th>CO (g/kW-hr)</th><th>HC+NOx[a] (g/kW-hr)</th><th>CO (g/kW-hr)</th><th>HC+NOx[a] (g/kW-hr)</th><th>CO (g/kW-hr)</th></tr>
<tr><td rowspan="6">Federal [b]</td><td>1[c]</td><td>2004-2006</td><td>4.0[d]</td><td>50.0</td><td>4.0[d]</td><td>130.0</td><td>-</td><td>-</td><td>7 / 5,000[e]</td></tr>
<tr><td rowspan="5">2[f]</td><td rowspan="5">2007+</td><td>2.7[f]</td><td>4.4[f]</td><td>2.7</td><td>130.0</td><td>3.8[f]</td><td>6.5[f]</td><td>7 / 5,000[e]</td></tr>
<tr><td colspan="7">Evaporative emission standards (for engines fueled by a volatile liquid fuel)</td></tr>
<tr><td>Fuel line permeation</td><td colspan="5">Nonmetallic fuel lines must meet the permeation specifications of SAE J2260 (November 1996)</td><td rowspan="3">5 / -</td></tr>
<tr><td>Diurnal emissions</td><td colspan="5">Evaporative HC emissions may not exceed 0.2 grams per gallon of fuel tank capacity</td></tr>
<tr><td>Running loss</td><td colspan="5">Liquid fuel in the fuel tank may not reach boiling during continuous engine operation in the final installation at an ambient temperature of 30°C</td></tr>
</table>

Sources:
40 CFR 1048.101 = Exhaust emission standards
40 CFR 1048.105 = Evaporative emission standards
40 CFR 1048.110 = Engine diagnostic requirements (Additional resources: www.epa.gov/otaq/standards)

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[a] The numerical emission standards for hydrocarbons (HC) must be met based on the following types of hydrocarbon emissions for engines powered by the following fuels: (1) non-methane hydrocarbons (NMHC) for natural gas; (2) total hydrocarbon equivalent (THCE) for alcohol; and (3) total hydrocarbons (THC) for other fuels.

[b] Voluntary Blue Sky standards for large spark-ignition (SI) engines are available. Engines with displacement at or below 1,000 cubic centimeters (cc) and maximum power at or below 30 kilowatts (kW) may be certified under the program for small SI engines.

[c] Emission standards are based on testing over a steady-state duty-cycle.

[d] The Tier 1 HC plus nitrogen oxides (NOx) emission standard for in-use testing is 5.4 grams per kW-hour (g/kW-hr).

[e] Useful life is expressed in years and hours, whichever comes first. These are the minimum useful life requirements. For severe-duty engines, the minimum useful life is seven years or 1,500 hours of operation, whichever comes first. A longer useful life in hours is required if: (a) the engine is designed to operate longer than the minimum useful life based on the recommended rebuild interval; or (b) the basic mechanical warranty is longer than the minimum useful life.

[f] Optional engine certification is allowed according to the following formula: $(HC+NOx) \times CO^{0.784} \leq 8.57$. The HC+NOx and carbon monoxide (CO) emission levels selected to satisfy this formula, rounded to the nearest 0.1 g/kW-hr, become the emission standards that apply for those engines. One may not select an HC+NOx emission standard higher than 2.7 g/kW-hr or a CO emission standard higher than 20.6 g/kW-hr.

Table 12.24
Locomotives – Exhaust Emission Standards

	Duty-cycle[b]	Tier	Year[c]	HC[i] (g/hp-hr)	NOx (g/bhp-hr)	PM (g/bhp-hr)	CO (g/bhp-hr)	Smoke (percentage)[m]	Minimum useful life (hours / years / miles)[n]
Federal[a]	Line-haul	Tier 0	1973-1992[d,e]	1.0	9.5 [ABT]	0.22 [ABT]	5.0	30 / 40 / 50	(7.5 x hp) / 10 / 750,000[o]
		Tier 1	1993-2004[d,e]	0.55	7.4 [ABT]	0.22 [ABT]	2.2	25 / 40 / 50	(7.5 x hp) / 10 / 750,000[o] (7.5 x hp) / 10 / -
		Tier 2	2005-2011[d]	0.30	5.5 [ABT]	0.10[k] [ABT]	1.5	20 / 40 / 50	(7.5 x hp) / 10 / -
		Tier 3	2012-2014[f]	0.30	5.5 [ABT]	0.10 [ABT]	1.5	20 / 40 / 50	(7.5 x hp) / 10 / -
		Tier 4	2015+[g]	0.14	1.3 [ABT]	0.03 [ABT]	1.5	-	(7.5 x hp) / 10 / -
	Switch	Tier 0	1973-2001	2.10	11.8 [ABT]	0.26 [ABT]	8.0	30 / 40 / 50	(7.5 x hp) / 10 / 750,000[o]
		Tier 1	2002-2004[h]	1.20	11.0 [ABT]	0.26 [ABT]	2.5	25 / 40 / 50	(7.5 x hp) / 10 / -
		Tier 2	2005-2010[h]	0.60	8.1 [ABT]	0.13[l] [ABT]	2.4	20 / 40 / 50	(7.5 x hp) / 10 / -
		Tier 3	2011-2014	0.60	5.0 [ABT]	0.10 [ABT]	2.4	20 / 40 / 50	(7.5 x hp) / 10 / -
		Tier 4	2015+	0.14[j]	1.3[j][ABT]	0.03 [ABT]	2.4	-	(7.5 x hp) / 10 / -

Sources:
40 CFR 1033.101 = Emission Standards and Useful Life

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[a] These standards apply to locomotives that are propelled by engines with total rated horsepower (hp) of 750 kilowatts (kW) (1006 hp) or more, unless the owner chooses to have the equipment certified to meet the requirements of locomotives. This does not include vehicles propelled by engines with total rated horsepower of less than 750 kW (1006 hp); see the requirements in 40 Code of Federal Regulations (CFR) Parts 86, 89 and 1039. The test procedures specify chassis-based testing of locomotives. These test procedures include certification testing, production line testing, and in-use testing using the Federal Test Procedure (FTP) when the locomotive has reached between 50-70 percent of its useful life.

[b] Line-haul locomotives are powered by an engine with a maximum rated power (or a combination of engines having a total rated power) greater than 2300 hp. Switch locomotives are powered by an engine with a maximum rated power (or a combination of engines having a total rated power) of 2300 hp or less.

[c] The Tier 0 standards apply to locomotives manufactured after 1972 when they are manufactured or remanufactured. Note that interim standards may apply for Tier 0 or Tier 1 locomotives remanufactured in 2008 or 2009, or for Tier 2 locomotives manufactured or remanufactured in 2008-2012.

[d] Line-haul locomotives subject to the Tier 0 through Tier 2 emission standards must also meet switch standards of the same tier.

[e] The Tier 0 standards apply for 1993-2001 locomotives not originally manufactured with a separate loop intake air cooling system.

[f] Tier 3 line-haul locomotives must also meet Tier 2 switch standards.

[g] Manufacturers using credits may elect to meet a combined nitrogen oxides (NOx) plus hydrocarbon (HC) standard of 1.4 grams per brakehorsepower-hour (g/bhp-hr) instead of the otherwise applicable Tier 4 NOx and HC standards.

[h] Tier 1 and Tier 2 switch locomotives must also meet line-haul standards of the same tier.

[i] The numerical emission standards for HC must be met based on the following types of hydrocarbon emissions for locomotives powered by the following fuels: (1) alcohol: total hydrocarbon equivalent (THCE) emissions for Tier 3 and earlier locomotives, and non-methane hydrocarbon equivalent (NMHCE) for Tier 4; (2) natural gas and liquefied petroleum gas: non-methane hydrocarbon (NMHC) emissions; and (3) diesel: total hydrocarbon (THC) emissions for Tier 3 and earlier locomotives, and NMHC for Tier 4.

Table 12.24 (continued)
Locomotives – Exhaust Emission Standards

[j] Manufacturers may elect to meet a combined NOx+HC standard of 1.4 g/bhp-hr instead of the otherwise applicable Tier 4 NOx and HC standards.

[k] The line-haul particulate matter (PM) standard for newly remanufactured Tier 2 locomotives is 0.20 g/bhp-hr until January 1, 2013, except as specified in 40 CFR Part 1033.150(a).

[l] The switch PM standard for new Tier 2 locomotives is 0.24 g/bhp-hr until January 1, 2013, except as specified in 40 CFR Part 1033.150(a).

[m] The smoke opacity standards apply only for locomotives certified to one or more PM standards or Family Emission Limits (FEL) greater than 0.05 g/bhp-hr. Percentages apply to smoke opacity at steady state/30-second peak/3-second peak, as measured continuously during testing.

[n] Useful life and warranty period are expressed in megawatt-hours (mw-hr), years, or miles, whichever comes first. Manufacturers are required to certify to longer useful lives if their locomotives are designed to last longer between overhauls than the minimum useful life value.

[o] For locomotives originally manufactured before January 1, 2000, and not equipped with mw-hr meters.

These standards apply to auxiliary and propulsion engines used by all types of recreational and commercial vessels, from small fishing boats to ocean-going ships.

Table 12.25
Marine Compression-Ignition (CI) Engines – Exhaust Emission Standards

	Category [a, b]	Tier	Displacement (L/cylinder)	Power [c] (kW)	Speed (rpm)	Model Year	NOx (g/kW-hr)	HC (g/kW-hr)	HC+NOx [d] (g/kW-hr)	PM (g/kW-hr)	CO (g/kW-hr)	Useful Life [e] (years/hours)	
Federal [g]	C1 Commercial	1	≥ 2.5	≥ 37	rpm < 130		17.0	-	-	-	-	10 / 10,000	
					130 ≤rpm < 2000		$45.0 \times N^{-0.20}$ [i]	-	-	-	-		
					rpm ≥2000	2004 [h]	9.8	-	-	-	-		
		2	disp. < 0.9	≥ 37	-	2005 [h]	-	-	7.5 (ABT)	0.40 (ABT)	5.0	10 / 10,000	
			0.9 ≤ disp < 1.2	all	-	2004 [h]	-	-	7.2 (ABT)	0.30 (ABT)	5.0		
			1.2 ≤ disp < 2.5		-	2004 [h]	-	-	7.2 (ABT)	0.20 (ABT)	5.0		
			2.5 ≤ disp < 5.0		-	2007 [h]	-	-	7.2 (ABT)	0.20 (ABT)	5.0		
	C1 Commercial & Recreational	1	≥ 2.5	≥ 37	rpm < 130		17.0	-	-	-	-	10/ 1,000	
					130 ≤ rpm < 2000		$45.0 \times N^{-0.20}$ [i]	-	-	-	-		
					rpm ≥ 2000	2004	9.8	-	-	-	-		
		2	disp < 0.9	≥ 37	-	2007	-	-	7.5 (ABT)	0.40 (ABT)	5.0	10 / 1,000	
			0.9 ≤ disp < 1.2	all	-	2006	-	-	7.2 (ABT)	0.30 (ABT)	5.0		
			1.2 ≤ disp < 2.5		-	2006	-	-	7.2 (ABT)	0.20 (ABT)	5.0		
			2.5 ≤ disp < 5.0		-	2009	-	-	7.2 (ABT)	0.20 (ABT)	5.0		
	C1 Commercial & Recreational < 75 kW	3	< 0.9	< 8	-	2009+	-	-	7.5 (ABT)	0.40 (ABT)	8.0	5 / 3,000	10 / 1,000 for CI Recreational
				8 ≤ kW < 19	-	2009+	-	-	7.5 (ABT)	0.40 (ABT)	6.6		
				19 ≤ kW < 37	-	2009-2013	-	-	7.5 [j] (ABT)	0.30 [j] (ABT)	5.5	7 / 5,000	
					-	2014+	-	-	4.7 [j] (ABT)	0.20 (ABT)	5.0		
				37 ≤ kW < 75	-	2009-2013	-	-	7.5 [j] (ABT)	0.30 [j] (ABT)	5.0	10 / 10,000	
					-	2014+	-	-	4.7 [j] (ABT)		5.0		
	C1 Commercial Engines with ≤ 35 kW/L power density [k]	3 [l]	< 0.9	-	-	2012+	-	-	5.4 (ABT)	0.14 (ABT)	8.0 for < 8 kW	5 / 3,000 for commercial engines < 19 kW	
			0.9 ≤ disp < 1.2	All	-	2013+	-	-	5.4 (ABT)	0.12 (ABT)	6.6 for 8 ≤ kW < 19	7 / 5,000 for commercial engines 19 ≤ kW < 37	
			1.2 ≤ disp < 2.5	< 600	-	2014-2017	-	-	5.6 (ABT)	0.11 (ABT)	5.5 for 19 ≤ kW < 37	10 / 10,000 for C1 Commercial ≤ 37 kW	
					-	2018+	-			0.10 (ABT)	5.0 for ≤ 37 kW		
				≥ 600	-	2014+	-	-	5.6 (ABT)	0.11 (ABT)			
			2.5 ≤ disp < 3.5	< 600	-	2013-2017	-	-	5.6 (ABT)	0.11 (ABT)			
					-	2018+	-			0.10 (ABT)			
				≥ 600	-	2013+	-	-	5.6 (ABT)	0.11 (ABT)			
			3.5 ≤ disp < 7.0	< 600	-	2012-2017	-	-	5.8 (ABT)	0.11 (ABT)			
					-	2018+	-			0.10 (ABT)			
				≥ 600	-	2012+	-	-	5.8 (ABT)	0.11 (ABT)			
	C1 Commercial engines with > 35 kW/L power density & All Recreational Engines [k]	3 [l]	< 0.9	≥ 75	-	2012+	-	-	5.8 (ABT)	0.15 (ABT)	8.0 for < 8 kW	5 / 3,000 for commercial engines < 19 kW	
			0.9 ≤ disp < 1.2	All	-	2013+	-	-	5.8 (ABT)	0.14 (ABT)	6.6 for 8 ≤ kW < 19	7 / 5,000 for commercial engines 19 ≤ kW < 37	
			1.2 ≤ disp < 2.5		-	2014+	-	-	5.8 (ABT)	0.14 (ABT)	5.5 for 19 ≤ kW < 37	10 / 10,000 for C1 Commercial ≥ 37 kW	
			2.5 ≤ disp < 3.5		-	2013+	-	-	5.8 (ABT)	0.12 (ABT)	5.0 for ≥ 37 kW	10 / 1,000 for CI Recreational	
			3.5 ≤ disp < 7.0		-	2012+	-	-	5.8 (ABT)	0.11 (ABT)			

(Continued on next page)

Table 12.25 (continued)
Marine Compression-Ignition (CI) Engines – Exhaust Emission Standards

	Category [a, b]	Tier	Displacement (L/cylinder)	Power [c] (kW)	Speed (rpm)	Model Year	NOx (g/kW-hr)	HC (g/kW-hr)	HC+NOx [d] (g/kW-hr)	PM (g/kW-hr)	CO (g/kW-hr)	Useful Life[e] (years/hours)
Federal[g]	C1 Commercial > 600 kW	4[m]	All	600 ≤ kW < 1,400	-	2017+	1.8 (ABT)	-	0.19 HC[n]	0.04 (ABT)	5.0	10 / 10,000
			All	1,400 ≤ kW < 2,000	-	2016+	1.8 (ABT)	-	0.19 HC[n]	0.04 (ABT)		
			All	2,000 ≤ kW < 3,700	-	2014+	1.8 (ABT)	-	0.19 HC[n]	0.04 (ABT)		
			< 7.0	≥ 3,700	-	2014-2015	1.8 (ABT)	-	0.19 HC[n]	0.12 (ABT)		
					-	2016+	1.8 (ABT)	-	0.19 HC[n]	0.06 (ABT)		
	C2	1	≥ 2.5	≥ 37	rpm < 130	2004	17.0	-	-	-	-	10 / 20,000
					130 ≤ rpm < 2,000		$45.0 \times N^{-0.20}$ [i]	-	-	-	-	
					rpm ≥ 2,000		9.8	-	-	-	-	
		2	5.0 ≤ disp < 15.0	all	-	2007	-	-	7.8 (ABT)	0.27 (ABT)	5.0	10 / 20,000
			15.0 ≤ disp < 20.0	< 3,300	-		-	-	8.7 (ABT)	0.50 (ABT)	5.0	
			15.0 ≤ disp < 20.0	≥ 3,300	-		-	-	9.8 (ABT)	0.50 (ABT)	5.0	
			20.0 ≤ disp < 25.0	all	-		-	-	9.8 (ABT)	0.50 (ABT)	5.0	
			25.0 ≤ disp < 30.0	all	-		-	-	11.0 (ABT)	0.50 (ABT)	5.0	
		3[o,p]	7.0 ≤ disp < 15.0	< 2,000	-	2013+	-	-	6.2 (ABT)	0.14 (ABT)	5.0	10 / 20,000
				2,000 ≤ kW < 3,700	-		-	-	7.8 (ABT)	0.14 (ABT)	5.0	
			15.0 ≤ disp < 20.0	< 2,000	-	2014+	-	-	7.0 (ABT)	0.34 (ABT)	5.0	
			20.0 ≤ disp < 25.0	< 2,000	-		-	-	9.8 (ABT)	0.27 (ABT)	5.0	
			25.0 ≤ disp < 30.0	< 2,000	-		-	-	11.0 (ABT)	0.27 (ABT)	5.0	
		4[m,p]	All	600 ≤ kW < 1,400	-	2017+	1.8 (ABT)	-	0.19 HC[n]	0.04 (ABT)		10 / 20,000
			All	1400 ≤ kW < 2,000	-	2016+	1.8 (ABT)	-	0.19 HC[n]	0.04 (ABT)		
			All	2,000 ≤ kW < 3,700[q]	-	2014+	1.8 (ABT)	-	0.19 HC[n]	0.04 (ABT)		
			< 15.0	≥ 3,700	-	2014-2015	1.8 (ABT)	-	0.19 HC[n]	0.12 (ABT)		
			15.0 ≤ disp < 30.0		-	2014-2015	1.8 (ABT)	-	0.19 HC[n]	0.25 (ABT)		
			All		-	2016+	1.8 (ABT)	-	0.19 HC[n]	0.06 (ABT)	5.0	
	C3	1	≥30.0	All	rpm < 130	2004	17.0	-	-	-	-	3 / 10,000
					130 ≤ rpm < 2,000		$45.0 \times N^{-0.20}$ [i]	-	-	-	-	
					rpm ≥ 2,000		9.8	-	-	-	-	
		2	≥30.0	All	rpm < 130	2011	14.4	2.0	-	-	5.0	3 / 10,000
					130 ≤ rpm < 2,000		$44.0 \times N^{-0.23}$ [i]		-	-		
					rpm ≥ 2,000		7.7		-	-		
		3	≥ 30.0	All	rpm < 130	2016	3.4	2.0	-	-	5.0	3 / 10,000
					130 ≤ rpm < 2,000		$9.0 \times N^{-0.20}$ [i]		-	-		
					rpm ≥ 2,000		2.0		-	-		

Sources:
40 CFR 89.104 = Tiers 1 and 2 useful life & warranty period for marine CI engines less than 37 kW
40 CFR 89.112 = Tiers 1 and 2 emission standards for marine CI engines less than 37 kW
40 CFR 89 Subpart E = Tiers 1 and 2 test procedures for marine CI engines less than 37 kW
40 CFR 94.8 = Tiers 1 and 2 emission standards for C1 (both commercial & recreational), C2 and C3 engines
40 CFR 94.9 = Tiers 1 and 2 useful life for C1 (both commercial & recreational), C2 and C3 engines
40 CFR 94 Subpart B = Tiers 1 and 2 test procedures for C1 (both commercial & recreational), C2 and C3 engines
40 CFR 1042.101 = Tiers 3 and 4 exhaust emission standards and useful life

Table 12.25 (continued)
Marine Compression-Ignition (CI) Engines – Exhaust Emission Standards

Sources (continued):
40 CFR 1042.107 = Tiers 3 and 4 evaporative emission standards engines using a volatile liquid fuel (e.g., methanol)
40 CFR 1042.120 = Tiers 3 and 4 warranty period
40 CFR 1042 Subpart F = Tiers 3 and 4 test procedures (Additional resources: www.epa.gov/otaq/standards)

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[a] For Tiers 1 and 2, Category 1 marine engines are greater than or equal to 37 kilowatts (kW) and have a displacement less than 5.0 liters per cylinder (L/cylinder); Category 2 marine engines have a displacement greater than or equal to 5.0 L/cylinder and less than 30 L/cylinder; and Category 3 marine engines have a displacement greater than or equal to 30.0 L/cylinder. For Tiers 3 and 4, Category 1 represents engines up to 7 L/cylinder displacement; and Category 2 includes engines from 7 to 30 L/cylinder. The definition of Category 3 marine engines remains the same.

[b] Tiers 1 and 2 for marine engines less than 37 kW are subject to the same emission standards as for land-based engines. See Table 1 in 40 Code of Federal Regulations (CFR) Part 89.112 and 40 CFR Part 89.104.

[c] For Tiers 1 and 2, this refers to the rated power; for Tiers 3 and 4, this refers to the maximum engine power.

[d] Total hydrocarbon (THC) plus nitrogen oxides (NOx) for Tier 2 standards.

[e] Useful life is expressed in hours or years, whichever comes first. For Tiers 3 and 4, a longer useful life in hours for an engine family must be specified if either:1) the engine is designed, advertised, or marketed to operate longer than the minimum useful life; or 2) the basic mechanical warranty is longer than the minimum useful life.

[f] Warranty period is expressed in years and hours, whichever comes first.

[g] For Tiers 3 and 4, there are no evaporative emission standards for diesel-fueled engines, or engines using other nonvolatile or nonliquid fuels (e.g., natural gas). If an engine uses a volatile liquid fuel, such as methanol, the engine's fuel system and the vessel in which the engine is installed must meet the evaporative emission requirements of 40 Code of Federal Regulations (CFR) Part 1045 that apply with respect to spark-ignition engines. Manufacturers subject to evaporative emission standards must meet the requirements of 40 CFR 1045.112 as described in 40 CFR 1060.1(a)(2).

[h] Indicates the model years for which the specified standards start.

[i] N is the maximum test speed of the engine in revolutions per minute (rpm).

[j] Manufacturers of Tier 3 engines greater than or equal to 19 kW and less than 75 kW with displacement below 0.9 L/cylinder may alternatively certify some or all of their engine families to a particulate matter (PM) emission standard of 0.20 grams per kilowatt-hour (g/kW-hr) and a NOx+HC emission standard fo 5.8 g/kW-hr for 2014 and later model years.

[k] The applicable Tier 2 NOx+HC standards continue to apply instead of the Tier 3 values for engines at or above 2000 kW.

[l] These Tier 3 standards apply to Category 1 engines below 3700 kW except for recreational marine engines at or above 3700 kW (with any displacement), which must meet the Tier 3 standards specified for recreational marine engines with a displacement of 3.5 to 7.0 L/cylinder.

[m] The following provisions are optional: 1) Manufacturers may use NOx credits to certify Tier 4 engines to a NOX+HC emission standard of 1.9 g/kW-hr instead of the NOX and HC standards. See 40 CFR 1042.101(a)(8)(i) for more details. 2) For engines below 1000 kW, manufacturers may delay complying with the Tier 4 standards until October 1, 2017. 3) For engines at or above 3700 kW, manufacturers may delay complying with the Tier 4 standards until December 31, 2016.

[n] The Tier 4 standard is for HC (not HC+NOx) in g/kW-hr.

[o] These Tier 3 standards apply to Category 2 engines below 3700 kW; no Tier 3 standards apply for Category 2 engines at or above 3700 kW, although there are Tier 4 standards that apply.

Table 12.25 (continued)
Marine Compression-Ignition (CI) Engines – Exhaust Emission Standards

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[p] An alternative set of Tier 3 and Tier 4 standards for PM, NOx, and HC are available for Category 2 engines at or above 1400 kW, but must be applied to all of a manufacturer's engines in a given displacement category in model years 2012 through 2015.

Tier	Maximum engine power	Model year	PM (g/kW-hr)	NOx (g/kW-hr)	HC (g/kW-hr)
3	kW ≥ 1400	2012-2014	0.14	7.8 NOx+HC	
4	1400 ≤ kW < 3700	2015	0.04	1.8	0.19
	kW ≥ 3700	2015	0.06	1.8	0.19

[q] Interim Tier 4 PM standards apply for 2014 and 2015 model year Category 2 engines with per-cylinder displacement at or above 15.0 liters: 0.34 g/kW-hr for engines 2000 = kW < 3000, and 0.27 g/kW-hr for engines 3300 = kW < 3700.

These standards apply to gasoline boats and personal watercraft, such as pleasure boats, jet-skis, outboard engines and sterndrive/inboard engines.

Table 12.26
Marine Spark-Ignition Engines and Vessels – Exhaust Emission Standards

	Engine type		Model year	HC + NOx[a] (g/KW-hr) P ≤ 4.3 kW[b]	HC + NOx[a] (g/KW-hr) P > 4.3 kW[b]	CO[c] (g/KW-hr) P ≤ 4.3 kW[b]	CO[c] (g/KW-hr) P > 4.3 kW[b]	Useful life (hours/years)[d]
Federal[e]	Personal watercraft & outboard marine engines		1998	278 ABT	(0.917 x (151 + 557/$P^{0.9}$ + 2.44) [ABT]	--	--	350 / 5
			1999	253 ABT	(0.833 x (151 + 557/$P^{0.9}$ + 2.89) [ABT]	--	--	
			2000	228 ABT	(0.750 x (151 + 557/$P^{0.9}$) + 3.33 [ABT]	--	--	
			2001	204 ABT	(0.667 x (151 + 557/$P^{0.9}$) + 3.78 [ABT]	--	--	
			2002	179 ABT	(0.583 x (151 + 557/$P^{0.9}$) + 4.22 [ABT]	--	--	
			2003	155 ABT	(0.500 x (151 + 557/$P^{0.9}$) + 4.67 [ABT]	--	--	
			2004	130 ABT	(0.417 x (151 + 557/$P^{0.9}$) + 5.11 [ABT]	--	--	
			2005	105 ABT	(0.333 x (151 + 557/$P^{0.9}$) + 5.56 [ABT]	--	--	
			2006-2009	81 ABT	(0.250 x (151 + 557/$P^{0.9}$) + 6.00 [ABT]	--	--	
			2010 +[g]	30 ABT [ABT]	2.1 + 0.09 x (151 + 557/$P^{0.9}$) [ABT]	500 - 5.0 x P	300	Personal Watercraft: 350 / 5[h] Outboard: 350 / 10[h]
	Sterndrive/ inboard engines	Conventional engines[g]	2010 +	5.0 [ABT]		75 [ABT]		480 / 10[i]
		High-performance engines		P ≤ kW[b]	P > 485 kW[b]	350		P ≤ 485 kW: 150 / 3 P > 485 kW: 50 / 1
			2010	20.0	25.0			
			2011+	16.0	22.0			

Sources:
40 CFR 91.104 = Outboard and personal watercraft (PWC) exhaust emission standards (1998-2009)
40 CFR 91.105 = Outboard and PWC useful life (1998-2009)
40 CFR 1045.103 = Outboard and PWC exhaust emission standards (2010+)
40 CFR 1045.105 = Sterndrive/Inboard exhaust emission standards
40 CFR 1045.107 = Not-to-exceed exhaust emission standards (Additional resources: www.epa.gov/otaq/standards)

[a] The numerical emission standards for hydrocarbons (HC) must be met based on the following types of HC emissions for engines powered by the following fuels: (1) total hydrocarbon equivalent for alcohol; (2) non-methane hydrocarbon for natural gas; and (3) total hydrocarbons for other fuels.

Table 12.26 (continued)
Marine Spark-Ignition Engines and Vessels – Exhaust Emission Standards

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[b] P stands for the maximum engine power in kilowatts.

[c] Manufacturers may generate or use emission credits for averaging, but not for banking or trading.

[d] Useful life and warranty period are expressed hours or years of operation (unless otherwise indicated), whichever comes first.

[e] The test procedure for federal standards uses the International Organization for Standardization (ISO) 8178 E4 5-Mode Steady-State Test Cycle.

[f] Also applies to model year (MY) 1997 engine families certified pursuant to 40 Code of Federal Regulations (CFR) 91.205.

[g] Not-to-exceed emission standards specified in 40 CFR 1045.107 also apply.

[h] A longer useful life in terms of hours must be specified for the engine family if the average service life is longer than the minimum value as described in 40 CFR 1045.103(e)(3).

[i] The useful life may not be shorter than: (1) 150 hours of operation; (2) the recommended overhaul interval; or (3) the engine's mechanical warranty. A longer useful life must be specified in terms of hours if the average service life is longer than the minimum value as described in 40 CFR 1045.105(e)(3).

These standards apply to land-based recreational vehicles, such as snowmobiles, dirt bikes, all-terrain vehicles and go-karts.

Table 12.27
Nonroad Recreational Engines and Vehicles – Exhaust Emission Standards

	Vehicle	Phase	Year	HC[a] g/kW-hr	HC + NOx g/km	CO g/kW-hr	CO g/km	Minimum useful life (hours/years/km)[b]
Federal	Snowmobiles[c]	1[d]	2006+	100 [ABT]	-	275 [ABT]	-	400 / 5 / 8,000
		2	2010-2011	75 [ABT]	-	275 [ABT]	-	
		3[e]	2012+	150 [f] [ABT]	-	400 [f] [ABT]	-	
	Off-highway motorcycles[g]	1[d]	2006+	-	2.0[h, i] [ABT]	-	25[h, i] [ABT]	> 70 cc Displacement: - / 5 / 10,000 ≤ 70 cc Displacement: - / 5 / 5,000
	ATVs[g]	1[d]	2006+	-	1.5[j, k] [ABT]	-	35[k] [ABT]	≥ 100 cc Displacement: 1000 / 5 / 10,000 < 100 cc Displacement: 500 / 5 / 5,000

Sources:
40 CFR 1051.101-115 = Emission standards (Additional resources: www.epa.gov/otaq/standards)

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[a] The numerical emission standards for hydrocarbons (HC) must be met based on the following types of hydrocarbon emissions for recreational engines and vehicles powered by the following fuels: (1) non-methane hydrocarbons for natural gas; (2) total hydrocarbon equivalent for alcohol; and (3) total hydrocarbons for other fuels.

[b] Useful life is expressed in hours, years, or kilometers, whichever comes first; warranty period is expressed in hours, months, or kilometers (km), whichever comes first. Nonroad recreational engines and vehicles must meet emission standards over their full useful life. A longer useful life in terms of km and hours must be specified for the engine family if the average service life is longer than the minimum value as described in 40 Code of Federal Regulations (CFR) 1051 Subpart B.

[c] Test procedures for snowmobiles use the equipment and procedures for spark-ignition engines in 40 CFR Part 1065.

[d] Phase 1 standards will be phased in: 50 percent by 2006, 100 percent by 2007.

[e] Litigation on the November 2002 final rule resulted in a court decision that requires EPA to clarify the evidence and analysis upon which the Phase 3 carbon monoxide (CO) and HC standards were based. EPA will address this in a future rulemaking.

[f] These are the maximum allowable family emission limits (FEL). The HC and CO standards are defined by a functional relationship as described in 40 CFR 1051.103(a)(2).

[g] For off-highway motorcycles and ATVs, chassis dynamometer emissions test procedures are specified in 40 CFR Part 86, Subpart F and engine dynamometer emissions test procedures are specified in 40 CFR Part 1065.

[h] Maximum allowable FEL: 20.0 grams per kilometer (g/km) for HC plus nitrogen oxides (NOx) and 50 g/km for CO.

Table 12.27 (continued)
Nonroad Recreational Engines and Vehicles – Exhaust Emission Standards

[i] Manufacturers may certify off-highway motorcycles with engines that have total displacement of 70 cubic centimeters (cc) or less to an HC+NOx standard of 16.1 grams per kilowatt-hour (g/kW-hr) (with an FEL cap of 32.2 g/kW-hr) and a CO standard of 519 g/kW-hr.

[j] Maximum allowable FEL for HC+NOx is 20.0 g/km.

[k] Manufacturers may certify all-terrain vehicles with engines that have total displacement of less than 100 cc to an HC+NOx standard of 25.0 g/KW-hr (with an FEL cap of 40.0 g/kW-hr) and a CO standard of 500 g/kW-hr.

The latest standards were established by the Environmental Protection Agency in conjunction with the Tier 3 emission standards.

Table 12.28
Gasoline Sulfur Standards

	Regulated entity	Refinery average and per-gallon cap by year (ppm) 2004	2005	2006	2007	2008-2016	2017-2019	2020
Federal	Large refiners / importers[a]	120[b] / 300[c]	30 / 90[b] / 300	30 / 80	30 / 80	30 / 80	10 / 80	10 / 80
	GPA refiners [d, e]	150 / 300[c]	150 / 300	150 / 300	30 / 80	30 / 80	30 / 80	10 / 80
	Small refiners [f, g, h]	[k]	[k]	[k]	[k]	30 / 80	30 / 80	10 / 80
	Downstream standards [i, j]	378	326	95	95	95	95	95

Source:
40 CFR Part 80 Subpart H (Additional resources: www.epa.gov/otaq/standards)

[a] Standards effective January 1 at the refinery gate.

[b] No Refinery Average Standard applies in 2004; Corporate Average Standard applies in 2004 (120 ppm) and 2005 (90 ppm).

[c] Cap exceedances up to 50 ppm in 2004 must be made up in 2005.

[d] Geographic Phase-in Area (GPA) refiners must also comply with the corporate average standards in 2004 and 2005 if less than 50% of the refiner's gasoline is designated as GPA gasoline in a given compliance period.

[e] GPA refiners may receive an additional two years (i.e., through 2008) to comply with the 30 / 80 ppm gasoline sulfur standards in exchange for producing 95% of their highway diesel fuel at the 15 ppm sulfur standard by June 1, 2006.

[f] Small refiners may receive an additional two years (i.e., through 2009) to comply with the 30 / 80 ppm gasoline sulfur standards via a hardship demonstration.

[g] Small refiners may receive an additional three years (i.e., through 2010) to comply with the 30 / 80 ppm gasoline sulfur standards in exchange for producing 95% of their highway diesel fuel at the 15 ppm sulfur standard by June 1, 2006.

[h] Small refiners may receive a 20% increase in their annual average and per-gallon cap standards in exchange for producing 95% of their highway, nonroad, locomotive, and marine diesel fuel at the 15 ppm sulfur standard by June 1, 2006.

[i] Downstream standards are effective February 1 at any downstream location other than at a retail outlet or wholesale purchaser-consumer (e.g., pipelines and terminals) and March 1 at any downstream location.

[j] Downstream standards for gasoline that is not blended with small refiner gasoline are shown. Refer to the Code of Federal Regulations (CFR) for the downstream standards that apply when a gasoline blend includes small refiner gasoline.

[k]

1997-98 Refinery baseline sulfur level (ppm)	Small refiner interim gasoline sulfur standards (ppm) 2004 - 2007 Average	Cap
0 to 30	30	300
31 to 200	baseline level	300
201 to 400	200	300
401 to 600	50% of baseline	1.5 x avg. standard
601 and above	300	450

Ultra-low sulfur diesel (ULSD) fuel is necessary for new advanced emission control technologies. It also reduces particulate matter in the existing fleet of nonroad engines and equipment.

Table 12.29
Highway, Nonroad, Locomotive, and Marine (NRLM) Diesel Fuel Sulfur Standards

<table>
<tr><th rowspan="2"></th><th rowspan="2">Regulated entity</th><th rowspan="2">Covered fuel</th><th colspan="9">Per-gallon maximum sulfur level by year (ppm)</th></tr>
<tr><th>2006[a]</th><th>2007[b]</th><th>2008</th><th>2009</th><th>2010[c,d]</th><th>2011</th><th>2012</th><th>2013</th><th>2014</th></tr>
<tr><td rowspan="8">Federal</td><td>Large refiners & importers</td><td>Highway</td><td colspan="4">80% 15
20% 500</td><td colspan="5" rowspan="2">15</td></tr>
<tr><td>Small refiners</td><td>Highway</td><td colspan="4">500</td></tr>
<tr><td rowspan="3">Large refiners & importers</td><td>NR</td><td>-</td><td>500</td><td>500</td><td>500</td><td>15</td><td>15</td><td>15</td><td>15</td><td>15</td></tr>
<tr><td>LM</td><td>-</td><td>500</td><td>500</td><td>500</td><td>500</td><td>500</td><td>15</td><td>15</td><td>15</td></tr>
<tr><td>NRLM with credits[e]</td><td>-</td><td>HS</td><td>HS</td><td>HS</td><td>500</td><td>500</td><td>500</td><td>500</td><td>15</td></tr>
<tr><td>Small refiners</td><td>NRLM[f]</td><td>-</td><td>HS</td><td>HS</td><td>HS</td><td>500</td><td>500</td><td>500</td><td>500</td><td>15</td></tr>
<tr><td rowspan="2">Transmix processor & in-use</td><td>NR[e]</td><td>-</td><td>HS</td><td>HS</td><td>HS</td><td>500</td><td>500</td><td>500</td><td>500</td><td>15</td></tr>
<tr><td>LM[e]</td><td>-</td><td>HS</td><td>HS</td><td>HS</td><td>500</td><td>500</td><td>500</td><td>500</td><td>500</td></tr>
</table>

Source:
40 CFR Part 80 Subpart I (Additional resources: www.epa.gov/otaq/standards)

[a] For highway diesel fuel, standards are effective June 1 for refiners/importers, September 1 for pipelines and terminals, and October 15 for retailers and wholesale purchaser-consumers. Anti-downgrading provisions effective October 16, 2006.

[b] For Nonroad, Locomotive, and Marine (NRLM) diesel fuel, standards are effective June 1 for refiners; downstream requirements apply for Northeast/Mid-Atlantic area only (August 1 for terminals, October 1 for retailers and wholesale purchaser-consumers, and December 1 for in-use).

[c] For highway diesel fuel, standards are effective June 1 for refiners/importers, October 1 for pipelines and terminals, and December 1 for retailers and wholesale purchaser-consumers.

[d] For NRLM diesel fuel, standards are effective June 1 for refiners, August 1 for terminals, October 1 for retailers and wholesale purchaser-consumers, and December 1 for in-use.

[e] Excluding the Northeast and Alaska.

[f] Excluding the Northeast, with approval in Alaska.

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.

Contents of Appendix A

List of Abbreviations Used in Appendix A

AAR	Association of American Railroads
APTA	American Public Transportation Association
Amtrak	National Railroad Passenger Corporation
BTS	Bureau of Transportation Statistics
Btu	British thermal unit
CD	Compact Disc
CNG	Compressed Natural Gas
DOE	Department of Energy
DOT	Department of Transportation
EIA	Energy Information Administration
EPA	Environmental Protection Agency
FAA	Federal Aviation Administration
FHWA	Federal Highway Administration
kWhr	Kilowatt hour
lpg	liquefied petroleum gas
NHTS	National Household Travel Survey
NPTS	Nationwide Personal Transportation Survey
NVPP	National Vehicle Population Profile
ORNL	Oak Ridge National Laboratory
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

Cars

Fuel use in gallons (1970-2008) – DOT, FHWA, *Highway Statistics 2008*, Table VM-1 and annual editions back to 1996; DOT, FHWA, *Highway Statistics Summary* to 1995.
Fuel use in gallons (2009 – 2013) – See Appendix A for Car/Light Truck Shares.
Fuel type distribution – Fuel use was distributed among fuel types using the percentages shown in Table A.1. The FHWA discontinued gasohol data in 2005. Therefore, data from EIA, *Alternatives to Traditional Transportation Fuels*, 2006-2011, Table C1 were used.

Table A.1
Car 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[b] Gasoline	Gasohol	Diesel
1970	67,820		1984 NVPP	99.8%	0.0%	0.2%
1971	71,346		interpolated	99.2%	0.0%	0.8%
1972	75,937		interpolated	98.7%	0.0%	1.3%
1973	78,233		interpolated	98.1%	0.0%	1.9%
1974	74,229		interpolated	97.5%	0.0%	2.5%
1975	74,140		interpolated	97.0%	0.0%	3.0%
1976	78,297		interpolated	96.4%	0.0%	3.6%
1977	79,060		interpolated	95.8%	0.0%	4.2%
1978	80,652		interpolated	95.3%	0.0%	4.7%
1979	76,588		1979 RTECS	94.7%	0.0%	5.3%
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	74,377	EIA, C1	2001 NVPP	72.9%	26.6%	0.5%
2008	71,497 [a]	EIA, C1	2001 NVPP	61.8%	37.7%	0.5%
2009	66,587	EIA, C1	2001 NVPP	55.8%	43.7%	0.5%
2010	62,245	EIA, C1	2001 NVPP	49.5%	50.0%	0.5%
2011	59,646	EIA, C1	2001 NVPP	48.7%	50.8%	0.5%
2012	57,899	EIA, C1	2001 NVPP	48.7%	50.8%	0.5%
2013	57,290	EIA, C1	2001 NVPP	49.0%	50.5%	0.5%
	Heat content used for conversion to btu:			125,000 btu/gallon	120,900 btu/gallon	138,700 btu/gallon

[a] Data are not continuous between 2008 and 2009 due to changes in source.
[b] Percentages may not sum due to rounding.

Motorcycles

DOT, FHWA, *Highway Statistics 2013*, Table VM-1, and annual editions. The FHWA made methodology changes for *Highway Statistics 2009-10*. At that time, they published historical data back to 2007 which do not match the previous data.

Table A.2
Motorcycle Fuel Use

Year	Fuel use (thousand gallons)	Year	Fuel use (thousand gallons)
1970	59,580	1992	191,140
1971	72,140	1993	198,120
1972	86,620	1994	204,800
1973	103,880	1995	198,262
1974	108,900	1996	195,940
1975	112,580	1997	201,620
1976	120,060	1998	205,660
1977	126,980	1999	211,680
1978	143,160	2000	209,380
1979	172,740	2001	192,780
1980	204,280	2002	191,040
1981	213,800	2003	190,780
1982	198,200	2004	202,447
1983	175,200	2005	189,495
1984	175,680	2006	221,030 [a]
1985	181,720	2007	474,923
1986	187,940	2008	489,417
1987	190,120	2009	482,290
1988	200,480	2010	426,732
1989	207,420	2011	426,378
1990	191,140	2012	491,130
1991	183,560	2013	467,716
Heat content used for conversion to btu:		125,000 btu/gallon	

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

Buses

Transit:

APTA, *2015 Public Transportation Fact Book*, Washington, DC, 2015. 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 (thousand kilowatt hours)	Biodiesel (million gallons)	Methanol (million gallons)
1994	1.1	0.2	3.1	2.1	565.1	102.9	[a]	12.5
1995	1.7	0.3	10.0	2.3	563.8	100.0	[a]	12.0
1996	2.3	0.6	11.5	1.8	577.7	69.0	[a]	11.6
1997	3.3	1.0	20.0	2.7	597.6	78.0	[a]	8.7
1998	3.1	0.9	32.6	2.0	606.6	74.0	[a]	5.0
1999	5.3	0.8	39.9	1.4	618.0	75.0	[a]	2.7
2000	10.5	0.7	50.4	1.3	635.2	77.0	[a]	0.8
2001	11.7	1.2	60.9	1.5	587.2	74.0	[a]	0.8
2002	16.8	1.8	77.8	1.3	559.0	73.0	[a]	1.8
2003	14.2	1.8	94.9	1.1	536.0	69.0	[a]	1.9
2004	16.5	1.7	106.7	1.8	550.5	68.0	[a]	4.7
2005	18.3	2.0	117.2	1.0	533.8	67.0	[a]	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
2008	17.9	[a]	135.5	3.8	493.3	62.2	41.8	0.9
2009	25.5	[a]	141.6	6.7	455.5	69.5	40.6	0.0
2010	23.0	[a]	126.2	8.1	435.4	66.0	43.5	0.0
2011	21.6	[a]	131.1	8.9	455.1	61.0	51.1	0.0
2012	19.6	[a]	127.3	12.5	439.0	61.0	56.6	0.0
2013	17.6	6.3	134.9	12.9	427.5	63.0	66.2	0.0
Heat content used for conversion to btu:	84,800 btu/gallon	91,300 btu/gallon	138,700 btu/gallon	125,000 btu/gallon	138,700 btu/gallon	64,600 btu/gallon		10,339 but/kWhr

Note: CNG is reported in diesel-gallon equivalents.

[a] Data are not available.

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	214.37*	530.70*
2008	218.48*	540.89*
2009	224.58*	556.00*
2010	214.95*	532.15*
2011	215.53*	533.58*
2012	230.42	570.45
2013	236.76	586.14
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 (recently revised).

Trucks

Light Trucks:

Fuel use in gallons (1970-2007) – DOT, FHWA, *Highway Statistics 2008*, Table VM-1 and annual editions back to 1996 and DOT, FHWA, *Highway Statistics Summary to 1995.*

Fuel use in gallons (2008 – 2013) – Results of a model developed by ORNL to estimate data for cars and light trucks since the FHWA discontinued their VM-1 series showing cars and light trucks separately. The model uses data from FHWA *Highway Statistics 2013*, EPA *Light-Duty Automotive Technology, Carbon Dioxide Emissions, and Fuel Economy Trends: 1975 Through 2014*, and HIS Automotive to estimate the number of vehicles, vehicle-miles of travel, energy use, and fuel efficiency of cars and light trucks. Documentation of the model will be published in an ORNL report, forthcoming.

Fuel type distribution – Fuel use was distributed among fuel types using the percentages shown in Table A.1. The FHWA discontinued gasohol data in 2005. Therefore, data from EIA, *Alternatives to Traditional Transportation Fuels*, 2006-2011, Table C.1 were used.

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%
1971	13,484		1977 TIUS	97.6%	0.0%	1.6%	0.8%
1972	15,150		1977 TIUS	97.6%	0.0%	1.6%	0.8%
1973	16,828		1977 TIUS	97.6%	0.0%	1.6%	0.8%
1974	16,657		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	61,836	EIA, C1	2002 VIUS	68.6%	26.6%	4.0%	0.8%
2008	61,199 [a]	EIA, C1	2002 VIUS	57.5%	37.7%	4.0%	0.8%
2009	61,824	EIA, C1	2002 VIUS	51.5%	43.7%	4.0%	0.8%
2010	64,687	EIA, C1	2002 VIUS	45.2%	50.0%	4.0%	0.8%
2011	65,786	EIA, C1	2002 VIUS	44.4%	50.8%	4.0%	0.8%
2012	66,395	EIA, C1	2002 VIUS	44.4%	50.8%	4.0%	0.8%
2013	65,555	EIA, C1	2002 VIUS	44.7%	50.5%	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

[a] Data are not continuous between 2008 and 2009 due to changes in source.

Medium/Heavy Trucks:

DOT, FHWA, *Highway Statistics 2013*, Table VM-1 and annual editions back to 1996 and DOT, FHWA, *Highway Statistics Summary to 1995*. The FHWA made methodology changes for *Highway Statistics 2009*. At that time, they published historical data back to 2007 which do not match the previous data. Total gallons for medium/heavy trucks are the sum of single-unit trucks and combination 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 fuel type shares	Shares by fuel type Gasoline	Diesel	Lpg
1970	11,316	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 [a]	2002 VIUS	11.0%	88.4%	0.5%
2007	47,218	2002 VIUS	11.0%	88.4%	0.5%
2008	47,705	2002 VIUS	11.0%	88.4%	0.5%
2009	44,303	2002 VIUS	11.0%	88.4%	0.5%
2010	45,024	2002 VIUS	11.0%	88.4%	0.5%
2011	42,396	2002 VIUS	11.0%	88.4%	0.5%
2012	42,351	2002 VIUS	11.0%	88.4%	0.5%
2013	43,297	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

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

Shares of Class 3-6 and 7-8 energy use by fuel type were calculated from the 2002 Vehicle Inventory and Use Survey (VIUS) and applied to all years 1970-2012.

Table A.7
Share of Medium and Heavy Truck Energy Use

	Share of energy use		
Fuel type	Class 3-6	Class 7-8	Total
Gasoline	92%	8%	100%
Diesel	14%	86%	100%
LPG	99%	1%	100%

Off-highway energy use

U.S. Environmental Protection Agency, NONROAD2008a model, results generated July 2015. Gallons of fuel by fuel type were produced for agricultural equipment, airport equipment, construction and mining equipment, industrial equipment, lawn and garden equipment, logging equipment, railroad maintenance equipment, and recreational equipment. Some non-transportation-related equipment, such as generators, chain saws, compressors, and pumps, were excluded from the data.

Nonhighway energy use

Air

General Aviation:

DOT, FAA, *On-line General Aviation Activity and Air Taxi Activity Surveys: Annual Summary Report Calendar Year 2013*, Table 5.1, and annual. 2011 Data: *Aviation Forecasts*, Tables 28 and 29, May 2013. (Additional resources: www.faa.gov/data_research/aviation_data_statistics/)

Table A.8
General Aviation Fuel Use

Year	Jet fuel (million gallons)	Aviation gasoline (million gallons)	Year	Jet fuel (million gallons)	Aviation gasoline (million gallons)
1970	208.0	551.0	1992	496.0	306.0
1971	226.0	508.0	1993	454.1	268.4
1972	245.0	584.0	1994	470.8	264.1
1973	304.0	411.0	1995	544.0	276.0
1974	357.0	443.0	1996	567.5	286.5
1975	453.0	412.0	1997	639.4	289.7
1976	495.0	432.0	1998	814.6	311.4
1977	536.0	456.0	1999	967.2	345.4
1978	763.0	518.0	2000	998.1	336.3
1979	736.0	570.0	2001	938.7	319.3
1980	766.0	520.0	2002	815.5	261.4
1981	759.0	489.0	2003	820.0	255.5
1982	887.0	448.0	2004	1,075.2	256.1
1983	613.0	428.0	2005	1,507.4	323.6
1984	738.9	462.4	2006	1,636.3	294.7
1985	691.0	421.0	2007	1,516.3	314.8
1986	732.1	408.6	2008	1,688.6	306.3
1987	672.7	401.8	2009	1,350.6	226.6
1988	746.0	398.0	2010	1,451.5	210.3
1989	688.0	342.8	2011	1,490.7	215.5
1990	662.0	353.0	2012	1,492.1	227.7
1991	579.0	348.0	2013	1,353.6	173.3
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.transtats.bts.gov/fuel.asp. 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.9
Air Carrier Fuel Use

Year	Domestic (thousand gallons)	International (thousand gallons)	Total (thousand gallons)
1970			10,085,000
1971			10,140,000
1972	Separate estimates for domestic		10,302,000
1973	and international are not available		10,671,000
1974	from 1970-1976.		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
2008	12,666,911	6,186,747	18,853,658
2009	11,339,220	5,721,298	17,060,517
2010	11,256,900	6,041,500	17,288,400
2011	11,035,400	6,522,600	17,558,000
2012	10,439,700	6,506,300	16,946,000
2013	10,337,000	6,487,300	16,824,300
Heat content used for conversion to btu:	135,000 btu/gallon	135,000 btu/gallon	135,000 btu/gallon

Water

Freight:

Total – DOE, EIA, *Petroleum and Other Liquids Database*, June 2015. 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.10
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
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	1,692,045	5,688,931
1985	1,894,265	5,269,733
1986	2,034,215	5,690,250
1987	2,223,258	5,869,154
1988	2,310,367	6,025,511
1989	2,356,444	6,621,100
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	2,206,690	6,000,434
2007	2,158,930	6,773,950
2008	1,980,729	6,274,047
2009	2,138,690	5,331,657
2010	2,427,051	6,032,367
2011	2,651,859	5,207,886
2012	1,842,107	4,560,546
2013	1,655,258	3,876,795
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 NONROAD2008A model.

Table A.11
Recreational Boating Fuel Use

Year	Diesel use (gallons)	Gasoline use (gallons)
1970	39,589,953	1,213,397,311
1971	47,130,906	1,220,995,448
1972	54,671,856	1,228,593,572
1973	62,212,803	1,236,191,635
1974	69,753,735	1,243,789,752
1975	77,294,680	1,251,387,972
1976	84,835,632	1,258,986,070
1977	92,376,573	1,266,584,111
1978	99,917,523	1,274,182,341
1979	107,458,470	1,281,780,460
1980	114,999,421	1,289,378,532
1981	122,540,357	1,296,976,672
1982	130,081,302	1,304,574,832
1983	137,622,248	1,312,172,890
1984	145,163,202	1,319,771,007
1985	152,704,140	1,327,369,146
1986	160,245,074	1,334,967,322
1987	167,786,030	1,342,565,455
1988	175,326,970	1,362,856,034
1989	182,867,916	1,383,146,636
1990	190,408,869	1,403,437,194
1991	197,949,808	1,429,688,292
1992	205,490,749	1,455,939,504
1993	213,031,707	1,482,190,597
1994	220,572,649	1,539,794,180
1995	228,113,596	1,597,269,921
1996	235,654,521	1,654,446,069
1997	243,195,481	1,657,737,628
1998	250,736,414	1,659,056,085
1999	258,159,525	1,657,198,161
2000	265,582,657	1,652,906,973
2001	273,547,835	1,655,303,922
2002	281,512,965	1,653,583,696
2003	289,478,093	1,648,070,959
2004	297,443,197	1,639,713,127
2005	305,408,463	1,629,873,278
2006	313,420,594	1,619,603,593
2007	321,432,801	1,609,567,873
2008	329,445,068	1,599,830,522
2009	337,457,287	1,590,749,216
2010	345,469,668	1,578,405,558
2011	353,434,754	1,566,937,275
2012	361,399,927	1,557,381,573
2013	369,365,038	1,550,075,141
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 2013*, Table 1. Cubic feet were converted to Btu using 1,031 Btu/ft3. 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 horsepower 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.12
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	621,364	2,816.0	212.1
2008	647,956	2,936.6	212.1
2009	670,174	3,037.2	212.1
2010	674,124	3,055.1	212.1
2011	687,784	3,117.0	212.1
2012	730,790	3,312.0	212.1
2013	861,583	3,904.7	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*, 2014 Edition, Washington, DC, 2014.

Table A.13
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
2008	3,911,178
2009	3,220,059
2010	3,519,021
2011	3,710,485
2012	3,634,025
2013	3,712,582
Heat content used for conversion to btu:	138,700 Btu/gallon

Passenger:

Commuter - APTA, *2015 Public Transportation Fact Book*, Washington, DC, 2015.

Table A.14
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
2008	83,500	1,718
2009	95,000	1,780
2010	93,200	1,797
2011	93,900	1,813
2012	92,800	1,808
2013	98,700	1,816
Heat content used for conversion to btu:	138,700 Btu/gallon	10,339 Btu/kWhr

Transit – APTA, *2015 Public Transportation Fact Book,* Washington, DC, 2015.
Includes light rail and heavy rail.

Table A.15
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	363	3,253	3,616
1998	382	3,280	3,662
1999	416	3,385	3,801
2000	563	3,549	4,112
2001	587	3,646	4,233
2002	510	3,683	4,193
2003	507	3,632	4,138
2004	553	3,684	4,237
2005	571	3,769	4,339
2006	634	3,709	4,343
2007	687	3,817	4,505
2008	721	3,898	4,619
2009	738	3,866	4,624
2010	749	3,780	4,529
2011	789	3,854	4,643
2012	806	3,795	4,601
2013	882	3,856	4,738
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, 2014.

Table A.16
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
2008	63,428	582,022
2009	61,704	564,968
2010	63,474	558,662
2011	63,450	555,425
2012	63,058	549,201
2013	66,036	525,127
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 2.5
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

Cars

Number of vehicles – DOT, FHWA, *Highway Statistics 2013,* Table MV-1 and annual editions back to 2009.
Vehicle-miles – See Appendix A "Car and Light Truck Shares" section.
Passenger-miles – Vehicle-miles multiplied by an average load factor.
Load factor – 2009 NHTS shows car load factor as 1.55 persons per vehicle.
Energy intensities –
***Btu per vehicle-mile* –** Car energy use divided by vehicle-miles.
***Btu per passenger-mile* –** Car energy use divided by passenger-miles.
Energy use – See Energy Use Sources, p. A-5. Data series shown in Table 2.9.

Light Trucks

Number of vehicles – DOT, FHWA, *Highway Statistics 2013*, Table MV-9 and annual editions back to 2009. Columns for pickups, vans, sport utility vehicles, and other light trucks.
Vehicle-miles – See Appendix A "Car and Light Truck Shares" section.
Passenger-miles – Vehicle-miles multiplied by an average load factor.
Load factor – 2009 NHTS shows personal light truck load factor as 1.84 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-10 and A-12 (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.17) which were derived by ORNL from the 2002 VIUS Micro Data File on CD.

Table A.17
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 2013.

Motorcycles

Number of vehicles, vehicle-miles – DOT, FHWA, *Highway Statistics 2013*, Table VM-1.
Passenger-miles – Vehicle-miles multiplied by an average load factor.
Load factor - 2009 NHTS shows motorcycle load factor as 1.16 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-7. Data series shown in Table 2.9.

Demand Response

Number of vehicles, vehicle-miles, passenger-miles – APTA, *2015 Public Transportation Fact Book*, Washington, DC, 2015.
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, *2015 Public Transportation Fact Book*, Washington, DC, 2015.

Buses

Transit

Number of vehicles, vehicle-miles, passenger-miles – APTA, *2015 Public Transportation Fact Book*, Washington, DC, 2015. Data series shown on Table 5.18.
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-8. Data series shown in Table 5.18.

Intercity

Energy use – See Energy Use Sources, p. A-9. Because the data past 2000 are not available, the rate of change in bus VMT from FHWA, *Highway Statistics 2013*, was used to estimate the change in energy use.

School

Number of vehicles – DOT, FHWA, *Highway Statistics 2013*, Table MV-10.
Energy use – See Energy Use Sources, p. A-9. Because the data past 2000 are not available, the rate of change in bus VMT from FHWA, *Highway Statistics 2013*, was used to estimate the change in energy use.

Air

Certificated air carriers

Aircraft-miles, passenger-miles – DOT, BTS, U.S. Air Traffic Statistics Through June 2015, www.transtats.bts.gov, 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-15. 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 and Air Taxi Activity Surveys - CY 2013*. 2011 Data: *Aviation Forecasts*, Tables 28 and 29, May 2013. 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-14. Data series shown in Table 9.3.

Recreational boating

Number of vehicles and energy use – U.S. EPA, NONROAD2008a model.

Rail

Intercity

Number of vehicles, vehicle-miles, passenger-miles – AAR, *Railroad Facts, 2014 Edition*, Washington, DC, 2014.
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-23. Data series shown in Table 9.10.

Transit

Number of vehicles, vehicle-miles, passenger-miles – APTA, *2015 Public Transportation Fact Book*, Washington, DC, 2015. 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-22. Data series shown in Table 9.12.

Commuter

Number of vehicles, vehicle-miles, passenger-miles – APTA, *2015 Public Transportation Fact Book*, Washington, DC, 2015. 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-21. Data series shown in Table 9.11.

Highway Passenger Mode Energy Intensities

Cars

Btu per vehicle-mile – Car energy use divided by car vehicle miles of travel.

Energy use – See Energy Use Sources, p. A-5. Data series shown in Table 2.9.

Vehicle-miles – 1970-2008: DOT, FHWA, *Highway Statistics 2008*, Table VM-1 and annual editions back to 1996 and DOT, FHWA, *Highway Statistics Summary to 1995*. Data series shown in Table 4.1.

2009-2012: See Appendix A for Car/Light Truck Shares.

Btu per passenger-mile – Car energy use divided by car passenger-miles.

Energy use – See Energy Use Sources, p. A-5. Data series shown in Table 2.9.

Passenger miles – Vehicle miles multiplied by an average load factor.

Vehicle-miles – DOT, FHWA, *Highway Statistics 2009*, Table VM-1 and annual editions back to 1996 and DOT, FHWA, *Highway Statistics Summary to 1995*. Data series shown in Table 4.1.

Load factor – NPTS 1969, 1977, 1983/84, 1990, and 1995; NHTS 2001 and 2009. Data series shown in Table A.18.

Table A.18
Car 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
2008	2009 NHTS	1.55
2009	2009 NHTS	1.55
2010	2009 NHTS	1.55
2011	2009 NHTS	1.55
2012	2009 NHTS	1.55
2013	2009 NHTS	1.55

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-10. Data series shown in Table 2.9.
Vehicle-miles – 1970-2008: DOT, FHWA, *Highway Statistics 2008*, Table VM-1 and annual editions back to 1996 and DOT, FHWA, *Highway Statistics Summary to 1995*. Data series shown in Table 4.2. 2009-2012: See Appendix A for Car/Light Truck Shares.

Buses

Transit

Btu per vehicle-mile – Transit bus energy use divided by transit bus vehicle-miles.
Energy use – See Energy Use Sources, p. A-8. Data series shown in Table 5.18.
Vehicle-miles – APTA, *2015 Public Transportation Fact Book*, Washington, DC, 2015. Data series shown on Table 5.18.

Btu per passenger-mile – Transit bus energy use divided by transit bus passenger-miles.
Energy use – See Energy Use Sources, p. A-8. Data series shown in Table 5.18.
Passenger-miles – APTA, *2015 Public Transportation Fact Book*, Washington, DC, 2015. Data series shown on Table 5.18.

Intercity

Btu per passenger-mile – Data are not available.
Energy use – See Energy Use Sources, p. A-9. Because the data past 2000 are not available, the rate of change in bus VMT from FHWA, *Highway Statistics 2013*, was used to estimate the change in energy use.
Passenger-miles – Data are not available.

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-15. 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*, Washington, DC, www.transtats.bts.gov. 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 – Data are not available.
Energy use – See Energy Use Sources, p. A-14. Data series shown in Table 9.3.
Passenger-miles – Data are not available.

Rail

Intercity

Btu per passenger-mile – Intercity rail energy use divided by passenger-miles.
Energy use – See Energy Use Sources, p. A-23. Data series shown in Table 9.10.
Passenger-miles – AAR, *Railroad Facts, 2014 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-22. Data series shown in Table 9.12.
Passenger-miles – APTA, *2015 Public Transportation Fact Book*, Washington, DC, 2015. 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-21. Data series shown in Table 9.11.
Passenger-miles – APTA, *2015 Public Transportation Fact Book*, Washington, DC, 2015. Data series shown on Table 9.11.

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-12.
Vehicle-miles – DOT, FHWA, *Highway Statistics 2013*, Table VM-1 and annual editions back to 1996 and 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-20. Data series shown in Table 9.8.
Freight car miles – AAR, *Railroad Facts, 2014 Edition*, Washington, DC, 2014. 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-20. Data series shown in Table 9.8.
Ton-miles – AAR, *Railroad Facts, 2014 Edition*, Washington, DC, 2014. Data series shown in Table 9.8.

Water

Btu per ton-mile – Domestic waterborne commerce energy use on taxable waterways divided by ton-miles on taxable waterways.
Energy use – Modeled by Chrisman A. Dager, University of Tennessee, Knoxville, using Waterborne Commerce Statistics Center detail records and annual IRS reports on the Inland Waterway Trust Fund tax on diesel fuel used on the inland waterway.
Ton-miles – Based on detailed records from the U.S. Department of the Army, Army Corps of Engineers, Waterborne Commerce Statistics Center. Includes only ton-miles on taxable waterways.

Car and Light Truck Shares

In 2011, the Federal Highway Administration (FHWA) changed the methodology for producing the data on the VM-1 Table in the annual *Highway Statistics* publication. Historically, VM-1 included individual categories for passenger cars and 2-axle, 4-tire trucks. VM-1 included the vehicle miles of travel (VMT), registrations, fuel use, and fuel economy of passenger cars and 2-axle, 4-tire trucks. After the methodology change, the categories of light vehicles on VM-1 changed to Light-Duty Vehicles with Short wheelbase (less than or equal to 121 inches) and Light-Duty Vehicles with Long Wheelbase (over 121 inches). As some passenger cars have long wheelbases and some 2-axle, 4-tire trucks have short wheelbases, the categories of cars and 2-axle, 4-tire trucks are no longer available. Despite these changes, there are many transportation analysts who require information on cars and 2-axle, 4-tire trucks. Thus, a new methodology to estimate the data in these categories was developed for years 2009 through 2013.

Cars

Registrations – DOT, FHWA, *Highway Statistics 2013*, Table MV-1 and annual editions back to 2009.
Vehicle travel –

***Total for all light vehicles* –** DOT, FHWA, *Highway Statistics 2013*, Table VM-1 and annual editions back to 2009; sum of light-duty short wheelbase and light-duty long wheelbase VMT.

***Cars* –** Using historical shares of passenger cars/2-axle, 4-tire trucks from the *Highway Statistics*, the percent of light vehicle travel attributable to cars was estimated for 2009-2013, keeping in mind the economic conditions present in those years and the general trend in total light vehicle VMT. The estimated share was applied to total VMT as shown in Table A.19.

Table A.19
Estimated Car VMT

Year	Total Light Vehicle VMT (billions)	Share Attributable to Cars	Total Car VMT (billions)
2009	2,633.3	59.5%	1,566.8
2010	2,648.5	56.5%	1,496.4
2011	2,650.5	55.0%	1,457.8
2012	2,664.1	54.0%	1,438.6
2013	2,667.8	54.0%	1,459.4

Miles per Vehicle – Vehicle travel divided by registrations.
Fuel Use – Vehicle travel divided by fuel economy.
Fuel Economy – DOE, EIA, *Annual Energy Outlook 2015*, April 2015 and annual editions back to 2012.

2-axle, 4-tire Trucks

Registrations – DOT, FHWA, *Highway Statistics 2013*, Table MV-1 and annual editions back to 2009.
Vehicle travel –

***Total for all light vehicles* –** DOT, FHWA, *Highway Statistics 2013*, Table VM-1 and annual editions back to 2009; sum of light-duty short wheelbase and light-duty long wheelbase VMT.

***2-axle, 4-tire truck VMT* –** Using historical shares of passenger cars/2-axle, 4-tire trucks from the *Highway Statistics*, the percent of light vehicle travel attributable to cars was estimated for 2009-2013, keeping in mind the economic conditions present in those years and the general trend in total light vehicle VMT. The estimated share was applied to total VMT as shown in Table A.20.

Table A.20
Estimated 2-axle, 4-tire Truck VMT

Year	Total Light Vehicle VMT (billions)	Share Attributable to 2-axle, 4-tire Trucks	Total 2-axle, 4-tire Truck VMT (billions)
2009	2,633.2	40.5%	1,066.5
2010	2,648.5	43.5%	1,152.1
2011	2,650.5	45.0%	1,192.7
2012	2,664.1	46.0%	1,225.5
2013	2,667.8	46.0%	1,218.4

Miles per Vehicle – Vehicle travel divided by registrations.
Fuel Use – Vehicle travel divided by fuel economy.
Fuel Economy – DOE, EIA, *Annual Energy Outlook 2015,* April 2015 and annual editions back to 2012.

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 the 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.

The Transportation Energy Data Book has always used gross heating values for fuel conversion.

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	0.00882	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
Atmosphere	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)
E10	120,900 Btu/gal (gross) = 112,400 Btu/gal (net)
E15	119,000 Btu/gal (gross) = 109,400 Btu/gal (net)
Hydrogen	134,200 Btu/kg (gross) = 113,400 Btu/kg (net)
Low-sulfur diesel	138,700 Btu/gal (gross) = 128,700 Btu/gal (net)
Biodiesel	126,200 Btu/gal (gross) = 117,100 Btu/gal (net)
Methanol	64,600 Btu/gal (gross) = 56,600 Btu/gal (net)
Ethanol	84,600 Btu/gal (gross) = 75,700 Btu/gal (net)
E85	90,700 Btu/gal (gross) = 81,600 Btu/gal (net)
Aviation gasoline	120,200 Btu/gal (gross) = 112,000 Btu/gal (net)
Liquefied petroleum gas (LPG)	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)
Liquefied natural gas (LNG)	23,700 Btu/lb (gross) = 20,900 Btu/lb (net)
Compressed natural gas (CNG)	22,500 Btu/lb (gross) = 20,200 Btu/lb (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	
Production average	20.160 x 10^6 Btu/short ton
Consumption average	19.622 x 10^6 Btu/short ton

Note: Heat content values are approximate. Data are rounded to the nearest hundred.

Table B.5
Fuel Equivalents

1 million bbl crude oil/day	= 0.365 billion bbl crude oil/year
	= 2.117 quadrillion Btu/year
	= 107.889 million short tons coal/year
	= 97.877 million metric tons coal/year
	= 2.053 trillion ft^3 natural gas/year
	= 2,233 petajoules/year
1 billion bbl crude oil/year	= 2.740 million bbl crude oil/day
	= 5.800 quadrillion Btu/year
	= 295.587 million short tons coal/year
	= 268.156 million metric tons coal/year
	= 5.626 trillion ft^3 natural gas/year
	= 6,119 petajoules/year
1 quadrillion Btu/year	= 8.000 million gasoline gallon equivalents
	= 0.472 million bbl crude oil/day
	= 172.414 million bbl crude oil/year
	= 50.963 million short tons coal/year
	= 46.234 million metric tons coal/year
	= 969.932 billion ft^3 natural gas/year
	= 1,055 petajoules/year
1 billion short tons coal/year	= 0.907 billion metric tons coal/year
	= 9.269 million bbl crude oil/day
	= 3.383 billion bbl crude oil/year
	= 19.622 quadrillion Btu/year
	= 19.032 trillion ft^3 natural gas/year
	= 20,701 petajoules/year
1 billion metric tons coal/year	= 1.102 billion short tons coal/year
	= 8.409 million bbl crude oil/day
	= 3.069 billion bbl crude oil/year
	= 17.801 quadrillion btu/year
	= 17.266 trillion ft^3 natural gas/year
	= 18,780 petajoules/year
1 trillion ft^3 natural gas/year	= 0.487 million bbl crude oil/day
	= 0.178 billion bbl crude oil/year
	= 1.031 quadrillion Btu/year
	= 52.543 million short tons coal/year
	= 47.667 million metric tons coal/year
	= 1,088 petajoules/year
1 petajoule/year	= 447.741 bbl crude oil/day
	= 163.425 thousand bbl crude oil/year
	= 0.948 trillion Btu/year
	= 48.306 thousand short tons coal/year
	= 43.824 thousand metric tons coal/year
	= 0.919 billion 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:	Petajoules	Giga-calories	Million tonnes of oil equivalent	Million Btu	Gigawatt-hours
From:	*multiply by:*				
Petajoules	1	238.8×10^{3}	2.388×10^{-2}	947.8×10^{3}	277.8
Gigacalories	4.1868×10^{-6}	1	10^{-7}	3.968	1.163×10^{-3}
Million tonnes of oil equivalent	41.868	10^{7}	1	3.968×10^{7}	11,630
Million Btu	1.0551×10^{-6}	0.252	2.52×10^{-8}	1	2.931×10^{-4}
Gigawatthours	3.6×10^{-3}	860	8.6×10^{-5}	3412	1

Table B.8
Distance and Velocity Conversions

1 in.	= 83.33×10^{-3} ft	1 ft	= 12.0 in.
	= 27.78×10^{-3} yd		= 0.33 yd
	= 15.78×10^{-6} mile		= 189.4×10^{-3} mile
	= 25.40×10^{-3} m		= 0.3048 m
	= 0.2540×10^{-6} km		= 0.3048×10^{-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

FROM	TO 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	1,106	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
(Million metric tons carbon per quadrillion Btu)

	Fuel Type	
Coal		
	Anthractie	28.28
	Bituminous	25.45
	Subbituminous	26.51
	Lignite	26.65
	Coke	31.12
	Coal (All types)	26.00
Natural gas		
	Natural Gas	14.47
	Flared natural gas	14.92
	Propane	17.20
	Butane	17.71
	Butane/Propane Mix	17.46
Petroleum		
	Gasoline	19.45
	Diesel fuel	19.95
	Jet Fuel	19.34
	Aviation Gas	18.87
	Kerosene	19.72
	Residual Heating Fuel	21.49
	Petroleum coke	27.85
	Asphalt and Road Oil	20.62
	Lubricants	20.24
	Petrochemical Feedstocks	19.37
	Special Naphthas (solvents)	19.85
	Waxes	19.81
	Other petroleum & miscellaneous	19.81

Note: Additional information:
www.eia.gov/environment/emissions/co2_vol_mass.cfm

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 2010 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 Table 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
2009	0.181	0.189	0.195	0.207	0.230	0.251	0.265	0.282	0.304	0.338
2010	0.178	0.186	0.192	0.204	0.226	0.247	0.261	0.278	0.299	0.333
2011	0.172	0.180	0.186	0.197	0.219	0.239	0.253	0.269	0.290	0.323
2012	0.169	0.176	0.182	0.193	0.215	0.234	0.248	0.264	0.284	0.316
2013	0.167	0.174	0.179	0.191	0.212	0.231	0.244	0.260	0.280	0.312
2014	0.164	0.171	0.177	0.188	0.208	0.227	0.240	0.256	0.275	0.306

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
2009	0.384	0.424	0.450	0.464	0.484	0.502	0.511	0.530	0.551	0.578
2010	0.378	0.417	0.443	0.457	0.476	0.493	0.503	0.521	0.543	0.569
2011	0.366	0.404	0.429	0.443	0.462	0.478	0.487	0.505	0.526	0.551
2012	0.359	0.396	0.420	0.434	0.453	0.469	0.477	0.495	0.515	0.540
2013	0.354	0.390	0.414	0.428	0.446	0.462	0.470	0.488	0.508	0.532
2014	0.348	0.384	0.408	0.421	0.439	0.455	0.463	0.480	0.500	0.524

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
2009	0.602	0.635	0.654	0.674	0.691	0.710	0.731	0.748	0.760	0.777
2010	0.599	0.625	0.643	0.663	0.680	0.699	0.720	0.736	0.748	0.764
2011	0.581	0.605	0.624	0.642	0.659	0.678	0.698	0.714	0.725	0.741
2012	0.569	0.593	0.611	0.629	0.645	0.664	0.683	0.699	0.710	0.726
2013	0.561	0.585	0.602	0.620	0.636	0.654	0.674	0.689	0.700	0.715
2014	0.552	0.575	0.593	0.610	0.626	0.644	0.663	0.678	0.689	0.704

Table B.17
Consumer Price Inflation (CPI) Index (Continued)

From:	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
1970	4.438	4.564	4.637	4.742	4.869	5.034	5.196	5.344	5.549	5.529
1971	4.252	4.373	4.442	4.543	4.664	4.822	4.978	5.120	5.316	5.297
1972	4.120	4.237	4.304	4.402	4.519	4.672	4.823	4.960	5.151	5.132
1973	3.878	3.989	4.052	4.144	4.255	4.399	4.541	4.670	4.849	4.832
1974	3.493	3.592	3.649	3.732	3.832	3.961	4.089	4.206	4.367	4.352
1975	3.201	3.292	3.344	3.420	3.511	3.630	3.747	3.854	4.002	3.988
1976	3.026	3.112	3.162	3.234	3.320	3.432	3.543	3.644	3.784	3.770
1977	2.842	2.922	2.969	3.036	3.117	3.223	3.327	3.421	3.553	3.540
1978	2.641	2.716	2.759	2.822	2.897	2.995	3.092	3.180	3.302	3.290
1979	2.372	2.439	2.478	2.534	2.602	2.690	2.777	2.856	2.966	2.955
1980	2.090	2.149	2.183	2.233	2.292	2.370	2.447	2.516	2.613	2.604
1981	1.894	1.948	1.979	2.024	2.078	2.149	2.218	2.281	2.369	2.360
1982	1.784	1.835	1.864	1.907	1.958	2.024	2.089	2.149	2.231	2.223
1983	1.729	1.778	1.806	1.847	1.897	1.961	2.024	2.082	2.162	2.154
1984	1.657	1.705	1.731	1.771	1.818	1.880	1.940	1.996	2.072	2.065
1985	1.600	1.646	1.672	1.710	1.756	1.815	1.874	1.927	2.001	1.994
1986	1.571	1.616	1.641	1.679	1.724	1.782	1.839	1.892	1.964	1.957
1987	1.516	1.559	1.584	1.620	1.663	1.719	1.775	1.825	1.895	1.889
1988	1.456	1.497	1.521	1.555	1.597	1.651	1.704	1.753	1.820	1.813
1989	1.389	1.428	1.451	1.484	1.523	1.575	1.626	1.672	1.736	1.730
1990	1.318	1.355	1.376	1.408	1.445	1.494	1.542	1.586	1.647	1.641
1991	1.264	1.300	1.321	1.351	1.387	1.434	1.480	1.522	1.581	1.575
1992	1.227	1.262	1.282	1.311	1.346	1.392	1.437	1.478	1.535	1.529
1993	1.192	1.226	1.245	1.273	1.307	1.352	1.395	1.435	1.490	1.485
1994	1.162	1.195	1.214	1.242	1.275	1.318	1.360	1.399	1.453	1.448
1995	1.130	1.162	1.180	1.207	1.240	1.281	1.323	1.360	1.413	1.408
1996	1.098	1.129	1.147	1.173	1.204	1.245	1.285	1.321	1.372	1.367
1997	1.073	1.103	1.121	1.146	1.177	1.217	1.256	1.292	1.341	1.337
1998	1.056	1.087	1.104	1.129	1.159	1.198	1.237	1.272	1.321	1.316
1999	1.034	1.063	1.080	1.104	1.134	1.172	1.210	1.245	1.292	1.288
2000	1.000	1.028	1.045	1.069	1.097	1.134	1.171	1.204	1.250	1.246
2001	0.972	1.000	1.016	1.039	1.067	1.103	1.138	1.171	1.216	1.211
2002	0.957	0.984	1.000	1.023	1.050	1.086	1.121	1.153	1.197	1.193
2003	0.936	0.963	0.978	1.000	1.027	1.061	1.096	1.127	1.170	1.166
2004	0.912	0.938	0.952	0.974	1.000	1.034	1.067	1.098	1.140	1.136
2005	0.882	0.907	0.921	0.942	0.967	1.000	1.032	1.062	1.102	1.098
2006	0.854	0.878	0.892	0.913	0.937	0.969	1.000	1.028	1.068	1.064
2007	0.831	0.854	0.868	0.887	0.911	0.942	0.972	1.000	1.038	1.035
2008	0.800	0.823	0.836	0.855	0.877	0.907	0.936	0.963	1.000	0.996
2009	0.803	0.825	0.839	0.858	0.881	0.910	0.940	0.966	1.004	1.000
2010	0.790	0.812	0.825	0.844	0.866	0.896	0.925	0.951	0.987	0.984
2011	0.766	0.787	0.800	0.818	0.840	0.868	0.896	0.922	0.957	0.954
2012	0.750	0.771	0.784	0.801	0.823	0.851	0.878	0.903	0.938	0.934
2013	0.739	0.760	0.772	0.790	0.811	0.838	0.865	0.890	0.924	0.921
2014	0.727	0.748	0.760	0.777	0.798	0.825	0.852	0.876	0.909	0.906

Table B.17
Consumer Price Inflation (CPI) Index (Continued)

From:	2010	2011	2012	2013	2014
1970	5.620	5.797	5.917	6.004	6.101
1971	5.384	5.554	5.669	5.752	5.845
1972	5.217	5.381	5.493	5.573	5.664
1973	4.911	5.066	5.171	5.247	5.332
1974	4.423	4.563	4.657	4.725	4.802
1975	4.053	4.181	4.268	4.330	4.400
1976	3.832	3.953	4.035	4.094	4.161
1977	3.598	3.712	3.789	3.844	3.907
1978	3.344	3.450	3.521	3.573	3.631
1979	3.004	3.098	3.162	3.209	3.261
1980	2.646	2.730	2.786	2.827	2.873
1981	2.399	2.475	2.526	2.563	2.604
1982	2.260	2.331	2.379	2.414	2.453
1983	2.189	2.258	2.305	2.339	2.377
1984	2.099	2.165	2.210	2.242	2.278
1985	2.027	2.091	2.134	2.165	2.200
1986	1.990	2.052	2.095	2.126	2.160
1987	1.920	1.980	2.021	2.051	2.084
1988	1.843	1.901	1.941	1.969	2.001
1989	1.759	1.814	1.852	1.879	1.909
1990	1.668	1.721	1.757	1.782	1.811
1991	1.601	1.652	1.686	1.710	1.738
1992	1.554	1.603	1.636	1.660	1.687
1993	1.509	1.557	1.589	1.612	1.638
1994	1.471	1.518	1.549	1.572	1.597
1995	1.431	1.476	1.507	1.529	1.553
1996	1.390	1.434	1.463	1.485	1.509
1997	1.359	1.401	1.430	1.451	1.475
1998	1.338	1.380	1.409	1.429	1.452
1999	1.309	1.350	1.378	1.398	1.421
2000	1.266	1.306	1.333	1.353	1.375
2001	1.231	1.270	1.296	1.315	1.337
2002	1.212	1.250	1.276	1.295	1.316
2003	1.185	1.222	1.248	1.266	1.287
2004	1.154	1.191	1.215	1.233	1.253
2005	1.117	1.152	1.176	1.193	1.212
2006	1.082	1.116	1.139	1.156	1.174
2007	1.052	1.085	1.107	1.124	1.142
2008	1.013	1.045	1.066	1.082	1.100
2009	1.016	1.048	1.070	1.086	1.103
2010	1.000	1.032	1.053	1.068	1.086
2011	0.969	1.000	1.021	1.036	1.052
2012	0.950	0.980	1.000	1.015	1.031
2013	0.936	0.966	0.986	1.000	1.016
2014	0.921	0.950	0.970	0.984	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	1.051	1.097	1.156	1.260	1.377	1.453	1.543	1.651	1.788
1971	0.952	1.000	1.043	1.100	1.199	1.310	1.382	1.468	1.571	1.701
1972	0.912	0.958	1.000	1.055	1.149	1.256	1.325	1.407	1.506	1.630
1973	0.865	0.909	0.948	1.000	1.090	1.191	1.256	1.334	1.428	1.546
1974	0.794	0.834	0.870	0.918	1.000	1.093	1.153	1.224	1.311	1.419
1975	0.726	0.763	0.796	0.840	0.915	1.000	1.055	1.121	1.199	1.298
1976	0.688	0.723	0.755	0.796	0.867	0.948	1.000	1.062	1.137	1.231
1977	0.648	0.681	0.711	0.749	0.817	0.892	0.942	1.000	1.070	1.159
1978	0.606	0.636	0.664	0.700	0.763	0.834	0.880	0.934	1.000	1.083
1979	0.559	0.588	0.613	0.647	0.705	0.770	0.813	0.863	0.924	1.000
1980	0.513	0.539	0.563	0.593	0.647	0.707	0.745	0.792	0.847	0.917
1981	0.469	0.493	0.515	0.543	0.591	0.646	0.682	0.724	0.775	0.839
1982	0.442	0.464	0.485	0.511	0.557	0.608	0.642	0.682	0.730	0.790
1983	0.425	0.447	0.466	0.492	0.536	0.585	0.617	0.656	0.702	0.760
1984	0.411	0.431	0.450	0.475	0.517	0.565	0.596	0.633	0.678	0.734
1985	0.398	0.418	0.436	0.460	0.501	0.548	0.578	0.614	0.657	0.711
1986	0.390	0.410	0.428	0.451	0.491	0.537	0.566	0.602	0.644	0.697
1987	0.380	0.399	0.417	0.440	0.479	0.523	0.552	0.586	0.628	0.679
1988	0.367	0.386	0.403	0.425	0.463	0.506	0.533	0.567	0.606	0.656
1989	0.353	0.371	0.388	0.409	0.445	0.487	0.513	0.545	0.584	0.632
1990	0.341	0.358	0.374	0.394	0.429	0.469	0.495	0.526	0.563	0.609
1991	0.330	0.346	0.362	0.381	0.415	0.454	0.479	0.509	0.544	0.589
1992	0.322	0.339	0.353	0.373	0.406	0.444	0.468	0.497	0.532	0.576
1993	0.315	0.331	0.345	0.364	0.397	0.434	0.457	0.486	0.520	0.563
1994	0.308	0.324	0.338	0.357	0.389	0.425	0.448	0.476	0.509	0.551
1995	0.302	0.317	0.331	0.349	0.381	0.416	0.439	0.466	0.499	0.540
1996	0.297	0.312	0.325	0.343	0.374	0.408	0.431	0.458	0.490	0.530
1997	0.292	0.306	0.320	0.337	0.367	0.401	0.424	0.450	0.481	0.521
1998	0.288	0.303	0.316	0.334	0.363	0.397	0.419	0.445	0.476	0.516
1999	0.284	0.299	0.312	0.329	0.358	0.392	0.413	0.439	0.470	0.508
2000	0.278	0.292	0.305	0.322	0.350	0.383	0.404	0.429	0.459	0.497
2001	0.272	0.286	0.298	0.314	0.343	0.374	0.395	0.419	0.449	0.486
2002	0.268	0.281	0.294	0.310	0.337	0.369	0.389	0.413	0.442	0.479
2003	0.262	0.276	0.288	0.303	0.331	0.361	0.381	0.405	0.433	0.469
2004	0.255	0.268	0.280	0.295	0.322	0.352	0.371	0.394	0.422	0.457
2005	0.248	0.260	0.271	0.286	0.312	0.341	0.360	0.382	0.409	0.442
2006	0.240	0.252	0.263	0.278	0.303	0.331	0.349	0.370	0.397	0.429
2007	0.234	0.246	0.256	0.270	0.295	0.322	0.340	0.361	0.386	0.418
2008	0.229	0.241	0.252	0.265	0.289	0.316	0.333	0.354	0.379	0.410
2009	0.228	0.239	0.250	0.263	0.287	0.313	0.331	0.351	0.376	0.407
2010	0.225	0.236	0.246	0.260	0.283	0.309	0.326	0.347	0.371	0.402
2011	0.220	0.232	0.242	0.255	0.278	0.303	0.320	0.340	0.364	0.394
2012	0.217	0.228	0.237	0.250	0.273	0.298	0.315	0.334	0.358	0.387
2013	0.213	0.224	0.234	0.247	0.269	0.294	0.310	0.329	0.352	0.381
2014	0.210	0.220	0.230	0.243	0.264	0.289	0.305	0.324	0.346	0.375

Table B.18
Gross National Product Implicit Price Deflator (Continued)

From:	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989
1970	1.949	2.131	2.263	2.353	2.436	2.514	2.565	2.631	2.723	2.830
1971	1.854	2.028	2.153	2.239	2.318	2.392	2.441	2.504	2.591	2.693
1972	1.777	1.943	2.064	2.145	2.222	2.293	2.339	2.399	2.484	2.580
1973	1.685	1.843	1.957	2.034	2.107	2.174	2.218	2.275	2.355	2.447
1974	1.547	1.691	1.796	1.867	1.933	1.995	2.036	2.088	2.161	2.246
1975	1.415	1.548	1.644	1.709	1.769	1.826	1.863	1.911	1.978	2.055
1976	1.341	1.467	1.558	1.619	1.677	1.731	1.766	1.811	1.875	1.948
1977	1.263	1.381	1.467	1.525	1.579	1.629	1.662	1.705	1.765	1.834
1978	1.180	1.290	1.370	1.425	1.475	1.522	1.553	1.593	1.649	1.714
1979	1.090	1.192	1.266	1.316	1.363	1.406	1.435	1.472	1.523	1.583
1980	1.000	1.093	1.161	1.207	1.250	1.290	1.316	1.350	1.398	1.452
1981	0.915	1.000	1.062	1.104	1.143	1.180	1.204	1.235	1.278	1.328
1982	0.861	0.942	1.000	1.040	1.076	1.111	1.133	1.163	1.203	1.250
1983	0.828	0.906	0.962	1.000	1.035	1.069	1.090	1.118	1.158	1.203
1984	0.800	0.875	0.929	0.966	1.000	1.032	1.053	1.080	1.118	1.162
1985	0.775	0.848	0.900	0.936	0.969	1.000	1.020	1.047	1.083	1.126
1986	0.760	0.831	0.882	0.917	0.950	0.980	1.000	1.026	1.062	1.103
1987	0.741	0.810	0.860	0.894	0.926	0.956	0.975	1.000	1.035	1.075
1988	0.716	0.782	0.831	0.864	0.895	0.923	0.942	0.966	1.000	1.039
1989	0.689	0.753	0.800	0.831	0.861	0.888	0.906	0.930	0.962	1.000
1990	0.664	0.726	0.771	0.802	0.830	0.857	0.874	0.897	0.928	0.964
1991	0.643	0.703	0.746	0.776	0.803	0.829	0.846	0.867	0.898	0.933
1992	0.628	0.687	0.730	0.758	0.785	0.810	0.827	0.848	0.878	0.912
1993	0.614	0.671	0.713	0.741	0.767	0.792	0.808	0.828	0.858	0.891
1994	0.601	0.657	0.698	0.725	0.751	0.775	0.791	0.811	0.840	0.872
1995	0.588	0.644	0.683	0.710	0.736	0.759	0.775	0.795	0.822	0.855
1996	0.578	0.632	0.671	0.698	0.722	0.746	0.761	0.780	0.808	0.839
1997	0.568	0.621	0.660	0.686	0.710	0.733	0.748	0.767	0.794	0.825
1998	0.562	0.615	0.653	0.679	0.703	0.725	0.740	0.759	0.786	0.816
1999	0.554	0.606	0.644	0.669	0.693	0.715	0.729	0.748	0.774	0.805
2000	0.542	0.592	0.629	0.654	0.677	0.699	0.713	0.732	0.757	0.787
2001	0.530	0.579	0.615	0.639	0.662	0.683	0.697	0.715	0.740	0.769
2002	0.522	0.570	0.606	0.630	0.652	0.673	0.687	0.704	0.729	0.757
2003	0.511	0.559	0.594	0.617	0.639	0.660	0.673	0.691	0.715	0.743
2004	0.498	0.544	0.578	0.601	0.622	0.642	0.655	0.672	0.696	0.723
2005	0.482	0.527	0.560	0.582	0.603	0.622	0.635	0.651	0.674	0.700
2006	0.468	0.512	0.543	0.565	0.585	0.604	0.616	0.632	0.654	0.679
2007	0.456	0.498	0.529	0.550	0.570	0.588	0.600	0.615	0.637	0.662
2008	0.447	0.489	0.519	0.540	0.559	0.577	0.588	0.604	0.625	0.649
2009	0.444	0.485	0.515	0.536	0.555	0.572	0.584	0.599	0.620	0.644
2010	0.438	0.479	0.508	0.529	0.547	0.565	0.576	0.591	0.612	0.636
2011	0.429	0.469	0.499	0.518	0.537	0.554	0.565	0.580	0.600	0.623
2012	0.422	0.461	0.490	0.509	0.527	0.544	0.555	0.570	0.590	0.613
2013	0.416	0.455	0.483	0.502	0.520	0.536	0.547	0.561	0.581	0.604
2014	0.409	0.447	0.475	0.493	0.511	0.527	0.538	0.552	0.571	0.593

Table B.18
Gross National Product Implicit Price Deflator (Continued)

From:	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
1970	2.935	3.033	3.102	3.176	3.243	3.311	3.372	3.429	3.467	3.517
1971	2.793	2.886	2.952	3.022	3.086	3.151	3.209	3.263	3.299	3.346
1972	2.676	2.766	2.829	2.896	2.958	3.020	3.075	3.128	3.162	3.207
1973	2.538	2.623	2.683	2.746	2.805	2.863	2.916	2.966	2.998	3.041
1974	2.329	2.407	2.462	2.520	2.574	2.628	2.676	2.722	2.751	2.791
1975	2.131	2.203	2.253	2.307	2.356	2.405	2.449	2.491	2.518	2.554
1976	2.020	2.088	2.135	2.186	2.233	2.279	2.321	2.361	2.387	2.421
1977	1.902	1.966	2.011	2.058	2.102	2.146	2.185	2.223	2.247	2.279
1978	1.777	1.837	1.879	1.923	1.964	2.005	2.042	2.077	2.099	2.130
1979	1.642	1.697	1.735	1.776	1.814	1.852	1.886	1.918	1.939	1.967
1980	1.506	1.556	1.592	1.630	1.664	1.699	1.730	1.760	1.779	1.805
1981	1.377	1.423	1.456	1.490	1.522	1.554	1.582	1.609	1.627	1.650
1982	1.297	1.340	1.371	1.403	1.433	1.463	1.490	1.516	1.532	1.554
1983	1.247	1.289	1.319	1.350	1.379	1.408	1.433	1.458	1.474	1.495
1984	1.205	1.245	1.273	1.304	1.331	1.359	1.384	1.408	1.423	1.444
1985	1.167	1.206	1.234	1.263	1.290	1.317	1.341	1.364	1.379	1.399
1986	1.144	1.182	1.209	1.238	1.264	1.291	1.315	1.337	1.352	1.371
1987	1.115	1.153	1.179	1.207	1.233	1.259	1.282	1.303	1.318	1.337
1988	1.078	1.114	1.139	1.166	1.191	1.216	1.238	1.259	1.273	1.291
1989	1.037	1.072	1.096	1.122	1.146	1.170	1.192	1.212	1.225	1.243
1990	1.000	1.033	1.057	1.082	1.105	1.128	1.149	1.169	1.181	1.198
1991	0.968	1.000	1.023	1.047	1.069	1.092	1.112	1.131	1.143	1.159
1992	0.946	0.978	1.000	1.024	1.046	1.067	1.087	1.106	1.118	1.134
1993	0.924	0.955	0.977	1.000	1.021	1.043	1.062	1.080	1.092	1.107
1994	0.905	0.935	0.956	0.979	1.000	1.021	1.040	1.057	1.069	1.084
1995	0.886	0.916	0.937	0.959	0.979	1.000	1.018	1.036	1.047	1.062
1996	0.870	0.899	0.920	0.942	0.962	0.982	1.000	1.017	1.028	1.043
1997	0.856	0.884	0.905	0.926	0.946	0.966	0.983	1.000	1.011	1.025
1998	0.847	0.875	0.895	0.916	0.936	0.955	0.973	0.989	1.000	1.014
1999	0.835	0.862	0.882	0.903	0.922	0.942	0.959	0.975	0.986	1.000
2000	0.816	0.843	0.863	0.883	0.902	0.921	0.938	0.954	0.964	0.978
2001	0.798	0.824	0.843	0.863	0.882	0.900	0.917	0.932	0.942	0.956
2002	0.786	0.812	0.830	0.850	0.868	0.886	0.903	0.918	0.928	0.941
2003	0.770	0.796	0.814	0.834	0.851	0.869	0.885	0.900	0.910	0.923
2004	0.750	0.775	0.792	0.811	0.829	0.846	0.861	0.876	0.886	0.898
2005	0.726	0.751	0.768	0.786	0.803	0.820	0.835	0.849	0.858	0.870
2006	0.705	0.728	0.745	0.763	0.779	0.795	0.810	0.824	0.832	0.844
2007	0.686	0.709	0.726	0.743	0.759	0.775	0.789	0.802	0.811	0.823
2008	0.673	0.696	0.712	0.729	0.744	0.760	0.773	0.787	0.795	0.807
2009	0.668	0.690	0.706	0.723	0.738	0.754	0.768	0.781	0.789	0.800
2010	0.659	0.681	0.697	0.713	0.729	0.744	0.758	0.770	0.779	0.790
2011	0.647	0.668	0.683	0.700	0.715	0.729	0.743	0.756	0.764	0.775
2012	0.635	0.657	0.672	0.688	0.702	0.717	0.730	0.743	0.751	0.761
2013	0.626	0.647	0.662	0.677	0.692	0.706	0.719	0.732	0.740	0.750
2014	0.616	0.636	0.651	0.666	0.680	0.695	0.707	0.719	0.727	0.738

Table B.18
Gross National Product Implicit Price Deflator (Continued)

From:	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
1970	3.596	3.679	3.735	3.810	3.915	4.040	4.164	4.275	4.359	4.393
1971	3.422	3.501	3.555	3.626	3.725	3.845	3.963	4.068	4.148	4.180
1972	3.280	3.355	3.407	3.475	3.570	3.685	3.798	3.899	3.976	4.006
1973	3.110	3.181	3.230	3.295	3.385	3.494	3.601	3.697	3.770	3.799
1974	2.854	2.920	2.965	3.024	3.107	3.206	3.305	3.393	3.460	3.487
1975	2.612	2.672	2.713	2.767	2.843	2.934	3.025	3.105	3.166	3.191
1976	2.476	2.532	2.571	2.623	2.695	2.781	2.867	2.943	3.001	3.024
1977	2.331	2.384	2.421	2.470	2.537	2.619	2.699	2.771	2.825	2.847
1978	2.178	2.228	2.262	2.307	2.371	2.447	2.522	2.589	2.640	2.660
1979	2.012	2.058	2.090	2.131	2.190	2.260	2.330	2.392	2.439	2.457
1980	1.846	1.888	1.917	1.955	2.009	2.073	2.137	2.194	2.237	2.254
1981	1.688	1.726	1.753	1.788	1.837	1.896	1.954	2.006	2.046	2.062
1982	1.589	1.626	1.651	1.684	1.730	1.785	1.840	1.889	1.926	1.941
1983	1.529	1.564	1.588	1.620	1.664	1.717	1.770	1.817	1.853	1.867
1984	1.476	1.510	1.533	1.564	1.607	1.659	1.710	1.755	1.789	1.803
1985	1.431	1.463	1.486	1.516	1.557	1.607	1.657	1.701	1.734	1.747
1986	1.402	1.434	1.456	1.485	1.526	1.575	1.624	1.667	1.700	1.713
1987	1.367	1.398	1.420	1.448	1.488	1.536	1.583	1.625	1.657	1.670
1988	1.321	1.351	1.372	1.399	1.437	1.484	1.529	1.570	1.601	1.613
1989	1.271	1.300	1.320	1.347	1.383	1.428	1.472	1.511	1.541	1.553
1990	1.225	1.254	1.273	1.298	1.334	1.377	1.419	1.457	1.485	1.497
1991	1.186	1.213	1.232	1.256	1.291	1.332	1.373	1.410	1.437	1.448
1992	1.159	1.186	1.204	1.228	1.262	1.302	1.343	1.378	1.405	1.416
1993	1.132	1.158	1.176	1.200	1.233	1.272	1.311	1.346	1.373	1.383
1994	1.109	1.134	1.152	1.175	1.207	1.246	1.284	1.318	1.344	1.355
1995	1.086	1.111	1.128	1.151	1.182	1.220	1.258	1.291	1.317	1.327
1996	1.067	1.091	1.108	1.130	1.161	1.198	1.235	1.268	1.293	1.303
1997	1.049	1.073	1.089	1.111	1.141	1.178	1.214	1.247	1.271	1.281
1998	1.037	1.061	1.077	1.099	1.129	1.165	1.201	1.233	1.257	1.267
1999	1.023	1.046	1.062	1.083	1.113	1.149	1.184	1.216	1.240	1.249
2000	1.000	1.023	1.039	1.059	1.088	1.123	1.158	1.189	1.212	1.222
2001	0.978	1.000	1.015	1.036	1.064	1.098	1.132	1.162	1.185	1.194
2002	0.963	0.985	1.000	1.020	1.048	1.082	1.115	1.145	1.167	1.176
2003	0.944	0.966	0.980	1.000	1.027	1.060	1.093	1.122	1.144	1.153
2004	0.919	0.940	0.954	0.973	1.000	1.032	1.064	1.092	1.114	1.122
2005	0.890	0.911	0.925	0.943	0.969	1.000	1.031	1.058	1.079	1.087
2006	0.864	0.883	0.897	0.915	0.940	0.970	1.000	1.027	1.047	1.055
2007	0.841	0.861	0.874	0.891	0.916	0.945	0.974	1.000	1.020	1.028
2008	0.825	0.844	0.857	0.874	0.898	0.927	0.955	0.981	1.000	1.008
2009	0.819	0.837	0.850	0.867	0.891	0.920	0.948	0.973	0.992	1.000
2010	0.808	0.826	0.839	0.856	0.879	0.908	0.936	0.960	0.979	0.987
2011	0.792	0.810	0.823	0.839	0.862	0.890	0.917	0.942	0.960	0.968
2012	0.779	0.797	0.809	0.825	0.848	0.875	0.902	0.926	0.944	0.951
2013	0.767	0.785	0.797	0.813	0.835	0.862	0.888	0.912	0.930	0.937
2014	0.755	0.772	0.784	0.800	0.822	0.848	0.874	0.898	0.915	0.922

Table B.18
Gross National Product Implicit Price Deflator (Continued)

From:	2010	2011	2012	2013	2014
1970	4.451	4.539	4.618	4.688	4.767
1971	4.236	4.319	4.395	4.461	4.536
1972	4.059	4.140	4.212	4.275	4.348
1973	3.849	3.925	3.994	4.054	4.123
1974	3.533	3.602	3.665	3.720	3.784
1975	3.233	3.297	3.354	3.405	3.463
1976	3.064	3.125	3.179	3.227	3.282
1977	2.885	2.942	2.993	3.038	3.090
1978	2.696	2.749	2.797	2.839	2.887
1979	2.490	2.539	2.583	2.622	2.667
1980	2.284	2.329	2.370	2.406	2.447
1981	2.089	2.130	2.167	2.200	2.237
1982	1.967	2.006	2.041	2.072	2.107
1983	1.892	1.929	1.963	1.993	2.027
1984	1.827	1.863	1.896	1.924	1.957
1985	1.771	1.806	1.837	1.865	1.896
1986	1.735	1.770	1.801	1.828	1.859
1987	1.692	1.725	1.755	1.782	1.812
1988	1.634	1.667	1.696	1.721	1.751
1989	1.573	1.604	1.632	1.657	1.685
1990	1.517	1.547	1.574	1.597	1.625
1991	1.468	1.497	1.523	1.546	1.572
1992	1.435	1.463	1.489	1.511	1.537
1993	1.402	1.429	1.454	1.476	1.501
1994	1.372	1.400	1.424	1.445	1.470
1995	1.344	1.371	1.395	1.416	1.440
1996	1.320	1.346	1.370	1.390	1.414
1997	1.298	1.324	1.347	1.367	1.390
1998	1.284	1.309	1.332	1.352	1.375
1999	1.266	1.291	1.313	1.333	1.354
2000	1.238	1.262	1.284	1.303	1.324
2001	1.210	1.234	1.255	1.274	1.295
2002	1.192	1.215	1.236	1.255	1.275
2003	1.168	1.191	1.212	1.230	1.250
2004	1.137	1.160	1.180	1.198	1.217
2005	1.102	1.123	1.143	1.160	1.179
2006	1.069	1.090	1.109	1.126	1.144
2007	1.041	1.062	1.080	1.097	1.114
2008	1.021	1.041	1.059	1.075	1.092
2009	1.013	1.033	1.051	1.067	1.084
2010	1.000	1.020	1.038	1.053	1.070
2011	0.981	1.000	1.017	1.033	1.048
2012	0.964	0.983	1.000	1.015	1.030
2013	0.949	0.968	0.990	1.000	1.015
2014	0.935	0.954	0.971	0.986	1.000

Source:
U.S. Department of Commerce, Bureau of Economic Analysis, *Survey of Current Business*, Washington, DC, monthly.

APPENDIX C

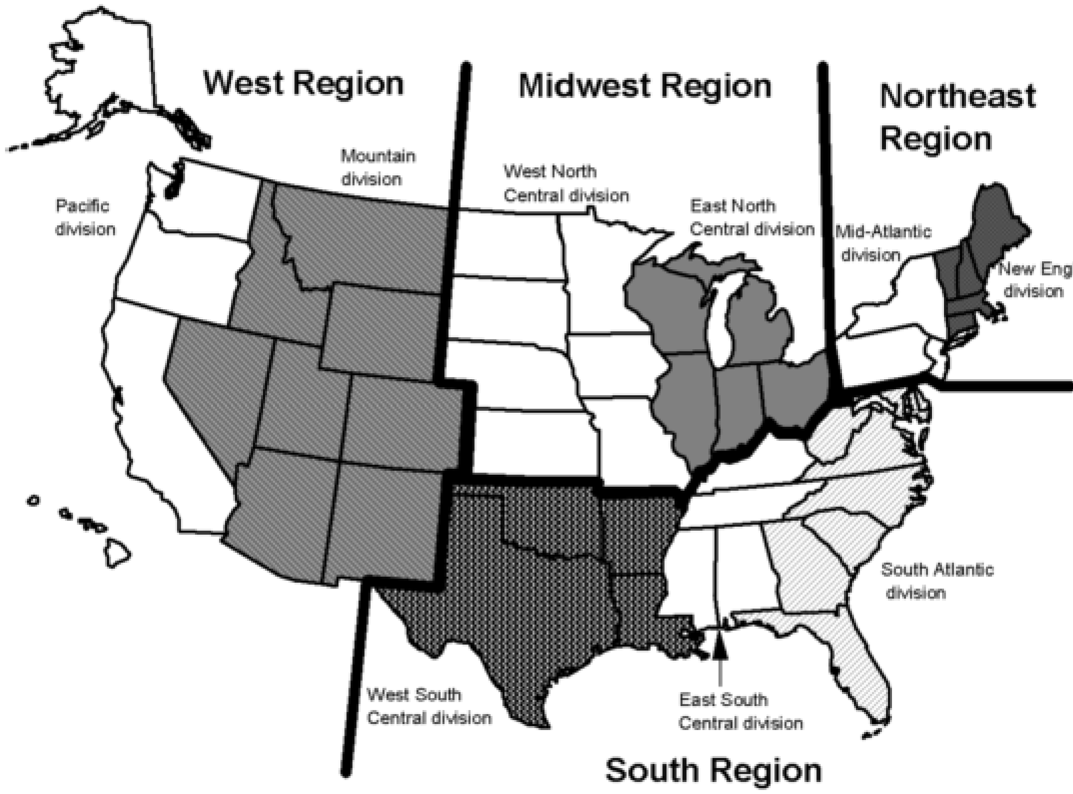
MAPS

Table C.1
Census Regions and Divisions

<table>
<tr><td colspan="4">Northeast Region</td></tr>
<tr><td colspan="2">Mid-Atlantic division</td><td colspan="2">New England division</td></tr>
<tr><td>New Jersey
New York</td><td>Pennsylvania</td><td>Connecticut
Maine
Massachusetts</td><td>New Hampshire
Rhode Island
Vermont</td></tr>
<tr><td colspan="4">South Region</td></tr>
<tr><td>West South Central division</td><td>East South Central division</td><td colspan="2">South Atlantic division</td></tr>
<tr><td>Arkansas
Louisiana
Oklahoma
Texas</td><td>Alabama
Kentucky
Mississippi
Tennessee</td><td>Delaware
Florida
Georgia
Maryland
North Carolina</td><td>South Carolina
Virginia
Washington, DC
West Virginia</td></tr>
<tr><td colspan="4">West Region</td></tr>
<tr><td colspan="2">Pacific division</td><td colspan="2">Mountain division</td></tr>
<tr><td>Alaska
California
Hawaii</td><td>Oregon
Washington</td><td>Arizona
Colorado
Idaho
Montana</td><td>Nevada
New Mexico
Utah
Wyoming</td></tr>
<tr><td colspan="4">Midwest Region</td></tr>
<tr><td colspan="2">West North Central division</td><td colspan="2">East North Central division</td></tr>
<tr><td>Iowa
Kansas
Minnesota
Missouri</td><td>Nebraska
North Dakota
South Dakota</td><td>Illinois
Indiana
Michigan</td><td>Ohio
Wisconsin</td></tr>
</table>

Source:
U.S. Census Bureau.

Figure C.1. Census Regions and Divisions



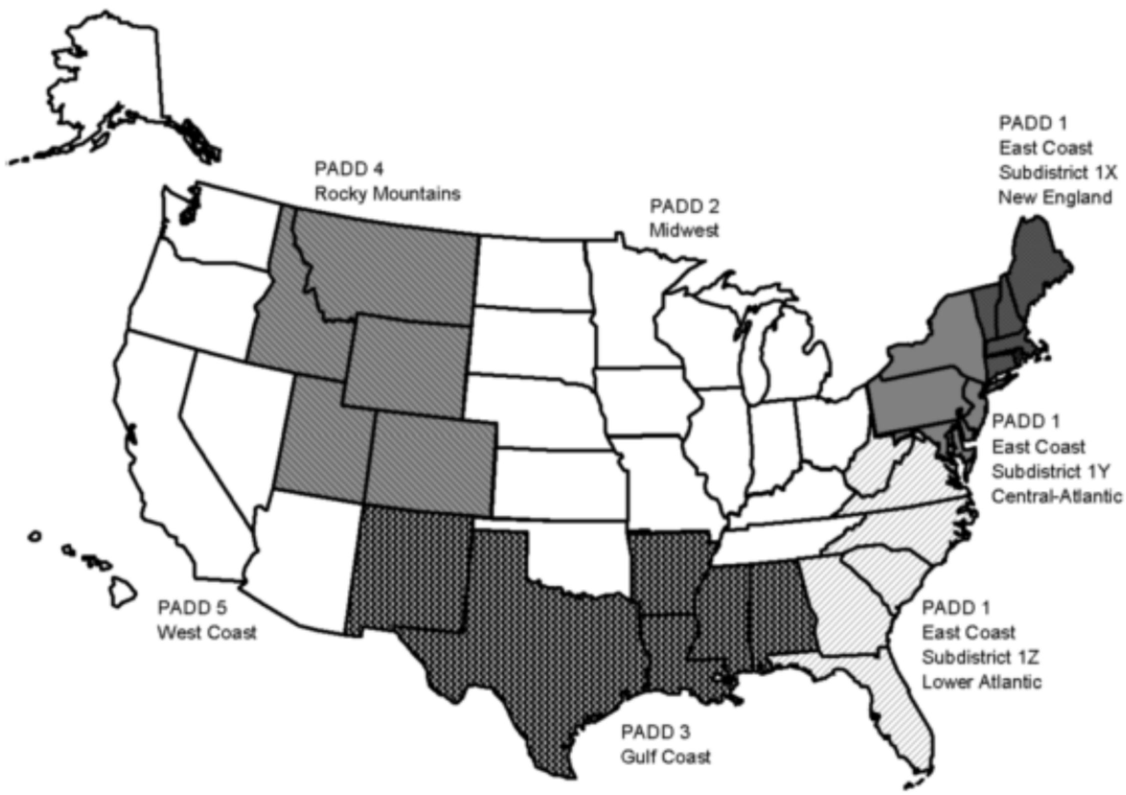
Source:
See Table C.1.

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://www.eia.gov/tools/glossary/index.cfm?id=Petroleum%20Administration%20for%20Defense%20District

Figure C.2. Petroleum Administration for Defense Districts



Source:
See Table C.2.

Table C.3. Counties Where Reformulated Gasoline is Sold

Reformulated Gasoline (RFG) used in entire county		
	California	
Fresno County	Orange County	Stanislaus County
Kings County	Sacramento County	Tulare County
Los Angeles County	San Diego County	Ventura County
Madera County	San Joaquin	Yolo County
Merced County		
	Connecticut	
Fairfield County	Middlesex County	New London County
Hartford County	New Haven County	Tolland County
Litchfield County		
	Delaware	
New Castle County	Kent County	Sussex County
	Illinois	
Cook County	Lake County	Monroe County
Du Page County	McHenry County	St. Clair County
Jersey County	Madison County	Will County
Kane County		
	Indiana	
Lake County	Porter County	
	Kentucky	
Boone County	Jefferson County	Kenton County
Campbell County		
	Maine	
Androscoggin County	Knox County	Sagadahoc County
Cumberland County	Lincoln County	York County
Kennebec County		
	Massachusetts	
Barnstable County	Franklin County	Norfolk County
Berkshire County	Hampden County	Plymouth County
Bristol County	Hampshire County	Suffolk County
Dukes County	Middlesex County	Worcester County
Essex County	Nantucket County	
	Maryland	
Anne Arundel County	Cecil County	Montgomery County
Baltimore County	Frederick County	Prince George's County
Calvert County	Harford County	The City of Baltimore
Carroll County	Howard County	Queen Anne's County
Charles County	Kent County	
	Missouri	
Franklin County	St. Louis County	St. Charles County
Jefferson County	St Louis (city)	
	New Hampshire	
Hillsborough County	Merrimack County	Strafford County
Rockingham County		
	New Jersey	
Bergen County	Gloucester County	Ocean County
Burlington County	Hudson County	Passaic County
Camden County	Hunterdon County	Salem County
Cumberland County	Mercer County	Somerset County
Atlantic County	Middlesex County	Sussex County
Cape May County	Monmouth County	Union County
Essex County	Morris County	Warren County
	New York	
Bronx County	New York County	Richmond County
Dutchess County	Orange County	Rockland County
Kings County	Putnam	Suffolk County
Nassau County	Queens County	Westchester County

Table C.3. Counties Where Reformulated Gasoline is Sold (continued)

RFG used in entire county (continued)		
Pennsylvania		
Bucks County	Delaware County	Philadelphia County
Chester County	Montgomery County	
Rhode Island		
Bristol County	Newport County	Washington County
Kent County	Providence County	
Texas		
Brazoria County	Denton County	Liberty County
Chambers County	Fort Bend County	Montgomery County
Collin County	Galveston County	Tarrant County
Dallas County	Harris County	Waller County
Virginia		
Alexandria	Hanover County	Poquoson
Arlington County	Henrico County	Portsmouth
Charles City County	Hopewell	Prince William County
Chesapeake	James City County	Richmond
Chesterfield County	Loudoun County	Stafford County
Colonial Heights	Manassas	Suffolk
Fairfax	Manassas Park	Virginia Beach
Fairfax County	Newport News	Williamsburg
Falls Church	Norfolk	York County
Hampton		
Wisconsin		
Kenosha County	Ozaukee County	Washington County
Milwaukee County	Racine County	Waukesha County
Partial RFG Counties		
California		
El Dorado County	Riverside County	Solano County
Kern County	San Bernardino County	Sutter County
Placer County		
Illinois		
Grundy County	Kendall County	
Kentucky		
Bullitt County	Oldham County	
New York		
Essex County		

Note: RFG is also sold in the District of Columbia. 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, but some of these counties opted-in to the RFG program.

Source:
U.S. Environmental Protection Agency, RFG Areas, accessed August 3, 2015, http://www.epa.gov/otaq/fuels/gasolinefuels/rfg/areas.htm

Figure C.3. Counties Where Reformulated Gasoline is Sold

Note: Reformulated gasoline (RFG) 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, but some of these counties opted-in to the RFG program.

Source:
See Table C.3.

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.

Alternative fuel – For transportation applications, includes the following: methanol; denatured ethanol, and other alcohols; fuel mixtures containing 85 percent or more by volume of methanol, denatured ethanol, and other alcohols with gasoline or other fuels; natural gas; liquefied petroleum gas (propane); hydrogen; coal-derived liquid fuels; fuels (other than alcohol) derived from biological materials (biofuels such as soy diesel fuel); and electricity (including electricity from solar energy). The term "alternative fuel" does not include alcohol or other blended portions of primarily petroleum-based fuels used as oxygenates or extenders, i.e. MTBE, ETBE, other ethers, and the 10-percent ethanol portion of gasohol.

Amtrak – See Rail.

Anthropogenic – Human made. Usually used in the context of emissions that are produced as the result of human activities.

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 –A mode of transit service characterized by roadway vehicles powered by diesel, gasoline, battery, or alternative fuel engines contained within the vehicle.

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.

Car size classifications – Size classifications of cars 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 – cars designed primarily to seat only two adults.
Station wagons are included with the size class for the sedan of the same name.

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 rail – A mode of transit service (also called metropolitan rail, regional rail, or suburban rail) characterized by an electric or diesel propelled railway for urban passenger train service consisting of local short distance travel operating between a central city and adjacent suburbs.

Compact car – See *car size classifications*.

Compression ignition – The form of ignition that initiates combustion in a diesel engine. The rapid compression of air within the cylinders generates the heat required to ignite the fuel as it is injected.

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) – A measure of the average change over time in the prices paid by urban consumers for a market basket of consumer goods and services.

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.

Conventional Refueling Station – An establishment for refueling motor vehicles with traditional transportation fuels, such as gasoline and diesel fuel.

Corporate Average Fuel Economy (CAFE) Standards – CAFE standards were originally established by Congress for new cars, 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, car 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.

Criteria pollutant – A pollutant determined to be hazardous to human health and regulated under EPA's National Ambient Air Quality Standards. The 1970 amendments to the Clean Air Act require EPA to describe the health and welfare impacts of a pollutant as the "criteria" for inclusion in the regulatory regime.

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*.

Domestic water transportation – See *Internal water transportation*.

E85 – 85% ethanol and 15% gasoline.

E95 – 95% ethanol and 5% gasoline.

Electric utilities sector – Consists of privately and publicly owned establishments which generate electricity primarily for resale.

Emission standards – Limits or ranges established for pollution levels emitted by vehicles as well as stationary sources. The first standards were established under the 1963 Clean Air Act.

End-use sector – See *Sector*.

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).

Excise tax – Paid when purchases are made on a specific good, such as gasoline. Excise taxes are often included in the price of the product. There are also excise taxes on activities, such as highway usage by trucks.

Ferry boat – A transit mode comprising vessels carrying passengers and in some cases vehicles over a body of water, and that are generally steam or diesel-powered.

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.

Global warming potential (GWP) – An index used to compare the relative radiative forcing of different gases without directly calculating the changes in atmospheric concentrations. GWPs are calculated as the ratio of the radiative forcing that would result from the emission of one kilogram of a greenhouse gas to that from the emission of one kilogram of carbon dioxide over a fixed period of time, such as 100 years.

Greenhouse gases – Those gases, such as water vapor, carbon dioxide, nitrous oxide, methane, hydrofluorocarbons (HFCs), perfluorocarbons (PFCs) and sulfur hexafluoride, that are transparent to solar (short-wave) radiation but opaque to long-wave (infrared) radiation, thus preventing long-wave radiant energy from leaving Earth's atmosphere. The net effect is a trapping of absorbed radiation and a tendency to warm the planet's surface.

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*.

Heavy rail – A mode of transit service (also called metro, subway, rapid transit, or rapid rail) operating on an electric railway with the capacity for a heavy volume of traffic. Characterized by high speed and rapid acceleration of passenger rail cars.

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.

Hybrid-electric vehicles – Combines the benefits of gasoline engines and electric motors and can be configured to obtain different objectives, such as improved fuel economy, increased power, or additional auxiliary power for electronic devices and power tools.

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*.

Intermodal – Transportation activities involving more than one mode of transportation, including transportation connections and coordination of various modes.

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 *Car 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 – Cars 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*.

Light rail – Mode of transit service (also called streetcar, tramway or trolley) operating passenger rail cars singly (or in short, usually two-car or three-car trains) on fixed rails in right-of-way that is often separated from other traffic for part or much of the way.

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 *Car size classifications*.

Minicompact car – See *Car 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 more details on this clean fuel program see http://www.epa.gov/otaq/fuels/gasolinefuels/rfg/index.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, Chile, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Israel, Italy, Japan, Luxembourg, Mexico, Netherlands, New Zealand, Norway, Poland, Portugal, Slovak Republic, Slovenia, 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, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Luxembourg, Netherlands, Norway, Poland, Portugal, Slovak Republic, Slovenia, 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, South Korea, and New Zealand.

Organization for Petroleum Exporting Countries (OPEC) – Includes Algeria, Angola, Ecuador, Iran, Iraq, Kuwait, Libya, Nigeria, Qatar, Saudi Arabia, United Arab Emirates, and Venezuela.

Arab OPEC – Consists of Algeria, Bahrain, Egypt, Iraq, Kuwait, Libya, Qatar, Saudi Arabia, Syria, Tunisia, 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).

Paratransit – Mode of transit service (also called demand response or dial-a-ride) characterized by the use of passenger cars, vans or small buses operating in response to calls from passengers or their agents to the transit operator, who then dispatches a vehicle to pick up the passengers and transport them to their destinations.

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 known 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.

Plug-in hybrid-electric vehicles (PHEVs) — Hybrid-electric vehicles with high capacity batteries that can be charged by plugging them into an electrical outlet or charging station. There are two basic PHEV configurations:

Parallel or Blended PHEV: Both the engine and electric motor are mechanically connected to the wheels, and both propel the vehicle under most driving conditions. Electric-only operation usually occurs only at low speeds.

Series PHEVs, also called Extended Range Electric Vehicles (EREVs): Only the electric motor turns the wheels; the gasoline engine is only used to generate electricity. Series PHEVs can run solely on electricity until the battery needs to be recharged. The gasoline engine will then generate the electricity needed to power the electric motor. For shorter trips, these vehicles might use no gasoline at all.

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.

Refiner sales price – Sales from the refinery made directly to ultimate consumers, including bulk consumers (such as agriculture, industry, and electric utilities) and residential and commercial consumers.

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*.

Sector – A group of major energy-consuming components of U.S. society developed to measure and analyze energy use. The sectors most commonly referred to are: residential, commercial, industrial, transportation, and electric power.

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.

Spark ignition engine – An internal combustion engine in which the charge is ignited electrically (e.g., with a spark plug).

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 *Car size classifications*.

Supplemental air carrier – See *Air carrier*.

Survival 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 will be in use at the end of a given year.

Tax incentives – In general, a means of employing the tax code to stimulate investment in or development of a socially desirable economic objective without direct expenditure from the budget of a given unit of government. Such incentives can take the form of tax exemptions or credits.

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.

Trolleybus – Mode of transit service (also called transit coach) using vehicles propelled by a motor drawing current from overhead wires via connecting poles called a trolley pole, from a central power source not onboard the vehicle.

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 *Car 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 ridesharing prearrangement using vans or small buses providing round-trip transportation between the participants's prearranged boarding points and a common and regular destination.

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.

Volatile organic compounds (VOCs) – Organic compounds that participate in atmospheric photochemical reactions.

Waterborne Commerce –

Coastwise: Domestic traffic receiving a carriage over the ocean, or the Gulf of Mexico. Traffic between Great Lakes ports and seacoast ports, when having a carriage over the ocean, is also termed Coastwise.

Domestic: Includes coastwise, lakewise, and internal waterborne movements.

Foreign: Waterborne import, export, and in-transit traffic between the United States, Puerto Rico and the Virgin Islands and any foreign country.

Internal: Vessel movements (origin and destination) which take place solely on inland waterways. An inland waterway is one geographically located within the boundaries of the contiguous 48 states or within the boundaries of the State of Alaska.

Lakewise: Waterborne traffic between the United States ports on the Great Lakes System. The Great Lakes System is treated as a separate waterway system rather than as a part of the inland waterway system. In comparing historical data for the Great Lakes System, one should note that prior to calendar year 1990, marine products, sand and gravel being moved from the Great Lakes to Great Lake destinations were classified as local traffic. From 1990-on, these activities are classified as lakewise traffic.

Well-to-wheel – A life cycle analysis used in transportation to consider the entire energy cycle for a given mode, rather than just tailpipe emissions. The analysis starts at the oil well and ends with the turning wheels of the vehicle.

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.

TITLE INDEX

USEFUL WEB SITES

U.S. DEPARTMENT OF ENERGY	www.energy.gov
Energy Efficiency and Renewable Energy	www.eere.doe.gov
Vehicle Technologies Office	www.eere.energy.gov/vehiclesandfuels
Fuel Cells Technologies Office	www.eere.energy.gov/hydrogenandfuelcells
Bioenergy Technologies Office	http://www.energy.gov/eere/bioenergy/bioenergy-technologies-office
Alternative Fuels Data Center	www.afdc.energy.gov/afdc
Clean Cities	www.eere.energy.gov/cleancities
Transportation Fact of the Week	**http://energy.gov/eere/vehicles/transportation-fact-week**
Fuel Economy	**www.fueleconomy.gov**
Hybrid and Vehicle Systems	www.eere.energy.gov/vehiclesandfuels/technologies/systems
Buildings Energy Data Book	www.btscoredatabook.net
Energy Information Administration	www.eia.gov
OAK RIDGE NATIONAL LABORATORY	www.ornl.gov
Center for Transportation Analysis	cta.ornl.gov
Transportation Energy Data Book	**cta.ornl.gov/data**
Vehicle Technologies Market Report	**cta.ornl.gov/vtmarketreport**
ARGONNE NATIONAL LABORATORY	www.anl.gov
GREET Model	greet.es.anl.gov
FEDERAL GOVERNMENT - FEDSTATS	http://fedstats.sites.usa.gov/
USA.GOV	www.usa.gov
U.S. ARMY CORPS OF ENGINEERS	www.iwr.usace.army.mil/ndc
U.S. BUREAU OF LABOR STATISTICS	www.bls.gov
U.S. CENSUS BUREAU	www.census.gov
Vehicle Inventory and Use Survey	www.census.gov/svsd/www/tiusview.html
U.S. DEPARTMENT OF COMMERCE	www.commerce.gov
Bureau of Economic Analysis	www.bea.gov
U.S. DEPARTMENT OF TRANSPORTATION	www.dot.gov
Bureau of Transportation Statistics	www.bts.gov
Commodity Flow Survey Program	www.bts.gov/publications/commodity_flow_survey
National Transportation Library	ntl.bts.gov
TranStats	www.transtats.bts.gov
Federal Aviation Administration	www.faa.gov
Federal Highway Administration	www.fhwa.dot.gov
Office of Highway Policy Information	www.fhwa.dot.gov/policyinformation
Nationwide Household Travel Survey	nhts.ornl.gov
Federal Motor Carrier Safety Administration	www.fmcsa.dot.gov
Federal Railroad Administration	www.fra.dot.gov
Federal Transit Administration	www.fta.dot.gov
Maritime Administration	www.marad.dot.gov
National Highway Traffic Safety Administration	www.nhtsa.dot.gov
Research and Innovative Technology Administration	www.rita.dot.gov
John A. Volpe National Transportation Systems Center	www.volpe.dot.gov
U.S. Coast Guard	www.uscg.mil
U.S. ENVIRONMENTAL PROTECTION AGENCY	www.epa.gov
Office of Air and Radiation	www.epa.gov/oar
Office of Transportation and Air Quality	www.epa.gov/otaq

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