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EDITION 20**

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TABLE OF CONTENTS

| | |
|--|-------------|
| FOREWORD | xv |
| ACKNOWLEDGMENTS | xvii |
| ABSTRACT | xix |
| INTRODUCTION | xxi |
| CHAPTER 1 PETROLEUM | 1-1 |
| Table 1.1 World Fossil Fuel Potential | 1-2 |
| <i>Figure 1.1 World Fossil Fuel Potential</i> | <i>1-2</i> |
| Table 1.2 World Crude Oil Production, 1960-98 | 1-3 |
| Table 1.3 World Oil Consumption, 1960-97 | 1-4 |
| Table 1.4 Petroleum Stocks in OECD Countries, End of Year 1973-98 | 1-5 |
| <i>Figure 1.2 Crude Oil Prices, 1870-98</i> | <i>1-6</i> |
| Table 1.5 U.S. Petroleum Net Imports by World Region of Origin, 1960-98 | 1-7 |
| Table 1.6 Summary of 1996 Military Expenditures for Defending Oil Supplies from the Middle East | 1-8 |
| <i>Figure 1.3 Refinery Gross Output by World Region, 1999</i> | <i>1-9</i> |
| Table 1.7 U.S. Refinery Input of Crude Oil and Petroleum Products, 1987-98 | 1-10 |
| Table 1.8 Refinery Yield of Petroleum Products from a Barrel of Crude Oil, 1978-98 | 1-11 |
| Table 1.9 United States Petroleum Production and Consumption, 1973-99 | 1-12 |
| <i>Figure 1.4 United States Petroleum Production and Consumption, 1973-99</i> | <i>1-13</i> |
| Table 1.10 Consumption of Petroleum by End-Use Sector, 1973-99 | 1-14 |
| Table 1.11 Transportation of Petroleum and Petroleum Products in the U.S. by Mode, 1975-98 | 1-15 |

TABLE OF CONTENTS (Continued)

| | | |
|-------------------|---|------------|
| CHAPTER 2 | ENERGY | 2-1 |
| Table 2.1 | World Production of Primary Energy by Selected Country Groups, 1989-98 | 2-2 |
| Table 2.2 | World Consumption of Primary Energy by Selected Country Groups, 1989-98 | 2-3 |
| Table 2.3 | U. S. Consumption of Total Energy by End-Use Sector, 1970-99 | 2-4 |
| Table 2.4 | Distribution of Energy Consumption by Source, 1973, 1980, and 1999 | 2-5 |
| Table 2.5 | Domestic Consumption of Transportation Energy by Mode and Fuel Type, 1998 | 2-6 |
| Table 2.6 | Transportation Energy Use by Mode, 1996-98 | 2-7 |
| Table 2.7 | Transportation Energy Consumption by Mode, 1970-98 | 2-8 |
| Table 2.8 | Highway Usage of Gasoline and Special Fuels, 1973-98 | 2-9 |
| <i>Figure 2.1</i> | <i>Motor Gasoline Quantities by Type, 1981 and 1998</i> | 2-10 |
| Table 2.9 | Alternative Vehicle Fuel Consumption, 1992-2000 | 2-11 |
| Table 2.10 | U.S. Production and Imports of MTBE and Fuel Ethanol, 1978-99 | 2-12 |
| Table 2.11 | Passenger Travel and Energy Use in the United States, 1998 | 2-13 |
| Table 2.12 | Energy Intensities of Passenger Modes, 1970-98 | 2-14 |
| <i>Figure 2.2</i> | <i>Energy Intensity for Transit in the U.S., 1997</i> | 2-15 |
| Table 2.13 | Intercity Freight Movement and Energy Use in the United States, 1998 | 2-16 |
| Table 2.14 | Energy Intensities of Freight Modes, 1970-98 | 2-17 |
| CHAPTER 3 | GREENHOUSE GAS EMISSIONS | 3-1 |
| Table 3.1 | International Man-Made Emissions of Greenhouse Gases, 1990-97 | 3-2 |
| Table 3.2 | International Man-Made Emissions of Carbon Dioxide, 1990-97 | 3-3 |
| Table 3.3 | International Man-Made Emissions of Carbon Dioxide by Source Category, 1990 and 1997 | 3-4 |
| Table 3.4 | Estimated U.S. Emissions of Greenhouse Gases, 1990-98 | 3-5 |
| Table 3.5 | U.S. Carbon Dioxide Emissions from Fossil Energy Consumption by End-Use Sector, 1984-98 | 3-6 |

TABLE OF CONTENTS (Continued)

| | | |
|------------------|---|------------|
| Table 3.6 | U.S. Carbon Dioxide Emissions from Energy Use in the Transportation Sector, 1980–98 | 3–7 |
| Table 3.7 | Numerical Estimates of Global Warming Potentials Compared With Carbon Dioxide | 3–8 |
| Table 3.8 | NEAR-TERM Technology: Fuel-Cycle Energy and Greenhouse Gas Emission Changes of Alternative Transportation Fuels and Advanced Vehicle Technologies | 3–11 |
| Table 3.9 | LONG-TERM Technology: Fuel-Cycle Energy and Greenhouse Gas Emission Changes of Alternative Transportation Fuels and Advanced Vehicle Technologies | 3–12 |
| CHAPTER 4 | CRITERIA POLLUTANTS | 4–1 |
| Table 4.1 | Total National Emissions of the Criteria Air Pollutants by Sector, 1998 | 4–2 |
| Table 4.2 | Total National Emissions of Carbon Monoxide, 1970–98 | 4–3 |
| Table 4.3 | Emissions of Carbon Monoxide from Highway Vehicles, 1970–98 | 4–4 |
| Table 4.4 | Total National Emissions of Nitrogen Oxides, 1970–98 | 4–5 |
| Table 4.5 | Emissions of Nitrogen Oxides from Highway Vehicles, 1970–98 | 4–6 |
| Table 4.6 | Total National Emissions of Volatile Organic Compounds, 1970–98 | 4–7 |
| Table 4.7 | Emissions of Volatile Organic Compounds from Highway Vehicles, 1970–98 | 4–8 |
| Table 4.8 | Total National Emissions of Particulate Matter (PM-10), 1970–98 | 4–9 |
| Table 4.9 | Emissions of Particulate Matter (PM-10) from Highway Vehicles, 1970–98 | 4–10 |
| Table 4.10 | Total National Emissions of Particulate Matter (PM-2.5), 1990–98 | 4–11 |
| Table 4.11 | Emissions of Particulate Matter (PM-2.5) from Highway Vehicles, 1990–98 | 4–12 |
| Table 4.12 | National Lead Emission Estimates, 1970–98 | 4–13 |
| Table 4.13 | State-level Emissions for Criteria Pollutants, 1998 | 4–14 |
| Table 4.14 | NEAR-TERM Technology: Fuel-Cycle Energy and Criteria Pollutant Emission Changes of Alternative Transportation Fuels and Advanced Vehicle Technologies | 4–17 |
| Table 4.15 | LONG-TERM Technology: Fuel-Cycle Energy and Greenhouse Gas Emission Changes of Alternative Transportation Fuels and Advanced Vehicle Technologies | 4–19 |
| Table 4.16 | Pollution from a Typical New Car and Light Truck, 2000 Model Year | 4–32 |
| Table 4.17 | Tier 2 Federal Emission Standards | 4–32 |

TABLE OF CONTENTS (Continued)

| | | |
|-------------------|--|------------|
| Table 4.18 | Federal Exhaust Emission Certification Standards for Gasoline- and Diesel-Powered Light Vehicles | 4-33 |
| Table 4.19 | Federal Exhaust Emission Certification Standards for Gasoline- and Diesel-Powered Light Trucks (Category LDT1) | 4-34 |
| Table 4.20 | Federal Exhaust Emission Certification Standards for Gasoline- and Diesel-Powered Light Trucks (Category LDT2) | 4-35 |
| Table 4.21 | Federal Exhaust Emission Certification Standards for Gasoline- and Diesel-Powered Light Trucks (Category LDT3) | 4-36 |
| Table 4.22 | Federal Exhaust Emission Certification Standards for Gasoline- and Diesel-Powered Light Trucks (Category LDT4) | 4-37 |
| Table 4.23 | Federal Exhaust Emission Certification Standards for Gasoline- and Diesel-Powered Light Heavy Trucks | 4-38 |
| Table 4.24 | Federal Exhaust Emission Certification Standards for Gasoline- and Diesel-Powered Heavy Heavy Trucks | 4-39 |
| Table 4.25 | <i>California</i> Passenger Cars and Light Trucks Emission Certification Standards | 4-40 |
| Table 4.26 | California Vehicle Emission Reduction for Passenger Cars and Light Trucks | 4-41 |
| Table 4.27 | California Air Resources Board Requirements for Meeting Emission Standards | 4-42 |
| CHAPTER 5 | TRANSPORTATION AND THE ECONOMY | 5-1 |
| Table 5.1 | Gasoline Prices for Selected Countries, 1978-99 | 5-2 |
| <i>Figure 5.1</i> | <i>Gasoline Prices for Selected Countries, 1990 and 1998</i> | <i>5-3</i> |
| Table 5.2 | Diesel Fuel Prices for Selected Countries, 1978-99 | 5-4 |
| <i>Figure 5.2</i> | <i>Diesel Fuel Prices for Selected Countries, 1990 and 1998</i> | <i>5-5</i> |
| Table 5.3 | Prices for a Barrel of Crude Oil and a Gallon of Gasoline, 1978-99 | 5-6 |
| Table 5.4 | Retail Prices for Motor Fuel, 1978-99 | 5-7 |
| Table 5.5 | Prices for Selected Transportation Fuels, 1978-99 | 5-8 |
| Table 5.6 | State Taxes on Motor Fuels, 1999 | 5-9 |
| Table 5.7 | State Tax Exemptions for Gasohol, January 1, 2000 | 5-11 |
| Table 5.8 | Federal Excise Taxes on Motor Fuels | 5-11 |
| Table 5.9 | States With Ethanol Tax Incentives | 5-12 |

TABLE OF CONTENTS (Continued)

| | | |
|-------------------|--|-------------|
| Table 5.10 | Average Price of a New Car, 1970–99 | 5–13 |
| Table 5.11 | Average Price of a New Car by Sector, 1970–99 | 5–14 |
| Table 5.12 | Automobile Operating Cost per Mile, 1975–99 | 5–15 |
| Table 5.13 | Fixed Automobile Operating Costs per Year, 1975–99 | 5–16 |
| Table 5.14 | Economic Indicators, 1970–99 | 5–17 |
| Table 5.15 | Consumer Price Indices, 1970–99 | 5–17 |
| Table 5.16 | Motor Vehicle Manufacturing Employment Statistics, 1972–98 | 5–18 |
| Table 5.17 | Employees of Motor Vehicle and Related Industries, 1990 and 1997 | 5–19 |
| Table 5.18 | Employment in Transportation and Related Industries, 1960–98 | 5–20 |
| CHAPTER 6 | HIGHWAY VEHICLES AND CHARACTERISTICS | 6–1 |
| Table 6.1 | Automobile Registrations for Selected Countries, 1950–96 | 6–2 |
| Table 6.2 | Truck and Bus Registrations for Selected Countries, 1950–96 | 6–3 |
| Table 6.3 | Automobiles and Trucks in Use, 1970–98 | 6–5 |
| Table 6.4 | Vehicle Stock and New Sales in United States, 1998 Calendar Year | 6–6 |
| Table 6.5 | Highway Vehicle Miles Traveled by Vehicle Type, 1970–98 | 6–7 |
| Table 6.6 | Automobiles in Operation and Vehicle Travel by Age, 1970 and 1998 | 6–8 |
| Table 6.7 | Trucks in Operation and Vehicle Travel by Age, 1970 and 1998 | 6–9 |
| Table 6.8 | Average Age of Automobiles and Trucks in Use, 1970–98 | 6–10 |
| Table 6.9 | Automobile Scrappage and Survival Rates | 6–11 |
| <i>Figure 6.1</i> | <i>Automobile Survival Rates</i> | <i>6–12</i> |
| Table 6.10 | Light Truck Scrappage and Survival Rates | 6–13 |
| <i>Figure 6.2</i> | <i>Light Truck Survival Rates</i> | <i>6–14</i> |
| CHAPTER 7 | LIGHT VEHICLES AND CHARACTERISTICS | 7–1 |
| Table 7.1 | Summary Statistics for Passenger Cars, 1970–98 | 7–2 |
| Table 7.2 | Summary Statistics for Two-Axle, Four-Tire Trucks, 1970–98 | 7–3 |
| Table 7.3 | New Retail Automobile Sales in the United States, 1970–98 | 7–4 |
| Table 7.4 | New Retail Sales of Trucks 10,000 pounds GVW and Less in the United States, 1970–98 | 7–5 |

TABLE OF CONTENTS (Continued)

| | | |
|-------------------|--|-------------|
| Table 7.5 | Period Sales, Market Shares, and Sales-Weighted Fuel Economies of New Domestic and Import Automobiles, Selected Sales Periods 1976–99 | 7–6 |
| Table 7.6 | Period Sales, Market Shares, and Sales-Weighted Fuel Economies of New Domestic and Import Light Trucks, Selected Sales Period 1976–99 | 7–7 |
| Table 7.7 | Light Vehicle Market Shares by Size Class, Sales Period 1976–99 | 7–8 |
| Table 7.8 | Sales-Weighted Engine Size of New Domestic and Import Automobiles by Size Class, Sales Periods 1976–99 | 7–9 |
| Table 7.9 | Sales-Weighted Engine Size of New Domestic and Import Light Trucks by Size Class, Sales Periods 1976–99 | 7–10 |
| Table 7.10 | Sales-Weighted Curb Weight of New Domestic and Import Automobiles by Size Class, Sales Periods 1976–99 | 7–11 |
| Table 7.11 | Sales-Weighted Interior Space of New Domestic and Import Automobiles by Size Class, Sales Periods 1976–99 | 7–12 |
| <i>Figure 7.1</i> | <i>Engine Size, Curb Weight, and Interior Space of New Domestic and Import Automobiles, 1976–99</i> | <i>7–13</i> |
| Table 7.12 | Sales-Weighted Wheelbase of New Automobiles and Light Trucks, Sales Period 1976–99 | 7–14 |
| Table 7.13 | Average Material Consumption for a Domestic Automobile, 1978, 1985, and 1999 | 7–15 |
| Table 7.14 | New Light Vehicle Dealerships and Sales, 1970–98 | 7–16 |
| Table 7.15 | Conventional and Alternative Fuel Refueling Stations | 7–17 |
| Table 7.16 | Corporate Average Fuel Economy (CAFE) Standards versus Sales-Weighted Fuel Economy Estimates for Automobiles and Light Trucks, 1978–99 | 7–18 |
| Table 7.17 | Corporate Average Fuel Economy (CAFE) Fines Collected, 1983–98 | 7–19 |
| Table 7.18 | Tax Receipts from the Sale of Gas Guzzlers, 1980–98 | 7–19 |
| Table 7.19 | The Gas Guzzler Tax on New Cars | 7–20 |
| Table 7.20 | Vehicle Specifications for Tested Vehicles | 7–22 |
| Table 7.21 | Fuel Economy by Speed, 1973, 1984 and 1997 | 7–23 |
| <i>Figure 7.2</i> | <i>Fuel Economy by Speed, 1973, 1984 and 1997</i> | <i>7–24</i> |
| Table 7.22 | Steady Speed Fuel Economy for Tested Vehicles | 7–25 |
| <i>Figure 7.3</i> | <i>Urban Driving Cycle</i> | <i>7–26</i> |
| <i>Figure 7.4</i> | <i>Highway Driving Cycle</i> | <i>7–26</i> |

TABLE OF CONTENTS (Continued)

| | | |
|-------------------|--|------------|
| <i>Figure 7.5</i> | <i>New York City Driving Cycle</i> | 7-27 |
| <i>Figure 7.6</i> | <i>Representative Number Five Driving Cycle</i> | 7-27 |
| <i>Figure 7.7</i> | <i>US06 Driving Cycle</i> | 7-28 |
| Table 7.23 | Occupant Fatalities by Vehicle Type and Nonoccupant Fatalities, 1975-98 | 7-29 |
| Table 7.24 | Light Vehicle Occupant Safety Data, 1975-98 | 7-30 |
| Table 7.25 | Crashes by Crash Severity, Crash Type, and Vehicle Type, 1998 | 7-31 |
| <i>Figure 7.8</i> | <i>Percent Rollover Occurrence by Vehicle Type and Crash Severity</i> | 7-32 |
| CHAPTER 8 | HEAVY VEHICLES AND CHARACTERISTICS | 8-1 |
| Table 8.1 | Summary Statistics for Other Single-Unit and Combination Trucks, 1970-98 | 8-2 |
| Table 8.2 | New Retail Truck Sales by Gross Vehicle Weight, 1970-98 | 8-3 |
| Table 8.3 | Truck Statistics by Gross Vehicle Weight Class, 1997 | 8-5 |
| Table 8.4 | Percentage of Trucks by Size Class, 1977, 1982, 1987, 1992, and 1997 | 8-5 |
| Table 8.5 | Truck Fuel Economy by Fuel Type and Size Class, 1997 | 8-6 |
| Table 8.6 | Truck Fuel Economy by Size Class, 1977, 1982, 1987, 1992, and 1997 | 8-6 |
| Table 8.7 | Truck Statistics by Size, 1997 | 8-7 |
| Table 8.8 | Percentage of Trucks by Size Ranked by Major Use, 1997 | 8-8 |
| Table 8.9 | Percentage of Trucks by Fleet Size and Primary Refueling Facility, 1997 | 8-9 |
| Table 8.10 | Percentage of Trucks by Major Use and Primary Refueling Facility, 1997 | 8-10 |
| Table 8.11 | Growth of Freight Activity in the United States: Comparison of the 1997 and 1993 Commodity Flow Surveys | 8-12 |
| Table 8.12 | Commodity Flow Survey Freight Activity, 1997 | 8-13 |
| Table 8.13 | Summary Statistics on Buses by Type, 1970-98 | 8-14 |
| CHAPTER 9 | ALTERNATIVE FUEL VEHICLES AND CHARACTERISTICS | 9-1 |
| Table 9.1 | Estimates of Alternative Fuel Vehicles in Use, 1992-2000 | 9-3 |
| Table 9.2 | Estimates of Light Alternative Fuel Vehicles, 1996, 1998, and 2000 | 9-4 |
| Table 9.3 | Estimates of Heavy Alternative Fuel Vehicles, 1996, 1998, and 2000 | 9-5 |
| Table 9.4 | Alternative Fuel Vehicles Available by Manufacturer, Model Year 2000 | 9-6 |

TABLE OF CONTENTS (Continued)

| | | |
|--|--|-------------|
| Table 9.5 | Number of Alternative Refuel Sites by State and Fuel Type, 1999 | 9-7 |
| Table 9.6 | List of Clean Cities as of 12/1/99 by Designation | 9-8 |
| <i>Figure 9.1</i> | <i>Map of Clean Cities as of 12/1/99</i> | <i>9-9</i> |
| Table 9.7 | U.S. Advanced Battery Consortium Goals for Electric Vehicle Batteries | 9-10 |
| Table 9.8 | PNGV Goals and Specifications of Hybrid-Electric Vehicles | 9-11 |
| CHAPTER 10 FLEET VEHICLES AND CHARACTERISTICS | | 10-1 |
| <i>Figure 10.1</i> | <i>Fleet Vehicles in Service as of January 1, 1999</i> | <i>10-2</i> |
| Table 10.1 | Top Ten States with Fleets of Ten Vehicles or More, 1999 | 10-3 |
| Table 10.2 | Fleet Vehicle Composition by Vehicle Type, 1991 | 10-4 |
| Table 10.3 | Average Length of Time Fleet Vehicles are Kept Before Sold to Others, 1991 | 10-4 |
| Table 10.4 | Average Annual and Daily Vehicle-Miles of Travel for Fleet Vehicles, 1991 | 10-4 |
| <i>Figure 10.2</i> | <i>Worldwide Federal Inventory, 1992-97</i> | <i>10-5</i> |
| <i>Figure 10.3</i> | <i>Average Miles per Federal Vehicle by Vehicle Type, 1997</i> | <i>10-5</i> |
| Table 10.5 | Federal Government Vehicles by Agency, Fiscal Year 1997 | 10-6 |
| Table 10.6 | Federal Fleet Vehicle Acquisitions by Fuel Type, FY 1997 | 10-7 |
| Table 10.7 | Fuel Consumed by Federal Government Fleets, FY 1997 | 10-7 |

TABLE OF CONTENTS (Continued)

| | | |
|--|---|--------------|
| Table 10.8 | Energy Policy Act Purchase Requirements of Light Alternative Fuel Vehicles | 10-8 |
| CHAPTER 11 HOUSEHOLD VEHICLES AND CHARACTERISTICS | | 11-1 |
| Table 11.1 | Population and Vehicle Profile, 1950–98 | 11-2 |
| Table 11.2 | Average Annual Expenditures of Households by Income, 1998 | 11-3 |
| Table 11.3 | Household Vehicle Ownership, 1960–90 Census | 11-4 |
| Table 11.4 | Demographic Statistics, 1969, 1977, 1983, 1990, and 1995 NPTS | 11-5 |
| Table 11.5 | Average Annual Vehicle-Miles, Vehicle Trips and Trip Length per Household 1969, 1977, 1983, 1990, and 1995 NPTS | 11-6 |
| Table 11.6 | Average Annual Person-Miles Traveled (PMT), Person Trips and Trip Length per Household by Selected Trip Purposes, 1983, 1990, and 1995 NPTS | 11-7 |
| Table 11.7 | Average Number of Vehicles and Vehicle Travel per Household, 1990 and 1995 NPTS | 11-8 |
| <i>Figure 11.1</i> | <i>Average Vehicle Occupancy by Vehicle Type, 1995 NPTS</i> | <i>11-9</i> |
| <i>Figure 11.2</i> | <i>Average Vehicle Occupancy by Trip Purpose, 1977, 1983, 1990, and 1995 NPTS</i> | <i>11-10</i> |
| Table 11.8 | Vehicle-Miles by Trip Purpose, 1995 NPTS | 11-11 |
| Table 11.9 | Average Annual Miles per Vehicle by Household Vehicle Ownership, 1995 NPTS | 11-12 |
| Table 11.10 | Average Age of Vehicles by Household Vehicle Ownership, 1995 NPTS | 11-12 |
| Table 11.11 | Average Annual Miles per Household Vehicle by Vehicle Age | 11-13 |
| Table 11.12 | Journey-to-Work Statistics, 1983, 1990, and 1995 NPTS | 11-14 |
| Table 11.13 | Means of Transportation to Work, 1980 and 1990 Census | 11-15 |
| Table 11.14 | National and Metropolitan Area Comparisons of Journey-to-Work Statistics, 1990 Census | 11-16 |
| <i>Figure 11.3</i> | <i>Long-Distance Trips by Destination, 1995</i> | <i>11-17</i> |
| Table 11.15 | Long-Distance Trips by Mode and Purpose, 1995 | 11-18 |
| <i>Figure 11.4</i> | <i>Long-Distance Household Trips by Mode and Trip Distance, 1995</i> | <i>11-19</i> |
| <i>Figure 11.5</i> | <i>Shares of Long-Distance Person Trips by Mode and Household Income, 1995</i> | <i>11-20</i> |

TABLE OF CONTENTS (Continued)

| | |
|--|-------------|
| CHAPTER 12 NONHIGHWAY MODES | 12-1 |
| Table 12.1 Summary Statistics for U.S. Domestic and International Certificated Route Air Carriers (Combined Totals), 1970-98 | 12-2 |
| Table 12.2 Summary Statistics for General Aviation, 1970-98 | 12-3 |
| Table 12.3 Tonnage Statistics for Domestic and International Waterborne Commerce, 1970-98 | 12-4 |
| Table 12.4 Summary Statistics for Domestic Waterborne Commerce, 1970-98 | 12-5 |
| Table 12.5 Breakdown of Domestic Marine Cargo by Commodity Class, 1998 | 12-6 |
| Table 12.6 Class I Railroad Freight Systems in the United States Ranked by Revenue Ton-Miles, 1998 | 12-7 |
| Table 12.7 Summary Statistics for Class I Freight Railroads, 1970-98 | 12-8 |
| Table 12.8 Railroad Revenue Carloads by Commodity Group, 1974 and 1998 | 12-9 |
| Table 12.9 Intermodal Rail Traffic, 1965-98 | 12-10 |
| Table 12.10 Summary Statistics for the National Railroad Passenger Corporation (Amtrak), 1971-98 | 12-11 |
| Table 12.11 Summary Statistics for Rail Transit Operations, 1970-98 | 12-12 |
| APPENDIX A. SOURCES | A-1 |
| APPENDIX B. CONVERSIONS | B-1 |
| APPENDIX C. CENSUS DIVISIONS AND REGIONS | C-1 |
| GLOSSARY | G-1 |
| INDEX | I-1 |

FOREWORD

This edition has many new tables and graphs. I would like to draw your attention to several of them.

First, Table 1.1 and Figure 1.1 show an estimate of the total potential for fossil fuels. All the values are expressed in trillion of barrels of oil equivalent (tboe). The table shows that the world has consumed 0.81 tboe of conventional oil since oil was first discovered. The remaining conventional oil is more than double this amount. The potential for other fossil fuels are enormous. Remaining unconventional oil is about eight times that for conventional oil. The amount of conventional and unconventional natural gas is about four times that for conventional oil. The potential for coal and methane hydrates is even higher by a large amount. There is no shortage of fossil fuels, but the U.S. may need fuels that are renewable, domestic and low in carbon.

Second, in Chapter 6, the scrappage functions have been up-dated.

Third, safety information is provided in Tables 7.23 through 7.25. It is seen that occupant fatalities are down since 1975 and that single vehicle crashes are responsible for about 60 percent as many deaths as multiple vehicle crashes.

Fourth, the heavy truck information in Chapter 8 has been enhanced with the addition of 1997 data from the Vehicle Inventory and Use Survey.

I hope you find this edition useful.



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ABSTRACT

The *Transportation Energy Data Book: Edition 20* is a statistical compendium prepared and published by Oak Ridge National Laboratory (ORNL) under contract with the Office of Transportation Technologies in the Department of Energy (DOE). 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 editions of the Data Book are available to a larger audience via the Internet (www-cta.ornl.gov/data/tedb.htm).

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 – greenhouse gas emissions; Chapter 4 – criteria pollutant emissions; Chapter 5 – transportation and the economy; Chapter 6 – highway vehicles; Chapter 7 – light vehicles; Chapter 8 – heavy vehicles; Chapter 9 – alternative fuel vehicles; Chapter 10 – fleet vehicles; Chapter 11 – household vehicles; and Chapter 12– nonhighway modes. 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 readers 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 (now the Office of Transportation Technologies). DOE, through the Office of Transportation Technologies, has supported the compilation of Editions 3 through 20.

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 20 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 1.2 | World Oil Production, 1998 | | |
| | <i>U.S. Oil Production (million barrels per day)</i> | | 6.2 |
| | <i>U.S. Share</i> | | 9.3% |
| Table 1.3 | World Oil Consumption, 1997 | | |
| | <i>U.S. Oil Consumption (million barrels per day)</i> | | 18.6 |
| | <i>U.S. Share</i> | | 25.5% |
| Figure 1.2 | Refinery yield, 1999 | OECD Europe | North America |
| | <i>Gasoline</i> | 21.3% | 40.8% |
| | <i>Diesel fuel</i> | 34.9% | 22.0% |
| | <i>Residual fuel</i> | 17.0% | 7.6% |
| | <i>Kerosene</i> | 6.7% | 8.9% |
| | <i>Other</i> | 20.1% | 20.7% |
| Table 1.9 | U.S. transportation oil use as a percent of U.S. oil production, 1999 | | 146% |
| Table 1.9 | Net imports as a percentage of U.S. oil consumption, 1999 | | 50% |
| Table 1.10 | Transportation share of oil consumption, 1999 | | 67% |

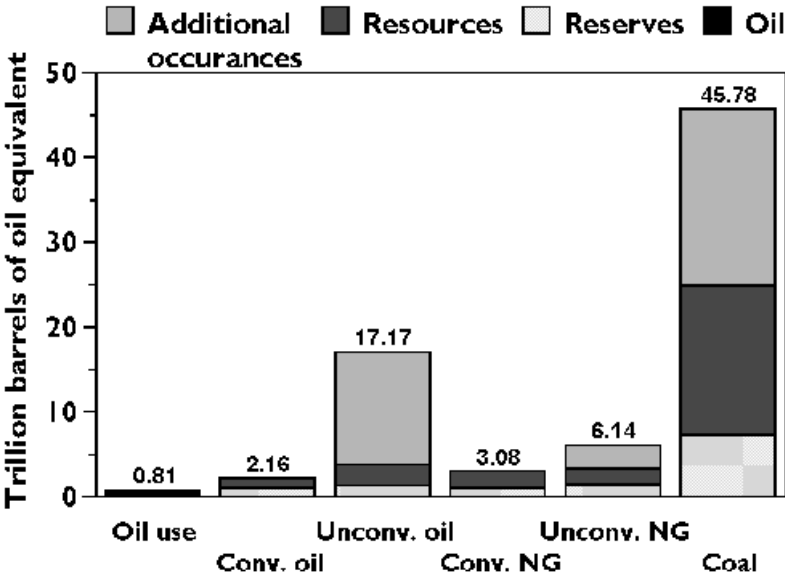
Although the world has consumed about one-third of estimated conventional oil resources, the total fossil fuel potential is huge. Methane hydrates—a potential source of natural gas—are not shown in the graph below, but constitute the largest resource at 137.5 trillion barrels of oil equivalent.

Table 1.1
World Fossil Fuel Potential
(trillion barrels of oil equivalent)

| | Oil | Reserves | Resources | Additional occurrences |
|--------------------|------|----------|-----------|------------------------|
| <i>Oil</i> | | | | |
| Use to Date | 0.81 | | | |
| Conventional | | 1.10 | 1.06 | 0.00 |
| Unconventional | | 1.34 | 2.46 | 13.37 |
| <i>Natural Gas</i> | | | | |
| Conventional | | 1.03 | 2.05 | 0.00 |
| Unconventional | | 1.41 | 1.89 | 2.84 |
| Methane hydrates | | 0.00 | 0.00 | 137.50 |
| <i>Coal</i> | | 7.35 | 17.57 | 20.86 |

Source:
H.H. Rogner, “An Assessment of World Hydrocarbon Resources,” *Annual Review of Energy and Environment*, 1997, p. 249.

Figure 1.1. World Fossil Fuel Potential



Source:
See Table 1.1.

Table 1.2
World Crude Oil Production, 1960-98^a
 (million barrels per day)

| Year | United States | U.S. Share | Total OPEC ^b | OPEC Share | OPEC + ^c | OPEC + ^c Share | Total Non-OPEC | Persian Gulf nations ^d | World |
|---|---------------|------------|-------------------------|------------|---------------------|---------------------------|----------------|-----------------------------------|-------|
| 1960 | 7.04 | 33.5% | 8.70 | 41.4% | 12.25 | 58.3% | 12.29 | 5.27 | 20.99 |
| 1965 | 7.80 | 25.7% | 14.35 | 47.3% | 19.83 | 65.4% | 15.98 | 8.37 | 30.33 |
| 1970 | 9.64 | 21.0% | 23.30 | 50.8% | 31.16 | 67.9% | 22.59 | 13.39 | 45.89 |
| 1971 | 9.46 | 19.5% | 25.21 | 52.0% | 33.58 | 69.2% | 23.31 | 15.77 | 48.52 |
| 1972 | 9.44 | 18.5% | 26.89 | 52.6% | 35.69 | 69.8% | 24.25 | 17.54 | 51.14 |
| 1973 | 9.21 | 16.5% | 30.63 | 55.0% | 39.82 | 71.5% | 25.05 | 20.67 | 55.68 |
| 1974 | 8.77 | 15.7% | 30.35 | 54.5% | 40.24 | 72.2% | 25.37 | 21.28 | 55.72 |
| 1975 | 8.37 | 15.8% | 26.77 | 50.7% | 37.56 | 71.1% | 26.06 | 18.93 | 52.83 |
| 1976 | 8.13 | 14.2% | 30.33 | 52.9% | 41.87 | 73.0% | 27.01 | 21.51 | 57.34 |
| 1977 | 8.24 | 13.8% | 30.89 | 51.7% | 43.09 | 72.2% | 28.82 | 21.73 | 59.71 |
| 1978 | 8.71 | 14.5% | 29.46 | 49.0% | 42.46 | 70.6% | 30.70 | 20.61 | 60.16 |
| 1979 | 8.55 | 13.6% | 30.58 | 48.8% | 44.12 | 70.4% | 32.09 | 21.07 | 62.67 |
| 1980 | 8.60 | 14.4% | 26.61 | 44.6% | 41.07 | 68.9% | 32.99 | 17.96 | 59.60 |
| 1981 | 8.57 | 15.3% | 22.48 | 40.1% | 37.46 | 66.8% | 33.60 | 15.25 | 56.08 |
| 1982 | 8.65 | 16.2% | 18.78 | 35.1% | 34.28 | 64.1% | 34.70 | 12.16 | 53.48 |
| 1983 | 8.69 | 16.3% | 17.50 | 32.9% | 33.15 | 62.2% | 35.76 | 11.08 | 53.26 |
| 1984 | 8.88 | 16.3% | 17.44 | 32.0% | 33.19 | 60.9% | 37.05 | 10.78 | 54.49 |
| 1985 | 8.97 | 16.6% | 16.18 | 30.0% | 31.81 | 58.9% | 37.80 | 9.63 | 53.98 |
| 1986 | 8.68 | 15.4% | 18.28 | 32.5% | 34.05 | 60.6% | 37.95 | 11.70 | 56.23 |
| 1987 | 8.35 | 14.7% | 18.52 | 32.7% | 34.72 | 61.3% | 38.15 | 12.10 | 56.67 |
| 1988 | 8.14 | 13.9% | 20.32 | 34.6% | 36.66 | 62.4% | 38.42 | 13.46 | 58.74 |
| 1989 | 7.61 | 12.7% | 22.07 | 36.9% | 38.50 | 64.3% | 37.79 | 14.84 | 59.86 |
| 1990 | 7.36 | 12.2% | 23.20 | 38.3% | 39.12 | 64.6% | 37.37 | 15.28 | 60.57 |
| 1991 | 7.42 | 12.3% | 23.27 | 38.6% | 38.53 | 64.0% | 36.94 | 14.74 | 60.21 |
| 1992 | 7.17 | 11.9% | 24.40 | 40.5% | 37.67 | 62.6% | 35.81 | 15.97 | 60.21 |
| 1993 | 6.85 | 11.4% | 25.12 | 41.7% | 37.65 | 62.5% | 35.12 | 16.71 | 60.24 |
| 1994 | 6.66 | 10.9% | 25.51 | 41.8% | 37.67 | 61.8% | 35.48 | 16.96 | 60.99 |
| 1995 | 6.56 | 10.5% | 26.00 | 41.7% | 38.24 | 61.4% | 36.33 | 17.21 | 62.33 |
| 1996 | 6.46 | 10.1% | 26.76 | 41.8% | 39.45 | 61.6% | 37.29 | 17.37 | 64.05 |
| 1997 | 6.45 | 9.7% | 28.36 | 42.8% | 41.31 | 62.3% | 37.96 | 18.50 | 66.32 |
| 1998 | 6.24 | 9.3% | 28.76 | 43.0% | 41.69 | 62.3% | 38.11 | 19.33 | 66.87 |
| <i>Average annual percentage change</i> | | | | | | | | | |
| 1960-98 | -0.3% | | 3.2% | | 3.3% | | 3.0% | 3.5% | 3.1% |
| 1970-98 | -1.5% | | 0.8% | | 1.0% | | 1.9% | 1.3% | 1.4% |
| 1988-98 | -2.6% | | 3.5% | | 1.3% | | -0.1% | 3.7% | 1.3% |

Source:

U.S. Department of Energy, Energy Information Administration, *Annual Energy Review 1998*, Washington, DC, July 1999, Table 11.4.

^aIncludes lease condensate. Excludes natural gas plant liquids.

^bOrganization of Petroleum Exporting Countries. See Glossary for membership.

^cOPEC includes all OPEC nations plus Russia, Mexico, Norway and Oman.

^dSee Glossary for Persian Gulf nations.

These data are the latest available; oil consumption data generally lags behind production data (previous table) by one year.

Table 1.3
World Oil Consumption, 1960–97
 (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% | 34.49 | 12.32 | 46.81 |
| 1971 | 15.21 | 30.8% | 36.07 | 13.35 | 49.42 |
| 1972 | 16.37 | 30.8% | 38.74 | 14.35 | 53.09 |
| 1973 | 17.31 | 30.2% | 41.53 | 15.71 | 57.24 |
| 1974 | 16.65 | 29.4% | 40.12 | 16.56 | 56.68 |
| 1975 | 16.32 | 29.0% | 38.82 | 17.38 | 56.20 |
| 1976 | 17.46 | 29.3% | 41.39 | 18.28 | 59.67 |
| 1977 | 18.43 | 29.8% | 42.43 | 19.40 | 61.83 |
| 1978 | 18.85 | 29.4% | 43.62 | 20.54 | 64.16 |
| 1979 | 18.51 | 28.4% | 44.01 | 21.21 | 65.22 |
| 1980 | 17.06 | 27.0% | 41.41 | 21.66 | 63.07 |
| 1981 | 16.06 | 26.4% | 39.14 | 21.76 | 60.90 |
| 1982 | 15.30 | 25.7% | 37.45 | 22.05 | 59.50 |
| 1983 | 15.23 | 25.9% | 36.59 | 22.15 | 58.74 |
| 1984 | 15.73 | 26.3% | 37.43 | 22.41 | 59.84 |
| 1985 | 15.73 | 26.2% | 37.23 | 22.87 | 60.10 |
| 1986 | 16.28 | 26.4% | 38.28 | 23.48 | 61.76 |
| 1987 | 16.67 | 26.5% | 38.96 | 24.04 | 63.00 |
| 1988 | 17.28 | 26.7% | 40.24 | 24.58 | 64.82 |
| 1989 | 17.33 | 26.3% | 40.88 | 25.04 | 65.92 |
| 1990 | 16.99 | 25.8% | 40.92 | 25.06 | 65.98 |
| 1991 | 16.71 | 25.1% | 41.40 | 25.17 | 66.57 |
| 1992 | 17.03 | 25.5% | 42.41 | 24.33 | 66.74 |
| 1993 | 17.24 | 25.7% | 42.98 | 24.01 | 66.99 |
| 1994 | 17.72 | 25.9% | 44.17 | 24.13 | 68.30 |
| 1995 | 17.72 | 25.4% | 44.95 | 24.94 | 69.89 |
| 1996 | 18.31 | 25.7% | 46.07 | 25.25 | 71.32 |
| 1997 | 18.62 | 25.5% | 46.67 | 26.34 | 73.01 |
| <i>Average annual percentage change</i> | | | | | |
| 1960–97 | 1.7% | | 3.0% | 4.3% | 3.4% |
| 1970–97 | 0.9% | | 1.1% | 2.9% | 1.7% |
| 1987–97 | 1.1% | | 1.8% | 0.9% | 1.5% |

Source:

U.S. Department of Energy, Energy Information Administration, *Annual Energy Review* 1998, Washington, DC, July 1999, Table 11.9.

^a Organization for Economic Cooperation and Development. See Glossary for membership.

The United States has increased its petroleum stocks by 55% from 1973 to 1984; there has been no significant change in the stocks since 1984. Petroleum demand, however, has increased 87% in that same time period (see Table 1.3). The Strategic Petroleum Reserve accounted for 35% of total U.S. stocks at the end of 1998.

Table 1.4
Petroleum Stocks in OECD Countries, End of Year 1973–98^a
(million barrels)

| Year | France | Germany ^b | Italy | United Kingdom | Other OECD ^c Europe | OECD ^c Europe | Canada | Japan | U.S. Strategic Petroleum Reserve | United States total | Other OECD ^d | OECD ^e |
|---|--------|----------------------|-------|----------------|--------------------------------|--------------------------|--------|-------|----------------------------------|---------------------|-------------------------|-------------------|
| 1973 | 201 | 181 | 152 | 156 | 380 | 1,070 | 140 | 303 | ^e | 1,008 | 67 | 2,588 |
| 1975 | 225 | 187 | 143 | 165 | 434 | 1,154 | 174 | 375 | ^e | 1,133 | 67 | 2,903 |
| 1980 | 243 | 319 | 170 | 168 | 564 | 1,464 | 164 | 495 | 108 | 1,392 | 72 | 3,587 |
| 1981 | 214 | 297 | 167 | 143 | 516 | 1,337 | 161 | 482 | 230 | 1,484 | 67 | 3,531 |
| 1982 | 193 | 272 | 179 | 125 | 489 | 1,258 | 136 | 484 | 294 | 1,430 | 68 | 3,376 |
| 1983 | 153 | 249 | 149 | 118 | 473 | 1,142 | 121 | 470 | 379 | 1,454 | 68 | 3,255 |
| 1984 | 152 | 239 | 159 | 112 | 468 | 1,130 | 128 | 479 | 451 | 1,556 | 69 | 3,362 |
| 1985 | 139 | 233 | 157 | 123 | 440 | 1,092 | 113 | 494 | 493 | 1,519 | 66 | 3,284 |
| 1986 | 127 | 252 | 155 | 124 | 475 | 1,133 | 111 | 509 | 512 | 1,593 | 72 | 3,418 |
| 1987 | 127 | 259 | 169 | 121 | 454 | 1,130 | 126 | 540 | 541 | 1,607 | 71 | 3,474 |
| 1988 | 140 | 266 | 155 | 112 | 445 | 1,118 | 116 | 538 | 560 | 1,597 | 71 | 3,440 |
| 1989 | 138 | 271 | 164 | 118 | 442 | 1,133 | 114 | 577 | 580 | 1,581 | 71 | 3,476 |
| 1990 | 140 | 265 | 172 | 112 | 474 | 1,163 | 121 | 590 | 586 | 1,621 | 73 | 3,568 |
| 1991 | 153 | 288 | 160 | 119 | 461 | 1,181 | 119 | 606 | 569 | 1,617 | 65 | 3,588 |
| 1992 | 146 | 310 | 174 | 113 | 476 | 1,219 | 107 | 603 | 575 | 1,592 | 67 | 3,588 |
| 1993 | 158 | 309 | 163 | 118 | 475 | 1,221 | 105 | 618 | 587 | 1,647 | 69 | 3,661 |
| 1994 | 158 | 312 | 164 | 115 | 490 | 1,240 | 119 | 645 | 592 | 1,653 | 69 | 3,726 |
| 1995 | 159 | 301 | 162 | 107 | 499 | 1,228 | 109 | 630 | 592 | 1,563 | 71 | 3,601 |
| 1996 | 158 | 300 | 152 | 108 | 538 | 1,256 | 103 | 651 | 566 | 1,507 | 74 | 3,591 |
| 1997 | 164 | 298 | 147 | 105 | 542 | 1,256 | 115 | 685 | 563 | 1,560 | 74 | 3,689 |
| 1998 | 161 | 321 | 153 | 108 | 561 | 1,304 | 118 | 649 | 571 | 1,647 | 66 | 3,784 |
| <i>Average annual percentage change</i> | | | | | | | | | | | | |
| 1973–98 | -0.9% | 2.3% | 0.0% | -1.5% | 1.6% | 0.8% | -0.7% | 3.1% | ^e | 2.0% | -0.1% | 1.5% |
| 1988–98 | 1.4% | 1.9% | -0.1% | -0.4% | 2.3% | 1.6% | 0.2% | 1.9% | 0.2% | 0.3% | -0.7% | 1.0% |

Source:

Country stocks - U.S. Department of Energy, Energy Information Administration, *International Petroleum Statistics Report*, Washington, DC, January 2000, Table 4.5.

U.S. Strategic Petroleum Reserve - U.S. Department of Energy, Energy Information Administration, *Annual Energy Review, 1998*, Washington, DC, July 1999, Table 5.15.

^a Includes crude oil (including strategic reserves), lease condensate, natural gas plant liquids, unfinished oils, and finished petroleum products. Oil stocks include all non-military stocks held by importers, refiners, Governments, major non-importing final consumers and by foreign entities in certain facilities. See *Stocks* in Glossary for details.

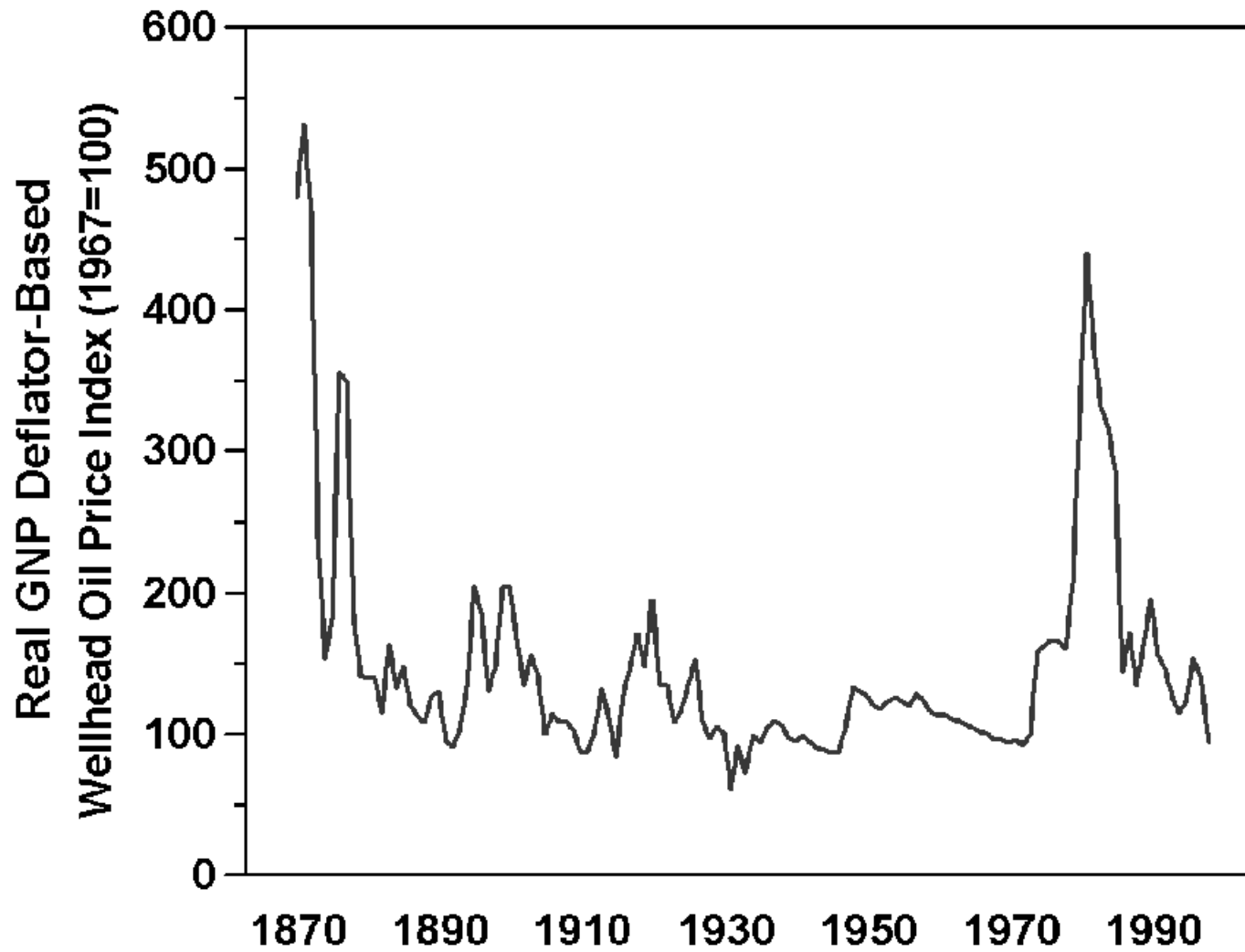
^b Through 1990, the data for Germany are for the former West Germany only. Beginning in 1991, the data for Germany are for the unified Germany, i.e., the former East Germany and West Germany.

^c Organization for Economic Cooperation and Development (OECD). See Glossary for membership.

^d Australia, New Zealand, and United States Territories. Data for Mexico, which joined the OECD on May 18, 1994, are not available.

^e Data are not available. The Energy Policy and Conservation Act, effective February 1976, authorized the establishment of the U.S. Strategic Petroleum Reserve.

Figure 1.2. Crude Oil Prices, 1870–98



Source:

Santini, Danilo J., "An Assessment of Oil Supply and Its Implications for Future Prices," *Nonrenewable Resources*, Vol. 7, No. 2, 1998, pp. 101-121, and 1994–98 data update.

The share of petroleum imported to the U.S. can be calculated using total imports or net imports. Net imports, which is the preferred data, rose to 50% of U.S. petroleum consumption for the first time in 1998 (see Table 1.9), while total imports reached 50% for the first time in 1993. OPEC share of net imports has been around 50-60% for the last ten years.

Table 1.5
U.S. Petroleum Net Imports by World Region of Origin, 1960–98
(thousand barrels per day)

| Year | Net imports | Total OPEC ^a | OPEC share | Persian Gulf nations ^b | Persian Gulf share |
|---|-------------|-------------------------|------------|-----------------------------------|--------------------|
| 1960 | 1,613 | 1,311 | 81.3% | c | c |
| 1965 | 2,281 | 1,475 | 64.7% | c | c |
| 1970 | 3,161 | 1,343 | 42.5% | c | c |
| 1971 | 3,701 | 1,671 | 45.2% | c | c |
| 1972 | 4,519 | 2,061 | 45.6% | c | c |
| 1973 | 6,025 | 2,991 | 49.6% | c | c |
| 1974 | 5,892 | 3,277 | 55.6% | c | c |
| 1975 | 5,846 | 3,599 | 61.6% | c | c |
| 1976 | 7,090 | 5,063 | 71.4% | c | c |
| 1977 | 8,565 | 6,190 | 72.3% | c | c |
| 1978 | 8,002 | 5,747 | 71.8% | c | c |
| 1979 | 7,985 | 5,633 | 70.5% | c | c |
| 1980 | 6,365 | 4,293 | 67.5% | c | c |
| 1981 | 5,401 | 3,315 | 61.4% | 1,215 | 22.5% |
| 1982 | 4,298 | 2,136 | 49.7% | 692 | 16.1% |
| 1983 | 4,312 | 1,843 | 42.7% | 439 | 10.2% |
| 1984 | 4,715 | 2,037 | 43.2% | 502 | 10.6% |
| 1985 | 4,286 | 1,821 | 42.5% | 309 | 7.2% |
| 1986 | 5,439 | 2,828 | 52.0% | 909 | 16.7% |
| 1987 | 5,914 | 3,055 | 51.7% | 1,074 | 18.2% |
| 1988 | 6,587 | 3,513 | 53.3% | 1,529 | 23.2% |
| 1989 | 7,202 | 4,124 | 57.3% | 1,858 | 25.8% |
| 1990 | 7,161 | 4,285 | 59.8% | 1,962 | 27.4% |
| 1991 | 6,626 | 4,065 | 61.3% | 1,833 | 27.7% |
| 1992 | 6,938 | 4,071 | 58.7% | 1,773 | 25.6% |
| 1993 | 7,618 | 4,253 | 55.8% | 1,774 | 23.3% |
| 1994 | 8,054 | 4,233 | 52.6% | 1,723 | 21.4% |
| 1995 | 7,886 | 3,980 | 50.5% | 1,563 | 19.8% |
| 1996 | 8,498 | 4,193 | 49.3% | 1,596 | 18.8% |
| 1997 | 9,158 | 4,542 | 49.6% | 1,747 | 19.1% |
| 1998 | 9,452 | 4,789 | 50.7% | 2,091 | 22.1% |
| <i>Average annual percentage change</i> | | | | | |
| 1960–98 | 4.8% | 3.5% | | c | |
| 1970–98 | 4.0% | 4.6% | | c | |
| 1988–98 | 3.7% | 3.1% | | 3.2% | |

Source:

U.S. Department of Energy, Energy Information Administration, *Annual Energy Review 1998*, Washington, DC, July 1999, Table 5.7.

^a Organization of Petroleum Exporting Countries. See Glossary for membership.

^b See Glossary for Persian Gulf nations.

^c Data are not available.

Estimates of 1996 military expenditures for defending oil supplies in the Middle East range from \$6 to \$60 billion per year. This wide range in estimates reflects the difficulty in assigning a precise figure to the military cost of defending the U.S. interests in the Middle East. The two main reasons for the difficulty are 1) the Department of Defense does not divide the budget into regional defense sectors and 2) it is difficult to determine how much of the cost is attributable to defending Persian Gulf oil.

Table 1.6
Summary of 1996 Military Expenditures for Defending Oil Supplies from the Middle East

| Source | Original estimates (billion dollars) | Year of original estimate | 1996 estimate (constant 1996 billion dollars) |
|--|---|------------------------------|---|
| General Accounting Office [1] | \$33 | 1990 | \$28 ^a |
| Congressional Research Service [2] | \$6.4 | 1990 | \$6 ^a |
| Greene and Leiby [3] | \$14.3 | 1990 | \$12 ^a |
| Ravenal [4] | \$50 | 1992 | \$60 ^b |
| Kaufmann and Steinbruner [5] | \$64.5 | 1990 | \$55 ^b |
| Delucchi and Murphy ^c [6] | \$20–40 | 1996 | \$20–40 ^b |
| Average estimate is \$32 billion, with a standard deviation of \$22 billion. | | | |

- [1] U.S. General Accounting Offices, *Southwest Asia: Cost of Protecting U.S. Interests*, GAO/NSIAD-91-250, Washington, DC, August 1991.
- [2] Congressional Research Service, *The External Costs of Oil Used in Transportation*, prepared for the U.S. Alternative Fuels Council, Washington, DC, June 1992.
- [3] Greene, D.L., and P. Leiby, *The Social Costs to the U.S. of Monopolization of the World Oil Market, 1972-1991*, ORNL-6744, Oak Ridge National Laboratory, Oak Ridge, TN, March 1993.
- [4] Ravenal, E.C., *Designing Defense for a New World Order: The Military Budget in 1992 and Beyond*, Cato Institute, Washington, DC, 1991.
- [5] Kaufmann, W.W., and J.D. Steinbruner, *Decisions for Defense: Prospects for a New Order*, The Brookings Institution, Washington, DC, 1991.
- [6] Delucchi, M.A., and J. Murphy, *U.S. Military Expenditures to Protect the Use of Persian-Gulf Oil for Motor Vehicles*, UCD-ITS-RR-96-3 (15), University of California, Davis, California, April 1996.

Source:

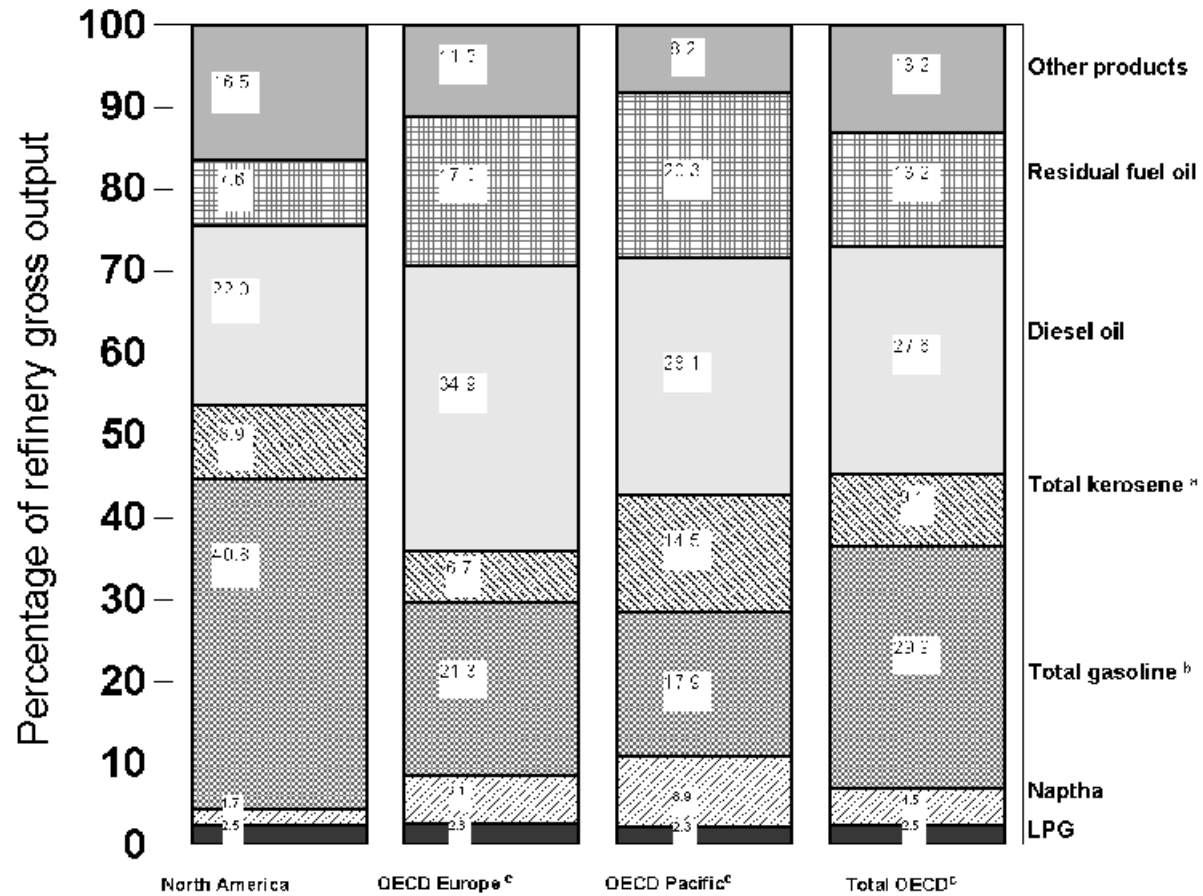
Hu, P.S., "Estimates of 1996 U.S. Military Expenditures on Defending Oil Supplies from the Middle East: A Literature Review," Oak Ridge National Laboratory, Oak Ridge, TN, March 1996.

^aEstimated based on a 3% annual inflation rate and a decrease of 30% in the total Defense budget from 1990 to 1996.

^bProvided by the author(s); thus, assumptions used for the projection are different from those used in the other estimates.

^cAnnual cost to defend all U.S. interests in the Persian Gulf.

Figure 1.3. Refinery Gross Output by World Region, 1999

**Source:**International Energy Agency, *Monthly Oil Survey*, January 2000, Paris, France, Table 7.^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.

Table 1.7
U.S. Refinery Input of Crude Oil and Petroleum Products, 1987–98
(thousand barrels)

| Year | Crude oil | Natural gas liquids | Oxygenates | | | | Other hydrocarbons ^c | Other liquids | Total input to refineries |
|---|-----------|---------------------|--------------|--------------|-------------------|-------------------------------|---------------------------------|---------------|---------------------------|
| | | | Fuel ethanol | Methanol | MTBE ^a | Other oxygenates ^b | | | |
| 1987 | 4,691,783 | 280,889 | d | d | d | d | 23,304 | 220,296 | 5,105,392 |
| 1988 | 4,848,175 | 304,566 | d | d | d | d | 19,515 | 203,794 | 5,258,386 |
| 1989 | 4,891,381 | 182,109 | d | d | d | d | 21,757 | 202,040 | 5,297,287 |
| 1990 | 4,894,379 | 170,589 | d | d | d | d | 28,642 | 231,466 | 5,325,076 |
| 1991 | 4,855,016 | 172,306 | d | d | d | d | 31,574 | 248,691 | 5,307,587 |
| 1992 | 4,908,603 | 171,701 | d | d | d | d | 47,918 | 224,758 | 5,352,980 |
| 1993 | 4,968,641 | 179,213 | 3,351 | 782 | 49,393 | 1,084 | 15,543 | 264,531 | 5,482,538 |
| 1994 | 5,061,111 | 169,868 | 3,620 | 242 | 52,937 | 1,676 | 14,130 | 179,678 | 5,483,262 |
| 1995 | 5,100,317 | 172,026 | 9,055 | 246 | 79,396 | 3,876 | 14,668 | 175,743 | 5,555,327 |
| 1996 | 5,195,265 | 164,552 | 11,156 | 126 | 79,407 | 3,444 | 20,587 | 193,695 | 5,668,232 |
| 1997 | 5,351,466 | 151,769 | 11,803 | 496 | 86,240 | 3,750 | 22,976 | 178,292 | 5,806,792 |
| 1998 | 5,434,383 | 146,921 | 11,722 | 675 | 89,362 | 3,363 | 22,759 | 183,376 | 5,892,561 |
| <i>Average annual percentage change</i> | | | | | | | | | |
| 1988-98 | 1.3% | -5.7% | ^e | ^e | ^e | ^e | -0.2% | -1.7% | 1.3% |
| 1993-98 | 1.8% | -3.9% | 28.5% | -2.9% | 12.6% | 25.4% | 7.9% | -7.1% | 1.5% |

Source:

U.S. Department of Energy, Energy Information Administration, *Petroleum Supply Annual*, 1998, Vol. 1, June 1999, Table 16, and annual.
(Additional resources: www.eia.doe.gov)

^aMethyl tertiary butyl ether (MTBE).

^bIncludes ethyl tertiary butyl ether (ETBE), tertiary amyl methyl ether (TAME), tertiary butyl alcohol (TBA), and other aliphatic alcohols and ethers intended for motor gasoline blending.

^cFor 1987-92, includes other hydrocarbons/hydrogen/oxygenates. For 1993-on, includes other hydrocarbons/hydrogen.

^dReported in "Other hydrocarbons" category in this year.

^eData 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 1.8
Refinery Yield of Petroleum Products from a Barrel of Crude Oil, 1978–98
(percentage)

| Year | Motor gasoline | Distillate fuel oil | Jet fuel | Liquified petroleum gas | Other ^a | Total ^b |
|------|----------------|---------------------|----------|-------------------------|--------------------|--------------------|
| 1978 | 44.1 | 21.4 | 6.6 | 2.3 | 29.6 | 104.0 |
| 1979 | 43.0 | 21.5 | 6.9 | 2.3 | 30.3 | 104.0 |
| 1980 | 44.5 | 19.7 | 7.4 | 2.4 | 30.0 | 104.0 |
| 1981 | 44.8 | 20.5 | 7.6 | 2.4 | 28.7 | 104.0 |
| 1982 | 46.4 | 21.5 | 8.1 | 2.2 | 26.2 | 104.4 |
| 1983 | 47.6 | 20.5 | 8.5 | 2.7 | 24.8 | 104.1 |
| 1984 | 46.7 | 21.5 | 9.1 | 2.9 | 24.2 | 104.4 |
| 1985 | 45.6 | 21.6 | 9.6 | 3.1 | 24.6 | 104.5 |
| 1986 | 45.7 | 21.2 | 9.8 | 3.2 | 24.8 | 104.7 |
| 1987 | 46.4 | 20.5 | 10.0 | 3.4 | 24.5 | 104.8 |
| 1988 | 46.0 | 20.8 | 10.0 | 3.6 | 24.4 | 104.8 |
| 1989 | 45.7 | 20.8 | 10.1 | 4.0 | 24.2 | 104.8 |
| 1990 | 45.6 | 20.9 | 10.7 | 3.6 | 24.1 | 104.9 |
| 1991 | 45.7 | 21.3 | 10.3 | 3.8 | 24.1 | 105.2 |
| 1992 | 46.0 | 21.2 | 9.9 | 4.3 | 24.0 | 105.4 |
| 1993 | 46.1 | 21.9 | 10.0 | 4.1 | 23.3 | 105.4 |
| 1994 | 45.5 | 22.3 | 10.1 | 4.2 | 23.2 | 105.3 |
| 1995 | 46.4 | 21.8 | 9.7 | 4.5 | 22.9 | 105.3 |
| 1996 | 45.7 | 22.7 | 10.4 | 4.5 | 22.4 | 105.7 |
| 1997 | 45.7 | 22.5 | 10.3 | 4.6 | 22.5 | 105.6 |
| 1998 | 46.2 | 22.3 | 10.4 | 4.4 | 22.5 | 105.8 |

Source:

Department of Energy, Energy Information Administration, *Petroleum Supply Annual 1998*, Vol. 1, June 1999, Table 19 and annual. (Additional resources: www.eia.doe.gov)

^a Includes aviation gasoline, kerosene, naphtha and other oils for petrochemical feedstock use, special naphthas, lubricants, waxes, petroleum coke, asphalt and road oil, still gas, and miscellaneous products.

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

Table 1.9
United States Petroleum Production and Consumption, 1973–99
(million barrels per day)

| Year | Domestic crude oil production | Net imports | | | Exports | | U.S. petroleum consumption ^a | World petroleum consumption | Net imports as a percentage of U.S. petroleum consumption | U.S. petroleum consumption as a percentage of world consumption | Transportation petroleum use as a percentage of domestic production ^b |
|----------------------------------|-------------------------------|-------------|--------------------|-------|--------------|--------------------|---|-----------------------------|---|---|--|
| | | Crude oil | Petroleum products | Total | Crude oil | Petroleum products | | | | | |
| 1973 | 9.21 | 3.24 | 2.78 | 6.03 | 0.00 | 0.23 | 17.31 | 56.39 | 34.8% | 30.7% | 76.7% |
| 1974 | 8.77 | 3.47 | 2.42 | 5.89 | 0.00 | 0.22 | 16.65 | 55.91 | 35.4% | 29.8% | 78.3% |
| 1975 | 8.37 | 4.10 | 1.75 | 5.85 | 0.00 | 0.20 | 16.32 | 55.48 | 35.8% | 29.4% | 82.8% |
| 1976 | 8.13 | 5.28 | 1.81 | 7.09 | 0.00 | 0.22 | 17.46 | 58.74 | 40.6% | 29.7% | 89.5% |
| 1977 | 8.25 | 6.57 | 2.00 | 8.57 | 0.05 | 0.19 | 18.43 | 61.63 | 46.5% | 29.9% | 91.7% |
| 1978 | 8.71 | 6.20 | 1.80 | 8.00 | 0.16 | 0.20 | 18.85 | 63.30 | 42.5% | 29.8% | 91.7% |
| 1979 | 8.55 | 6.28 | 1.70 | 7.99 | 0.24 | 0.24 | 18.51 | 65.17 | 43.1% | 28.4% | 92.0% |
| 1980 | 8.60 | 4.98 | 1.39 | 6.37 | 0.29 | 0.26 | 17.06 | 63.07 | 37.3% | 27.0% | 87.9% |
| 1981 | 8.57 | 4.17 | 1.23 | 5.40 | 0.23 | 0.37 | 16.06 | 60.87 | 33.6% | 26.4% | 86.9% |
| 1982 | 8.65 | 3.25 | 1.05 | 4.30 | 0.24 | 0.58 | 15.30 | 59.50 | 28.1% | 25.7% | 84.9% |
| 1983 | 8.69 | 3.17 | 1.15 | 4.31 | 0.16 | 0.58 | 15.23 | 58.74 | 28.3% | 25.9% | 85.3% |
| 1984 | 8.88 | 3.25 | 1.47 | 4.72 | 0.18 | 0.54 | 15.73 | 59.84 | 30.0% | 26.3% | 86.0% |
| 1985 | 8.97 | 3.00 | 1.29 | 4.29 | 0.20 | 0.58 | 15.73 | 60.10 | 27.3% | 26.2% | 86.6% |
| 1986 | 8.68 | 4.02 | 1.41 | 5.44 | 0.15 | 0.63 | 16.28 | 61.76 | 33.4% | 26.4% | 93.1% |
| 1987 | 8.35 | 4.52 | 1.39 | 5.91 | 0.15 | 0.61 | 16.67 | 63.00 | 35.5% | 26.5% | 98.5% |
| 1988 | 8.14 | 4.95 | 1.63 | 6.59 | 0.16 | 0.66 | 17.28 | 64.82 | 38.1% | 26.7% | 104.1% |
| 1989 | 7.61 | 5.70 | 1.50 | 7.20 | 0.14 | 0.72 | 17.33 | 65.92 | 41.6% | 26.3% | 112.1% |
| 1990 | 7.36 | 4.79 | 1.38 | 7.16 | 0.11 | 0.75 | 16.99 | 65.98 | 42.2% | 25.8% | 114.5% |
| 1991 | 7.42 | 5.67 | 0.96 | 6.63 | 0.12 | 0.89 | 16.71 | 66.57 | 39.6% | 25.1% | 110.6% |
| 1992 | 7.17 | 5.99 | 0.94 | 6.94 | 0.09 | 0.86 | 17.03 | 66.76 | 40.7% | 25.5% | 114.5% |
| 1993 | 6.85 | 6.69 | 0.93 | 7.62 | 0.10 | 0.90 | 17.24 | 67.00 | 44.2% | 25.7% | 118.7% |
| 1994 | 6.66 | 6.96 | 1.09 | 8.05 | 0.10 | 0.84 | 17.72 | 68.30 | 45.5% | 25.9% | 124.4% |
| 1995 | 6.56 | 7.14 | 0.75 | 7.89 | 0.10 | 0.86 | 17.73 | 69.87 | 44.5% | 25.4% | 127.0% |
| 1996 | 6.47 | 7.40 | 1.10 | 8.50 | 0.11 | 0.87 | 18.31 | 71.40 | 46.4% | 25.6% | 130.3% |
| 1997 | 6.45 | 8.12 | 1.04 | 9.16 | 0.11 | 0.90 | 18.62 | 73.13 | 49.2% | 25.5% | 131.7% |
| 1998 | 6.25 | 8.60 | 1.17 | 9.76 | 0.11 | 0.84 | 18.92 | 73.64 ^c | 51.6% | 25.7% ^c | 138.7% |
| 1999 | 5.95 | 8.47 | 1.14 | 9.61 | 0.11 | 0.82 | 19.39 | | 49.6% | | 146.2% |
| Average annual percentage change | | | | | | | | | | | |
| 1973–99 | -1.7% | 3.8% | -3.4% | 1.8% | ^c | 5.0% | 0.4% | 1.1% ^d | | | |
| 1989–99 | -2.4% | 4.0% | -2.7% | 2.9% | -2.4% | 1.3% | 1.1% | 1.2% ^d | | | |

Source:

U.S. Department of Energy, Energy Information Administration, *Monthly Energy Review*, March 2000, Washington, DC, 2000, pp. 42–47.

World petroleum consumption - U.S. Department of Energy, Energy Information Administration, *International Energy Annual 1998*, January 2000, Table 1.1.

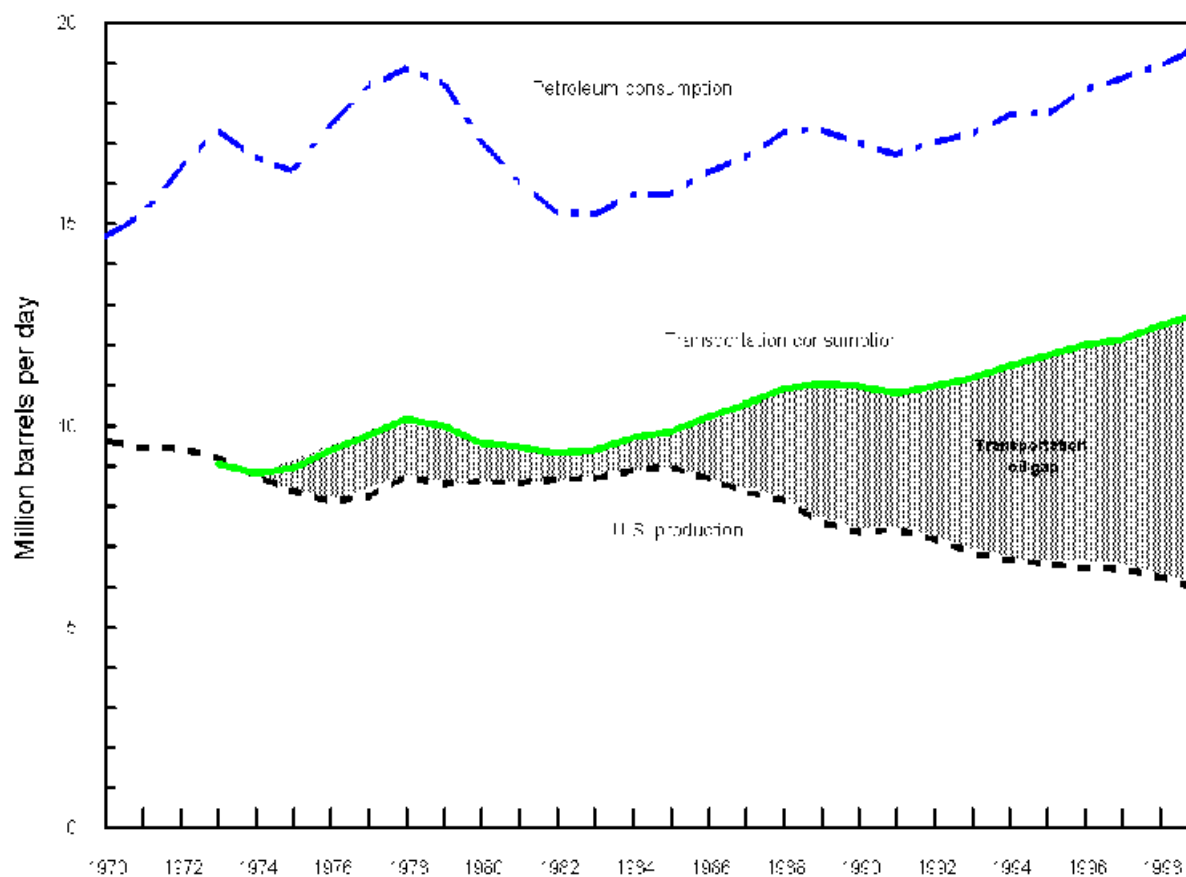
(Additional resources: www.eia.doe.gov)

^a Best estimate for U.S. petroleum consumption is the amount of petroleum products supplied to the U.S. in a given year. This is not the sum of crude oil production and net imports due to processing gain and stock changes.

^b Transportation petroleum use can be found on Table 1.10. This column has been revised to include domestic production of crude oil, natural gas plant liquids, and other hydrocarbons/hydrogen/oxygenates as shown in the *Monthly Energy Review*, Table 3.1a.

^c Data are not available.

^d Average annual percentage change is to the latest possible year.

Figure 1.4. United States Petroleum Production and Consumption, 1973–99

Source: See Tables 1.9 and 1.10.

Table 1.10
Consumption of Petroleum by End-Use Sector, 1973–99
(quadrillion Btu)

| Year | Transportation | Percentage | Residential and commercial | Percentage | Industrial | Percentage | Electric utilities | Percentage | Total | Total in million barrels per day ^a |
|---|----------------|------------|----------------------------|------------|------------|------------|--------------------|------------|-------|---|
| 1973 | 17.83 | 51.2% | 4.39 | 12.6% | 9.10 | 26.1% | 3.52 | 10.1% | 34.84 | 17.31 |
| 1974 | 17.40 | 52.0% | 4.00 | 12.0% | 8.69 | 26.0% | 3.37 | 10.1% | 33.46 | 16.66 |
| 1975 | 17.61 | 53.8% | 3.81 | 11.6% | 8.15 | 24.9% | 3.17 | 9.7% | 32.74 | 16.33 |
| 1976 | 18.51 | 52.6% | 4.18 | 11.9% | 9.01 | 25.6% | 3.48 | 9.9% | 35.18 | 17.51 |
| 1977 | 19.24 | 51.8% | 4.21 | 11.3% | 9.77 | 26.3% | 3.90 | 10.5% | 37.12 | 18.43 |
| 1978 | 20.04 | 52.8% | 4.07 | 10.7% | 9.87 | 26.0% | 3.99 | 10.5% | 37.97 | 18.85 |
| 1979 | 19.83 | 53.4% | 3.45 | 9.3% | 10.57 | 28.5% | 3.28 | 8.8% | 37.13 | 18.52 |
| 1980 | 19.01 | 55.6% | 3.04 | 8.9% | 9.53 | 27.9% | 2.63 | 7.7% | 34.21 | 17.11 |
| 1981 | 18.81 | 58.9% | 2.63 | 8.2% | 8.29 | 26.0% | 2.20 | 6.9% | 31.93 | 16.06 |
| 1982 | 18.42 | 60.9% | 2.45 | 8.1% | 7.79 | 25.8% | 1.57 | 5.2% | 30.23 | 15.29 |
| 1983 | 18.59 | 61.9% | 2.50 | 8.3% | 7.42 | 24.7% | 1.54 | 5.1% | 30.05 | 15.23 |
| 1984 | 19.22 | 61.9% | 2.54 | 8.2% | 8.01 | 25.8% | 1.29 | 4.2% | 31.06 | 15.77 |
| 1985 | 19.50 | 63.1% | 2.52 | 8.2% | 7.81 | 25.3% | 1.09 | 3.5% | 30.92 | 15.73 |
| 1986 | 20.27 | 63.0% | 2.56 | 8.0% | 7.92 | 24.6% | 1.45 | 4.5% | 32.20 | 16.28 |
| 1987 | 20.87 | 63.5% | 2.59 | 7.9% | 8.15 | 24.8% | 1.26 | 3.8% | 32.87 | 16.67 |
| 1988 | 21.63 | 63.2% | 2.60 | 7.6% | 8.43 | 24.6% | 1.56 | 4.6% | 34.22 | 17.33 |
| 1989 | 21.87 | 63.9% | 2.53 | 7.4% | 8.13 | 23.8% | 1.69 | 4.9% | 34.22 | 17.33 |
| 1990 | 21.81 | 65.0% | 2.17 | 6.5% | 8.32 | 24.8% | 1.25 | 3.7% | 33.55 | 16.99 |
| 1991 | 21.46 | 65.3% | 2.15 | 6.5% | 8.06 | 24.5% | 1.18 | 3.6% | 32.85 | 16.72 |
| 1992 | 21.81 | 65.0% | 2.13 | 6.4% | 8.64 | 25.8% | 0.95 | 2.8% | 33.53 | 17.08 |
| 1993 | 22.20 | 65.6% | 2.14 | 6.3% | 8.45 | 25.0% | 1.05 | 3.1% | 33.84 | 17.24 |
| 1994 | 22.76 | 65.6% | 2.09 | 6.0% | 8.85 | 25.5% | 0.97 | 2.8% | 34.67 | 17.72 |
| 1995 | 23.20 | 67.1% | 2.08 | 6.0% | 8.62 | 24.9% | 0.66 | 1.9% | 34.56 | 17.73 |
| 1996 | 23.74 | 66.4% | 2.20 | 6.2% | 9.10 | 25.4% | 0.73 | 2.0% | 35.77 | 18.37 |
| 1997 | 24.00 | 66.2% | 2.14 | 5.9% | 9.31 | 25.7% | 0.82 | 2.3% | 36.27 | 18.62 |
| 1998 | 24.64 | 66.7% | 1.97 | 5.3% | 9.15 | 24.8% | 1.17 | 3.2% | 36.93 | 18.92 |
| 1999 | 25.21 | 66.9% | 2.07 | 5.5% | 9.45 | 25.1% | 0.97 | 2.6% | 37.70 | 19.39 |
| <i>Average annual percentage change</i> | | | | | | | | | | |
| 1973–99 | 1.3% | | -2.9% | | 0.1% | | -4.8% | | 0.3% | 0.4% |
| 1989–99 | 1.4% | | -2.0% | | 1.5% | | -5.4% | | 1.0% | 1.1% |

Source:

U.S. Department of Energy, Energy Information Administration, *Monthly Energy Review*, March 2000, pp. 27, 29, 31, 33.

(Additional resources: www.eia.doe.gov)

^a Calculated from Total column using Table A.3. Approximate Heat Content of Petroleum Products, Weighted Average, from the *Monthly Energy Review*, March 2000.

Table 1.11
Transportation of Petroleum and Petroleum Products in the U.S. by Mode, 1975–98

| Year | Pipelines ^a | | Water carriers | | Motor carriers ^b | | Railroads | | Total |
|---|------------------------|-----------|---------------------|-----------|-----------------------------|-----------|---------------------|-----------|---------------------|
| | (billion ton-miles) | (percent) | (billion ton-miles) | (percent) | (billion ton-miles) | (percent) | (billion ton-miles) | (percent) | (billion ton-miles) |
| 1975 | 507.0 | 59.88% | 298.0 | 35.20% | 27.6 | 3.26% | 14.1 | 1.66% | 846.7 |
| 1976 | 515.0 | 59.35% | 306.9 | 35.37% | 32.5 | 3.75% | 13.3 | 1.53% | 867.7 |
| 1977 | 546.0 | 59.13% | 333.3 | 36.09% | 29.6 | 3.21% | 14.5 | 1.57% | 923.4 |
| 1978 | 585.8 | 50.49% | 530.6 | 45.73% | 30.6 | 2.65% | 13.2 | 1.14% | 1,160.2 |
| 1979 | 608.3 | 51.78% | 522.9 | 44.51% | 30.1 | 2.56% | 13.5 | 1.15% | 1,174.8 |
| 1980 | 588.2 | 47.24% | 617.8 | 49.61% | 26.8 | 2.15% | 12.5 | 1.00% | 1,245.3 |
| 1981 | 563.7 | 46.27% | 617.2 | 50.66% | 24.9 | 2.04% | 12.6 | 1.03% | 1,218.4 |
| 1982 | 565.7 | 46.44% | 616.9 | 50.64% | 22.7 | 1.86% | 12.9 | 1.06% | 1,218.2 |
| 1983 | 556.1 | 45.45% | 630.5 | 51.53% | 25.1 | 2.05% | 11.8 | 0.97% | 1,223.5 |
| 1984 | 568.1 | 48.14% | 570.7 | 48.36% | 29.2 | 2.47% | 12.2 | 1.03% | 1,180.2 |
| 1985 | 564.3 | 47.20% | 590.4 | 49.39% | 28.7 | 2.40% | 12.1 | 1.01% | 1,195.5 |
| 1986 | 577.9 | 48.65% | 568.1 | 47.83% | 29.7 | 2.50% | 12.1 | 1.02% | 1,187.8 |
| 1987 | 586.8 | 49.08% | 566.5 | 47.37% | 30.4 | 2.54% | 12.1 | 1.01% | 1,195.8 |
| 1988 | 601.1 | 50.59% | 543.7 | 45.76% | 30.5 | 2.57% | 12.8 | 1.08% | 1,188.1 |
| 1989 | 584.2 | 53.39% | 466.2 | 42.61% | 30.4 | 2.78% | 13.4 | 1.22% | 1,094.2 |
| 1990 | 584.1 | 54.24% | 449.0 | 41.70% | 29.7 | 2.76% | 14.0 | 1.30% | 1,076.8 |
| 1991 | 578.5 | 53.27% | 465.0 | 42.81% | 28.8 | 2.65% | 13.8 | 1.27% | 1,086.1 |
| 1992 | 588.8 | 53.93% | 459.3 | 42.07% | 28.8 | 2.64% | 14.8 | 1.36% | 1,091.7 |
| 1993 | 592.9 | 57.31% | 401.7 | 38.82% | 24.8 | 2.40% | 15.2 | 1.47% | 1,034.6 |
| 1994 | 591.4 | 56.50% | 411.4 | 39.31% | 28.1 | 2.68% | 15.8 | 1.51% | 1,046.7 |
| 1995 | 601.1 | 57.53% | 400.9 | 38.37% | 26.3 | 2.51% | 16.6 | 1.59% | 1,044.9 |
| 1996 | 619.2 | 60.58% | 356.5 | 34.88% | 29.7 | 2.90% | 16.8 | 1.64% | 1,022.2 |
| 1997 | 616.5 | 64.45% | 295.6 | 30.90% | 27.7 | 2.90% | 16.7 | 1.75% | 956.5 |
| 1998 | 619.8 | 66.66% | 265.0 | 28.50% | 28.3 | 3.04% | 16.7 | 1.80% | 929.8 |
| <i>Average annual percentage change</i> | | | | | | | | | |
| 1975–98 | 0.9% | | -0.5% | | 0.1% | | 0.7% | | 0.4% |
| 1988–98 | 0.1% | | -3.1% | | -0.3% | | 1.2% | | -1.1% |

Source:

Association of Oil Pipelines, *Shifts in Petroleum Transportation*, Washington, DC, April 2000, Table 1.

^a The amounts carried by pipeline are based on ton-miles of crude and petroleum products for Federally regulated pipelines (84 percent) plus an estimated breakdown of crude and petroleum products of the ton-miles for pipelines not Federally regulated (16 percent).

^b The amounts carried by motor carriers are estimated.

Chapter 2

Energy

Summary Statistics from Tables in this Chapter

| Source | | | |
|-----------|--|--|---------|
| Table 2.3 | Transportation share of U.S. energy consumption, 1999 | 28.0% | |
| Table 2.4 | Petroleum share of transportation energy consumption, 1999 | 97.4% | |
| Table 2.6 | Transportation energy use by mode, 1998 | (trillion Btu) | (share) |
| | <i>Automobiles</i> | 9,078 | 35.3% |
| | <i>Light trucks</i> | 6,324 | 24.6% |
| | <i>Heavy trucks</i> | 4,218 | 16.4% |
| | <i>Buses</i> | 195 | 0.8% |
| | <i>Air</i> | 2,351 | 9.2% |
| | <i>Water</i> | 1,295 | 5.0% |
| | <i>Pipeline</i> | 901 | 3.5% |
| | <i>Rail</i> | 586 | 2.3% |
| Table 2.9 | Alternative vehicle fuel and oxygenate consumption, 1999 | (thousand gasoline equivalent gallons) | (share) |
| | <i>Liquified petroleum gas</i> | 243,648 | 5.6% |
| | <i>Compressed natural gas</i> | 86,073 | 2.0% |
| | <i>Liquified natural gas</i> | 6,062 | 0.1% |
| | <i>M85/M100</i> | 1,557 | 0.0% |
| | <i>E85/E100</i> | 2,548 | 0.0% |
| | <i>Electricity</i> | 1,458 | 0.0% |
| | <i>MTBE</i> | 3,097,800 | 71.6% |
| | <i>Ethanol in gasohol</i> | 890,200 | 20.6% |

Table 2.1
World Production of Primary Energy by Selected Country Groups, 1989–98
(quadrillion Btu)

| | 1989 | 1990 | 1991 | 1992 | 1993 | 1994 | 1995 | 1996 | 1997 | 1998 ^a | 1998 Share |
|---------------------------------|---------------|---------------|---------------|---------------|---------------|---------------|---------------|---------------|---------------|-------------------|---------------|
| Petroleum | | | | | | | | | | | |
| World total | 134.66 | 136.35 | 135.90 | 136.50 | 136.52 | 138.30 | 141.47 | 144.93 | 149.01 | 151.96 | 39.8% |
| OECD ^b | 38.07 | 38.20 | 39.20 | 39.70 | 39.57 | 40.94 | 41.66 | 43.14 | 43.59 | 43.21 | 11.3% |
| Non OECD | 96.58 | 98.15 | 96.70 | 96.81 | 96.95 | 97.36 | 99.81 | 101.79 | 105.42 | 108.75 | 28.5% |
| Natural gas | | | | | | | | | | | |
| World total | 74.24 | 75.91 | 76.68 | 76.84 | 78.35 | 79.16 | 80.23 | 83.97 | 84.00 | 85.49 | 22.4% |
| OECD ^b | 30.61 | 31.44 | 32.18 | 33.02 | 34.18 | 35.67 | 36.14 | 38.05 | 37.94 | 38.19 | 10.0% |
| Non OECD | 43.63 | 44.47 | 44.50 | 43.82 | 44.17 | 43.49 | 44.09 | 45.92 | 46.06 | 47.30 | 12.4% |
| Coal | | | | | | | | | | | |
| World total | 91.05 | 92.28 | 87.65 | 88.35 | 85.72 | 87.53 | 89.67 | 90.78 | 90.64 | 88.61 | 23.2% |
| OECD ^b | 42.12 | 42.00 | 39.96 | 39.16 | 38.19 | 39.58 | 39.37 | 40.25 | 40.55 | 40.47 | 10.6% |
| Non OECD | 48.93 | 50.28 | 47.69 | 49.19 | 47.53 | 47.95 | 50.31 | 50.53 | 50.09 | 48.14 | 12.4% |
| Hydroelectric power | | | | | | | | | | | |
| World total | 21.74 | 22.56 | 22.98 | 22.96 | 24.31 | 24.48 | 25.73 | 26.11 | 26.74 | 26.63 | 7.0% |
| OECD ^b | 11.84 | 12.22 | 12.33 | 12.18 | 12.91 | 12.43 | 13.31 | 13.71 | 13.96 | 13.63 | 3.6% |
| Non OECD | 9.90 | 10.33 | 10.65 | 10.78 | 11.40 | 12.06 | 12.42 | 12.40 | 12.78 | 13.01 | 3.4% |
| Nuclear electric power | | | | | | | | | | | |
| World total | 19.82 | 20.37 | 21.29 | 21.36 | 22.07 | 22.50 | 23.35 | 24.17 | 23.95 | 24.48 | 6.4% |
| OECD ^b | 16.38 | 16.99 | 17.93 | 18.15 | 18.99 | 19.61 | 20.35 | 20.84 | 20.59 | 21.20 | 5.5% |
| Non OECD | 3.44 | 3.38 | 3.36 | 3.21 | 3.08 | 2.89 | 3.01 | 3.33 | 3.36 | 3.27 | 0.9% |
| Total energy^c | | | | | | | | | | | |
| World total | 345.76 | 351.39 | 348.48 | 350.29 | 351.33 | 356.54 | 365.18 | 374.87 | 379.22 | 382.18 | 100.0% |
| OECD ^b | 143.05 | 144.54 | 145.33 | 146.23 | 147.94 | 152.51 | 155.25 | 160.56 | 161.14 | 161.33 | 42.2% |
| Non OECD | 202.71 | 206.85 | 203.15 | 204.06 | 203.39 | 204.04 | 209.93 | 214.31 | 218.08 | 220.85 | 57.8% |

Source:

U.S. Department of Energy, Energy Information Administration, *International Energy Annual 1998*, Washington, DC, January 2000, Table 2.9. (Additional resources: www.eia.doe.gov)

^a Preliminary.

^b Organization for Economic Cooperation and Development (OECD). See Glossary for membership.

^c Geothermal, solar, and wind electric power are included in the total though not shown separately on this table.

Table 2.2
World Consumption of Primary Energy by Selected Country Groups, 1989–98
(quadrillion Btu)

| | 1989 | 1990 | 1991 | 1992 | 1993 | 1994 | 1995 | 1996 | 1997 | 1998 ^a | 1998 Share |
|---------------------------------|---------------|---------------|---------------|---------------|---------------|---------------|---------------|---------------|---------------|-------------------|---------------|
| Petroleum | | | | | | | | | | | |
| World total | 134.82 | 134.87 | 136.11 | 136.62 | 136.61 | 139.10 | 142.39 | 145.51 | 148.62 | 149.73 | 39.6% |
| OECD ^b | 82.63 | 82.70 | 83.63 | 85.72 | 86.56 | 88.92 | 90.45 | 92.70 | 94.01 | 94.39 | 25.0% |
| Non OECD | 52.19 | 52.17 | 52.48 | 50.90 | 50.05 | 50.18 | 51.94 | 52.82 | 54.61 | 55.34 | 14.7% |
| Natural gas | | | | | | | | | | | |
| World total | 73.93 | 74.78 | 76.02 | 76.23 | 78.40 | 78.34 | 80.01 | 84.01 | 83.77 | 84.40 | 22.3% |
| OECD ^b | 35.85 | 36.26 | 37.69 | 38.58 | 40.20 | 41.33 | 43.22 | 45.70 | 45.64 | 45.62 | 12.1% |
| Non OECD | 38.08 | 38.52 | 38.33 | 37.64 | 38.21 | 37.01 | 36.79 | 38.31 | 38.13 | 38.78 | 10.3% |
| Coal | | | | | | | | | | | |
| World total | 90.33 | 90.41 | 87.15 | 87.05 | 87.54 | 88.33 | 89.63 | 91.64 | 90.19 | 87.53 | 23.2% |
| OECD ^b | 42.76 | 41.82 | 40.77 | 39.45 | 41.05 | 40.85 | 40.55 | 41.99 | 41.50 | 41.13 | 10.9% |
| Non OECD | 47.57 | 48.59 | 46.39 | 47.60 | 46.49 | 47.48 | 49.07 | 49.64 | 48.69 | 46.40 | 12.3% |
| Hydroelectric power | | | | | | | | | | | |
| World total | 21.89 | 22.65 | 23.18 | 23.20 | 24.57 | 24.77 | 26.00 | 26.44 | 26.96 | 26.84 | 7.1% |
| OECD ^b | 11.99 | 12.31 | 12.53 | 12.42 | 13.16 | 12.71 | 13.58 | 14.03 | 14.18 | 13.83 | 3.7% |
| Non OECD | 9.90 | 10.33 | 10.65 | 10.78 | 11.40 | 12.06 | 12.42 | 12.40 | 12.78 | 13.01 | 3.4% |
| Nuclear electric power | | | | | | | | | | | |
| World total | 19.82 | 20.37 | 21.29 | 21.36 | 22.07 | 22.50 | 23.35 | 24.17 | 23.95 | 24.48 | 6.5% |
| OECD ^b | 16.38 | 16.99 | 17.93 | 18.15 | 18.99 | 19.61 | 20.35 | 20.84 | 20.59 | 21.20 | 5.6% |
| Non OECD | 3.44 | 3.38 | 3.36 | 3.21 | 3.08 | 2.89 | 3.01 | 3.33 | 3.36 | 3.27 | 0.9% |
| Total energy^c | | | | | | | | | | | |
| World total | 344.83 | 346.83 | 347.51 | 348.46 | 353.21 | 357.25 | 365.72 | 376.25 | 378.04 | 377.72 | 100.0% |
| OECD ^b | 193.67 | 193.76 | 196.20 | 198.11 | 203.78 | 207.38 | 212.22 | 219.47 | 220.15 | 220.59 | 58.4% |
| Non OECD | 151.16 | 153.07 | 151.31 | 150.35 | 149.43 | 149.87 | 153.50 | 156.78 | 157.89 | 157.13 | 41.6% |

Source:

U.S. Department of Energy, Energy Information Administration, *International Energy Annual 1998* Washington, DC, January 2000, Table 1.8. (Additional resources: www.eia.doe.gov)

^a Preliminary.

^b Organization for Economic Cooperation and Development (OECD). See Glossary for membership.

^c Geothermal, solar, and wind electric power are included in the total though not shown separately on this table.

Total energy use in the U.S. has grown to 92 quads in 1999. The transportation sector accounts for 28% of total energy use.

Table 2.3
U. S. Consumption of Total Energy by End-Use Sector, 1970–99^a
(quadrillion Btu)

| Year | Transportation | Percentage transportation of total | Residential and commercial | Industrial | Total |
|---|----------------|--|-------------------------------|------------|-------|
| 1970 | 16.07 | 24.2% | 21.71 | 28.65 | 66.43 |
| 1971 | 16.70 | 24.6% | 22.59 | 28.59 | 67.88 |
| 1972 | 17.70 | 24.8% | 23.69 | 29.88 | 71.27 |
| 1973 | 18.61 | 25.1% | 24.14 | 31.53 | 74.28 |
| 1974 | 18.12 | 25.0% | 23.72 | 30.69 | 72.54 |
| 1975 | 18.24 | 25.9% | 23.90 | 28.40 | 70.55 |
| 1976 | 19.10 | 25.7% | 25.02 | 30.24 | 74.36 |
| 1977 | 19.82 | 26.0% | 25.38 | 31.08 | 76.29 |
| 1978 | 20.62 | 26.4% | 26.08 | 31.39 | 78.09 |
| 1979 | 20.47 | 25.9% | 25.81 | 32.62 | 78.90 |
| 1980 | 19.70 | 25.9% | 25.65 | 30.61 | 75.96 |
| 1981 | 19.51 | 26.4% | 25.24 | 29.24 | 73.99 |
| 1982 | 19.07 | 26.9% | 25.63 | 26.15 | 70.85 |
| 1983 | 19.14 | 27.1% | 25.62 | 25.76 | 70.52 |
| 1984 | 19.81 | 26.7% | 26.47 | 27.87 | 74.14 |
| 1985 | 20.07 | 27.1% | 26.70 | 27.21 | 73.98 |
| 1986 | 20.82 | 28.0% | 26.85 | 26.63 | 74.30 |
| 1987 | 21.46 | 27.9% | 27.61 | 27.83 | 76.89 |
| 1988 | 22.31 | 27.8% | 28.92 | 28.99 | 80.22 |
| 1989 | 22.57 | 27.7% | 29.42 | 29.37 | 81.36 |
| 1990 | 22.54 | 27.7% | 28.80 | 29.95 | 81.30 |
| 1991 | 22.13 | 27.3% | 29.42 | 29.57 | 81.12 |
| 1992 | 22.47 | 27.3% | 29.27 | 30.68 | 82.42 |
| 1993 | 22.90 | 27.2% | 30.45 | 30.88 | 84.22 |
| 1994 | 23.52 | 27.4% | 30.70 | 31.76 | 85.99 |
| 1995 | 23.97 | 27.4% | 31.54 | 32.04 | 87.56 |
| 1996 | 24.52 | 27.1% | 32.94 | 32.95 | 90.42 |
| 1997 | 24.82 | 27.3% | 33.09 | 33.07 | 90.98 |
| 1998 | 25.36 | 27.8% | 33.17 | 32.73 | 91.26 |
| 1999 | 25.92 | 28.0% | 33.63 | 33.16 | 92.72 |
| <i>Average annual percentage change</i> | | | | | |
| 1970–99 | 1.7% | | 1.5% | 0.5% | 1.2% |
| 1989–99 | 1.4% | | 1.3% | 1.2% | 1.3% |

Source:

U.S. Department of Energy, Energy Information Administration, *Monthly Energy Review*, March 2000, Washington, DC, Table 2.2. (Additional resources: www.eia.doe.gov)

^aElectrical energy losses have been distributed among the sectors.

Due to the lack of consistent historical data, renewable energy sources are not included for sectors other than the electric utilities. Additional detailed data about oxygenates and other fuel types for the Transportation sector are found on Table 2.9.

Table 2.4
Distribution of Energy Consumption by Source, 1973, 1980, and 1999
(percentage)

| Energy source | Transportation | | | Residential & Commercial | | | Industrial | | | Electric utilities | | |
|--------------------------|----------------|-------|-------|--------------------------|-------|-------|------------|-------|-------|--------------------|-------|-------|
| | 1973 | 1980 | 1999 | 1973 | 1980 | 1999 | 1973 | 1980 | 1999 | 1973 | 1980 | 1999 |
| Petroleum | 95.8 | 96.5 | 97.4 | 18.2 | 11.8 | 11.7 | 28.9 | 31.1 | 36.9 | 17.7 | 10.7 | 2.8 |
| Natural gas ^a | 4.0 | 3.3 | 2.6 | 31.6 | 29.4 | 45.2 | 32.9 | 27.4 | 39.9 | 18.9 | 15.5 | 9.2 |
| Coal | 0.0 | 0.0 | 0.0 | 1.1 | 0.6 | 0.6 | 12.8 | 10.3 | 9.0 | 43.6 | 49.5 | 55.8 |
| Hydroelectric | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.1 | 0.1 | 0.1 | 15.0 | 12.6 | 9.6 |
| Nuclear | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 4.6 | 11.2 | 22.3 |
| Electricity ^b | 0.2 | 0.2 | 0.1 | 49.2 | 58.2 | 42.5 | 25.2 | 31.1 | 14.0 | 0.0 | 0.0 | 0.0 |
| Other ^c | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.2 | 0.5 | 0.2 |
| Total | 100.0 | 100.0 | 100.0 | 100. | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 |
| | | | | 0 | | | | | | | | |

Source:

U.S. Department of Energy, Energy Information Administration, *Monthly Energy Review, March 2000*, Washington, DC, pp. 27, 29, 31, 33.
(Additional resources: www.eia.doe.gov)

^a Includes supplemental gaseous fuels. Transportation sector includes pipeline fuel and natural gas vehicle use.

^b Includes electrical system energy losses.

^c Energy generated from geothermal, wood, waste, wind, photovoltaic, and solar thermal energy sources.

As data about alternative fuel use come available, an attempt is made to incorporate it into this table. Sometimes assumptions must be made in order to use the data. Please see Appendix A for detailed methodology of all energy data.

Table 2.5
Domestic Consumption of Transportation Energy by Mode and Fuel Type, 1998^a
(trillion Btu)

| | Gasoline | Diesel fuel | Liquified petroleum gas | Jet fuel | Residual fuel oil | Natural gas | Electricity |
|---|----------------------|--------------------------|-------------------------|----------------|-------------------|--------------|--------------|
| <u>HIGHWAY</u> | 15,544.9 | 4,266.4 | 23.7 | | | 4.8 | 0.9 |
| Automobiles | 8,952.3 ^b | 126.0 | | | | 0.1 | |
| Motorcycles | 25.7 | | | | | | |
| Buses | 12.5 | 176.4 | 0.5 | | | 4.3 | 0.9 |
| Transit | 4.8 | 76.8 | 0.5 | | | 4.3 | 0.9 |
| Intercity ^c | | 22.6 | | | | | |
| School ^c | 7.7 | 77.0 | | | | | |
| Trucks | 6,554.4 | 3,694.0 | 23.2 | | | 0.4 | |
| Light trucks ^d | 6,076.4 | 238.1 | 9.2 | | | 0.4 | |
| Other trucks | 478.0 | 3,726.0 | 14.0 | | | 0.0 | |
| <u>OFF-HIGHWAY</u> | 142.6 | 570.1^e | | | | | |
| Construction | 29.3 | 178.5 ^e | | | | | |
| Agriculture | 113.3 | 391.6 ^e | | | | | |
| <u>NONHIGHWAY</u> | 343.3 | 817.2 | | 2,313.7 | 694.6 | 655.2 | 309.9 |
| Air | 37.4 | | | 2,313.7 | | | |
| General aviation | 37.4 | | | 110.0 | | | |
| Domestic air carriers | | | | 1,857.3 | | | |
| International air carriers ^f | | | | 346.4 | | | |
| Water | 305.9 | 294.8 | | | 694.6 | | |
| Freight | | 294.8 | | | 694.6 | | |
| Recreational | 305.9 | | | | | | |
| Pipeline | | | | | | 655.2 | 246.0 |
| Rail | | 522.4 | | | | | 63.9 |
| Freight (Class I) | | 502.0 | | | | | |
| Passenger | | 20.4 | | | | | 61.0 |
| Transit | | | | | | | 42.6 |
| Commuter | | 10.8 | | | | | 15.1 |
| Intercity ^c | | 9.8 | | | | | 3.3 |
| TOTAL | 16,030.8 | 5,653.7 | 23.7 | 2,313.7 | 694.6 | 660.0 | 310.8 |

Source:

See Appendix A for Table 2.5.

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

^b Includes gasohol.

^c Estimated using vehicle travel information.

^d Two-axle, four-tire trucks.

^e 1985 data.

^f One half of fuel used by domestic carriers in international operation.

The 1997 data have been revised to include the latest data available.

Table 2.6
Transportation Energy Use by Mode, 1997–98^a

| | Trillion Btu | | Thousand barrels per day crude oil equivalent | | Percentage of total | |
|---------------------------|-------------------|-----------------|--|-----------------|---------------------|--------------|
| | 1997 | 1998 | 1997 | 1998 | 1997 | 1998 |
| <u>HIGHWAY</u> | 19,244.3 | 19,840.7 | 9,681.2 | 9,981.3 | 76.6% | 77.2% |
| Automobiles | 8,746.3 | 9,078.4 | 4,400.0 | 4,567.1 | 34.8% | 35.3% |
| Motorcycles | 25.2 | 25.7 | 12.7 | 12.9 | 0.1% | 0.1% |
| Buses | 199.1 | 194.6 | 100.1 | 97.9 | 0.8% | 0.8% |
| Transit | 93.0 | 87.3 | 46.8 | 43.9 | 0.4% | 0.3% |
| Intercity | 22.2 ^c | 22.6 | 11.2 ^c | 11.4 | 0.1% | 0.1% |
| School | 83.9 ^c | 84.7 | 42.2 ^c | 42.6 | 0.3% | 0.3% |
| Trucks | 10,273.7 | 10,542.0 | 5,168.4 | 5,303.4 | 40.9% | 41.0% |
| Light trucks ^d | 6,187.5 | 6,324.1 | 3,112.8 | 3,181.5 | 24.6% | 24.6% |
| Other trucks | 4,086.2 | 4,217.9 | 2,055.6 | 2,121.9 | 16.3% | 16.4% |
| <u>OFF-HIGHWAY</u> | 730.8 | 712.7 | 367.6 | 358.5 | 2.9% | 2.8% |
| Construction | 216.1 | 207.8 | 108.7 | 104.5 | 0.9% | 0.8% |
| Agriculture | 514.7 | 504.9 | 258.9 | 254.0 | 2.0% | 2.0% |
| <u>NONHIGHWAY</u> | 5,158.4 | 5,133.9 | 2,595.0 | 2,582.7 | 20.5% | 20.0% |
| Air | 2,383.9 | 2,351.1 | 1,149.0 | 1,182.8 | 9.1% | 9.2% |
| General aviation | 121.1 | 147.4 | 60.9 | 74.2 | 0.5% | 0.6% |
| Domestic air carriers | 1,831.0 | 1,857.3 | 921.1 | 934.4 | 7.3% | 7.2% |
| International air | 331.8 | 346.4 | 166.9 | 174.3 | 1.3% | 1.3% |
| Water | 1,309.0 | 1,295.3 | 658.5 | 651.6 | 5.2% | 5.0% |
| Freight | 1,009.3 | 989.4 | 507.7 | 497.7 | 4.0% | 3.9% |
| Recreational | 299.7 | 305.9 | 150.8 | 153.9 | 1.2% | 1.2% |
| Pipeline | 987.0 | 901.2 | 496.5 | 453.4 | 3.9% | 3.5% |
| Rail | 578.9 | 586.3 | 291.0 | 295.0 | 2.3% | 2.3% |
| Freight | 499.7 | 502.0 | 251.4 | 252.5 | 2.0% | 2.0% |
| Passenger | 78.8 | 84.3 | 39.6 | 42.4 | 0.3% | 0.3% |
| Transit | 42.5 | 43.1 | 21.4 | 21.7 | 0.2% | 0.2% |
| Commuter | 23.7 | 28.2 | 11.9 | 14.2 | 0.1% | 0.1% |
| Intercity | 12.6 ^c | 13.0 | 6.3 ^c | 6.5 | 0.1% | 0.1% |
| TOTAL | 25,133.5 | 25,687.3 | 12,643. | 12,922.5 | 100.0 | 100% |

Source: See Appendix A for Table 2.5 (detailed breakdown).

^aCivilian consumption only. Totals may not include all possible uses of fuels for transportation (e.g., snowmobiles).

^bThousand barrels per day crude oil equivalents based average on the EIA weighted average of heat content of petroleum products used in transportation.

^cEstimated using vehicle travel information.

^dTwo-axle, four-tire trucks.

The Federal Highway Administration produced revised estimates of auto, light truck, and other truck historical fuel use in order to produce a consistent trend. Light trucks include pickups, vans, and sport utility vehicles.

Table 2.7
Transportation Energy Consumption by Mode, 1970–98
(trillion Btu)

| Year | Autos | Light trucks | Light vehicles subtotal | Motor-cycles | Buses ^a | Heavy trucks | Highway subtotal | Air | Water | Pipeline | Rail | Nonhighway subtotal | Total transportation ^b |
|---|--------|--------------|-------------------------|--------------|--------------------|--------------|------------------|-------|-------|----------|------|---------------------|-----------------------------------|
| 1970 | 8,527 | 1,540 | 10,067 | 7 | 109 | 1,503 | 11,686 | 1,307 | 753 | 985 | 558 | 3,603 | 15,289 |
| 1975 | 9,321 | 2,386 | 11,707 | 14 | 119 | 1,939 | 13,779 | 1,274 | 851 | 835 | 563 | 3,523 | 17,302 |
| 1976 | 9,844 | 2,605 | 12,449 | 15 | 129 | 2,046 | 14,639 | 1,333 | 1,001 | 803 | 585 | 3,722 | 18,361 |
| 1977 | 9,940 | 2,799 | 12,739 | 16 | 132 | 2,268 | 15,155 | 1,411 | 1,103 | 781 | 595 | 3,890 | 19,045 |
| 1978 | 10,140 | 3,022 | 13,162 | 18 | 135 | 2,539 | 15,854 | 1,467 | 1,311 | 781 | 589 | 4,148 | 20,002 |
| 1979 | 9,629 | 3,057 | 12,686 | 22 | 137 | 2,644 | 15,489 | 1,568 | 1,539 | 856 | 613 | 4,576 | 20,065 |
| 1980 | 8,798 | 2,976 | 11,774 | 26 | 139 | 2,651 | 14,590 | 1,528 | 1,677 | 889 | 596 | 4,690 | 19,280 |
| 1981 | 8,695 | 2,964 | 11,659 | 27 | 143 | 2,706 | 14,535 | 1,455 | 1,562 | 899 | 565 | 4,481 | 19,016 |
| 1982 | 8,695 | 2,839 | 11,534 | 25 | 146 | 2,707 | 14,412 | 1,468 | 1,290 | 853 | 488 | 4,099 | 18,511 |
| 1983 | 8,814 | 2,995 | 11,809 | 22 | 145 | 2,757 | 14,733 | 1,505 | 1,187 | 738 | 482 | 3,912 | 18,645 |
| 1984 | 8,857 | 3,202 | 12,059 | 22 | 154 | 2,846 | 15,081 | 1,633 | 1,251 | 780 | 523 | 4,187 | 19,268 |
| 1985 | 8,954 | 3,422 | 12,376 | 23 | 161 | 2,842 | 15,402 | 1,678 | 1,311 | 758 | 487 | 4,234 | 19,636 |
| 1986 | 9,162 | 3,636 | 12,798 | 23 | 154 | 2,903 | 15,878 | 1,823 | 1,295 | 738 | 423 | 4,279 | 20,157 |
| 1987 | 9,179 | 3,827 | 13,006 | 24 | 157 | 2,990 | 16,177 | 1,894 | 1,326 | 775 | 485 | 4,480 | 20,657 |
| 1988 | 9,180 | 4,096 | 13,276 | 25 | 159 | 3,117 | 16,577 | 1,978 | 1,338 | 878 | 498 | 4,692 | 21,269 |
| 1989 | 9,251 | 4,173 | 13,424 | 26 | 163 | 3,196 | 16,809 | 1,981 | 1,376 | 895 | 501 | 4,753 | 21,562 |
| 1990 | 8,707 | 4,467 | 13,174 | 24 | 163 | 3,329 | 16,690 | 2,059 | 1,487 | 928 | 492 | 4,966 | 21,656 |
| 1991 | 8,048 | 4,793 | 12,841 | 23 | 174 | 3,396 | 16,434 | 1,926 | 1,567 | 864 | 463 | 4,820 | 21,254 |
| 1992 | 8,188 | 5,134 | 13,322 | 24 | 182 | 3,460 | 16,988 | 1,971 | 1,641 | 849 | 476 | 4,937 | 21,925 |
| 1993 | 8,389 | 5,375 | 13,764 | 25 | 192 | 3,567 | 17,548 | 1,996 | 1,473 | 889 | 513 | 4,871 | 22,419 |
| 1994 | 8,494 | 5,530 | 14,024 | 26 | 202 | 3,772 | 18,024 | 2,056 | 1,414 | 955 | 546 | 4,971 | 22,995 |
| 1995 | 8,519 | 5,717 | 14,236 | 25 | 179 | 3,950 | 18,390 | 2,117 | 1,522 | 971 | 565 | 5,175 | 23,565 |
| 1996 | 8,622 | 5,936 | 14,558 | 25 | 194 | 4,033 | 18,850 | 2,196 | 1,460 | 984 | 578 | 5,218 | 24,068 |
| 1997 | 8,746 | 6,188 | 14,934 | 25 | 199 | 4,086 | 19,244 | 2,284 | 1,309 | 987 | 579 | 5,159 | 24,403 |
| 1998 | 9,078 | 6,324 | 15,402 | 26 | 195 | 4,218 | 19,841 | 2,351 | 1,295 | 901 | 586 | 5,133 | 24,974 |
| <i>Average annual percentage change</i> | | | | | | | | | | | | | |
| 1970–9 | 0.2% | 5.2% | 1.5% | 4.7% | 2.1% | 3.8% | 1.9% | 2.2% | 2.0% | -0.3% | 0.2% | 1.3% | 1.8% |
| 1988–9 | -0.1% | 4.4% | 1.5% | 0.4% | 2.1% | 3.1% | 1.8% | 1.7% | 1.3% | 0.3% | 1.6% | 0.9% | 1.6% |

Source:

See Appendix A for Table 2.7.

^a Beginning in 1992 data became available on alternative fuel use by transit buses.

^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).

The Federal Highway Administration 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. Prior to the Energy Policy Act of 1992, gasohol was defined as a blend of gasoline and at least 10%, by volume, alcohol. Effective January 1, 1993, three types of gasohol were defined: 10% gasohol—containing at least 10% alcohol; 7.7% gasohol—containing 7.7% alcohol but less than 10%; and 5.7% gasohol—containing at least 5.7% alcohol but less than 7.7%. See Table 2.9 for details on oxygenate usage.

Table 2.8
Highway Usage of Gasoline and Special Fuels, 1973–98
(million gallons)

| Year | Gasoline | Gasohol | Ethanol used in gasohol ^a | Total gasoline and gasohol | Diesel ^b | Percent diesel | Total highway fuel use |
|---|----------|---------|---|-------------------------------|---------------------|-------------------|---------------------------|
| 1973 | c | c | c | 100,636 | 9,837 | 8.9% | 110,473 |
| 1975 | c | c | c | 99,354 | 9,631 | 8.8% | 108,985 |
| 1980 | 100,686 | 497 | 49.7 | 101,183 | 13,777 | 12.0% | 114,960 |
| 1981 | 98,884 | 713 | 71.3 | 99,597 | 14,856 | 13.0% | 114,453 |
| 1982 | 96,220 | 2,259 | 225.9 | 98,479 | 14,905 | 13.1% | 113,384 |
| 1983 | 95,852 | 4,254 | 425.5 | 100,106 | 15,975 | 13.8% | 116,081 |
| 1984 | 95,996 | 5,420 | 542.0 | 101,416 | 17,320 | 14.6% | 118,736 |
| 1985 | 95,567 | 8,004 | 781.7 | 103,571 | 17,751 | 14.6% | 121,322 |
| 1986 | 98,618 | 8,138 | 780.7 | 106,756 | 18,427 | 14.7% | 125,183 |
| 1987 | 101,790 | 6,912 | 800.4 | 108,702 | 19,046 | 14.9% | 127,748 |
| 1988 | 101,678 | 8,138 | 813.8 | 109,816 | 20,070 | 15.5% | 129,886 |
| 1989 | 103,691 | 6,941 | 694.1 | 110,632 | 21,232 | 16.1% | 131,864 |
| 1990 | 102,645 | 7,539 | 753.9 | 110,184 | 21,399 | 16.3% | 131,583 |
| 1991 | 99,304 | 8,644 | 864.4 | 107,948 | 20,676 | 16.1% | 128,624 |
| 1992 | 102,119 | 8,831 | 883.1 | 110,950 | 21,988 | 16.5% | 132,938 |
| 1993 | 103,417 | 10,287 | 978.8 | 113,704 | 23,490 | 17.1% | 137,194 |
| 1994 | 103,997 | 11,010 | 1,042.0 | 115,007 | 25,124 | 17.9% | 140,131 |
| 1995 | 103,968 | 13,093 | 1,213.7 | 117,061 | 26,206 | 18.3% | 143,267 |
| 1996 | 107,390 | 12,125 | 1,076.1 | 119,515 | 27,160 | 18.5% | 146,675 |
| 1997 | 106,237 | 14,701 | 1,328.9 | 120,938 | 29,394 | 19.6% | 150,332 |
| 1998 | 110,715 | 13,979 | 1,296.8 | 124,694 | 30,190 | 19.5% | 154,884 |
| <i>Average annual percentage change</i> | | | | | | | |
| 1973–98 | d | d | d | 0.9% | 4.6% | | 1.4% |
| 1988–98 | 0.9% | 5.6% | 4.8% | 1.3% | 4.2% | | 1.8% |

Source:

U.S. Department of Transportation, Federal Highway Administration, *Highway Statistics 1998*, Washington, DC, 1999, Tables MF-21 and MF-33E, and annual.
(Additional resources: www.fhwa.dot.gov)

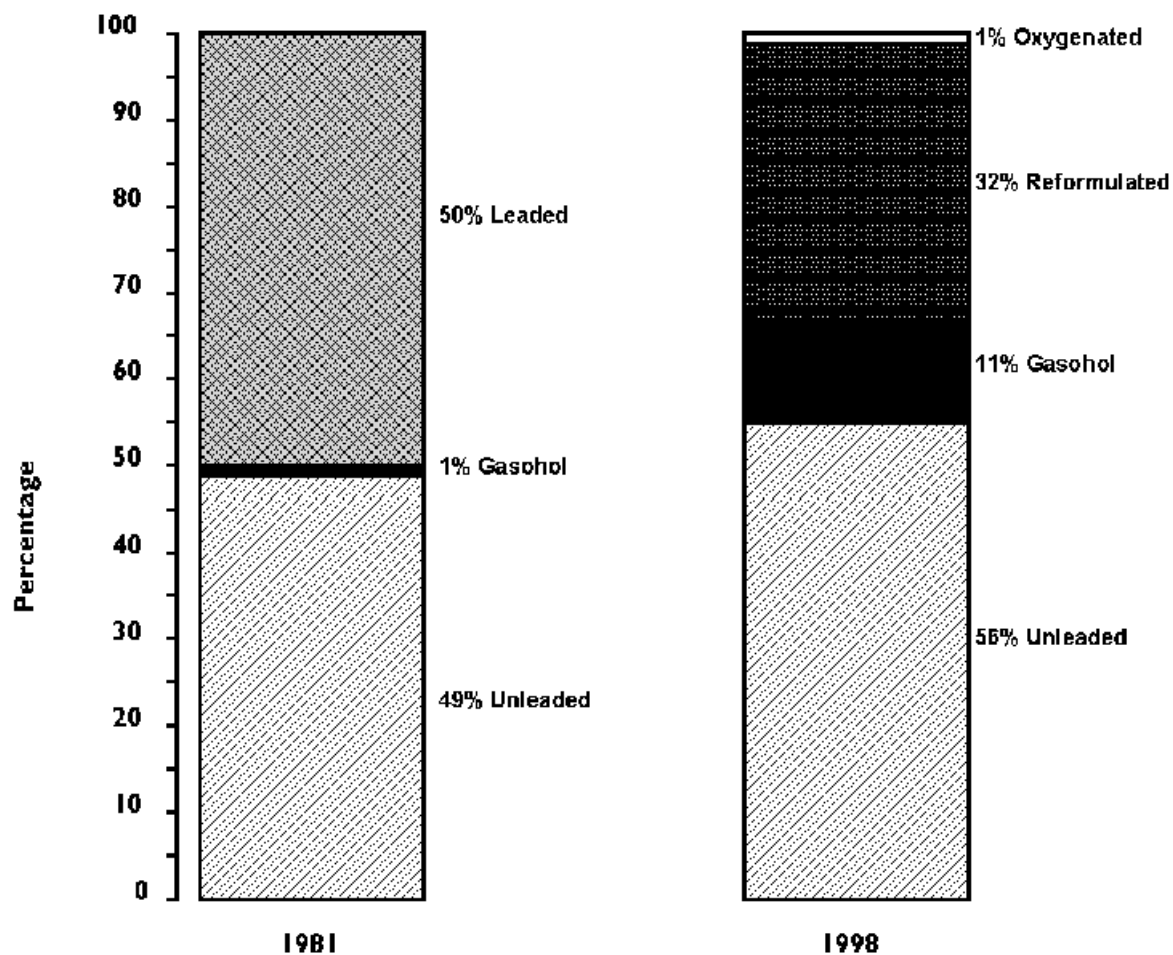
^a Estimated for 1980–92 as 10% of gasohol consumption.

^b Consists primarily of diesel fuel, with small quantities of liquified petroleum gas.

^c Data for gasoline and gasohol cannot be separated in this year.

^d Data are not available.

Figure 2.1. Motor Gasoline Quantities by Type, 1981 and 1998



Source:

U.S. Department of Energy, Energy Information Administration, *Petroleum Supply Annual 1998*, Washington, DC, Tables 17 and 20.

U.S. Department of Energy, Energy Information Administration, *The Motor Gasoline Industry: Past, Present and Future*, Washington, DC, Table 5.

U.S. Department of Transportation, Federal Highway Administration, *Highway Statistics 1998*, Washington, DC, Table MF-33E, and annual.

Table 2.9
Alternative Vehicle Fuel Consumption, 1992–2000
 (thousand gasoline equivalent gallons)

| Alternative fuel | 1992 | 1993 | 1994 | 1995 | 1996 | 1997 | 1998 | 1999 | 2000 ^a | 2000 Percentage |
|-----------------------|-----------------|-----------------|------------------|-----------------|-----------------|-----------------|-----------------|-----------------|-------------------|--------------------|
| Liquified petroleum | 208,142 | 264,655 | 248,467 | 232,701 | 239,158 | 238,356 | 241,583 | 243,648 | 249,550 | 5.7% |
| Compressed natural | 16,823 | 21,603 | 24,160 | 35,162 | 46,923 | 65,192 | 73,251 | 86,073 | 104,501 | 2.4% |
| Liquified natural gas | 585 | 1,901 | 2,345 | 2,759 | 3,247 | 3,714 | 5,343 | 6,062 | 7,460 | 0.2% |
| M85 ^b | 1,069 | 1,593 | 2,340 | 2,023 | 1,775 | 1,554 | 1,212 | 1,108 | 1,062 | 0.0% |
| M100 | 2,547 | 3,166 | 3,190 | 2,150 | 347 | 347 | 449 | 449 | 449 | 0.0% |
| E85 ^b | 21 | 48 | 80 | 190 | 694 | 1,280 | 1,727 | 2,489 | 3,283 | 0.1% |
| E95 ^b | 85 | 80 | 140 | 995 | 2,699 | 1,136 | 59 | 59 | 59 | 0.0% |
| Electricity | 359 | 288 | 430 | 663 | 773 | 1,010 | 1,202 | 1,458 | 1,712 | 0.0% |
| Subtotal | 229,631 | 293,334 | 281,152 | 276,643 | 295,616 | 312,589 | 324,826 | 341,346 | 368,076 | 8.4% |
| Oxygenates | | | | | | | | | | |
| MTBE ^c | 1,175,00 | 2,069,20 | 2,018,800 | 2,691,20 | 2,749,70 | 3,104,20 | 2,915,60 | 3,097,80 | 3,111,50 | 70.9% |
| Ethanol in gasohol | 701,000 | 760,000 | 845,900 | 910,700 | 660,200 | 830,700 | 916,000 | 890,200 | 908,700 | 20.7% |
| Total | 2,105,63 | 3,122,53 | 3,145,852 | 3,878,54 | 3,705,51 | 4,247,48 | 4,156,42 | 4,311,34 | 4,388,27 | 100.0% |

Source:

U.S. Department of Energy, Energy Information Administration, *Alternatives to Traditional Transportation Fuels, 1998*, Washington, DC, 1999, web site www.eia.doe.gov/cneaf/solar.renewables/alt_trans_fuel98/atf1-13_99.html. (Additional resources: www.eia.doe.gov)

^aBased on plans or projections.

^bConsumption includes gasoline portion of the mixture.

^cMethyl 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).

Table 2.10
U.S. Production and Imports of MTBE^a and Fuel Ethanol, 1978–99
(million gallons)

| Year | Production | | Imports | |
|---|--------------|-------------------|--------------|-------------------|
| | Fuel ethanol | MTBE ^a | Fuel ethanol | MTBE ^a |
| 1978 | 20 | b | b | b |
| 1979 | 40 | b | b | b |
| 1980 | 80 | b | b | b |
| 1981 | 85 | 122 | b | b |
| 1982 | 234 | 132 | b | b |
| 1983 | 443 | 134 | b | b |
| 1984 | 567 | 235 | b | b |
| 1985 | 793 | 302 | b | b |
| 1986 | 798 | 359 | b | b |
| 1987 | 825 | b | b | b |
| 1988 | 800 | b | b | b |
| 1989 | 750 | b | b | b |
| 1990 | 756 | b | b | b |
| 1991 | 875 | b | b | b |
| 1992 | 1,080 | 1,542 | b | b |
| 1993 | 1,156 | 2,081 | 10 | 306 |
| 1994 | 1,280 | 2,205 | 12 | 595 |
| 1995 | 1,355 | 2,506 | 16 | 692 |
| 1996 | 974 | 2,846 | 13 | 733 |
| 1997 | 1,274 | 3,011 | 4 | 918 |
| 1998 | 1,387 | 3,151 | 3 | 1,040 |
| 1999 | 1,472 | 3,315 | b | b |
| <i>Average annual percentage change</i> | | | | |
| 1978–99 | 22.7% | b | b | b |
| 1989–99 | 7.0% | b | b | b |

Source:

Production - 1992–99 Ethanol and MTBE: U.S. Department of Energy, Energy Information Administration, *Petroleum Supply Monthly*, Washington, DC, January 1999, Table D1. 1978–90 Ethanol: Information Resources, Inc., Washington, DC, 1991. 1981–86 MTBE: EA-Mueller, Inc., Baltimore, MD, 1992.

Imports - U.S. Department of Energy, Energy Information Administration, *Petroleum Supply Annual, 1998, Volume 1*, Washington, DC, 1999, Table 20, and annual.

^aMethyl tertiary-butyl ether.

^bData are not available.

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

Table 2.11
Passenger Travel and Energy Use in the United States, 1998

| | Number of vehicles (thousands) | Vehicle- miles (millions) | Passenger- miles (millions) | Load factor (persons/vehicle) | Energy intensities | | Energy use (trillion Btu) |
|---------------------------|-----------------------------------|---------------------------------|-----------------------------------|--------------------------------------|---------------------------|-----------------------------|------------------------------|
| | | | | | (Btu per vehicle-mile) | (Btu per passenger-mile) | |
| Automobiles | 131,838.5 | 1,545,830 | 2,473,328 | 1.6 | 5,873 | 3,671 | 9,078.4 |
| Personal trucks | 55,231.7 | 626,343 | 1,002,149 | 1.6 | 7,166 | 4,478 | 4,488.1 |
| Motorcycles | 3,879.5 | 10,260 | 12,312 | 1.2 | 2,505 | 2,087 | 25.7 |
| Buses | 658.2 | 7,957 | a | a | 243,457 | a | 194.6 |
| Transit | 74.6 | 2,291 | 20,602 | 9.0 | 38,106 | 4,238 | 87.3 |
| Intercity | 19.2 | 1,366 | 31,700 | 23.2 | 16,545 | 713 | 22.6 |
| School | 582.4 | 4,300 | a | a | 19,698 | a | 84.7 |
| Air | a | a | 477,695 | a | a | 41,966 | 2,004.7 |
| Certificated route | a | 5,031 | 464,395 | 92.3 | 369,171 | 3,999 | 1,857.3 |
| General aviation | 204.7 | a | 13,300 | a | a | 11,083 | 147.4 |
| Recreational boats | 12,565.9 | a | a | a | a | a | 305.9 |
| Rail | 17.7 | 1,176 | 26,765 | 23.1 | 71,684 | 3,150 | 84.3 |
| Intercity ^b | 1.3 ^c | 316 ^d | 5,325 ^e | 16.9 | 41,139 | 2,441 | 13.0 ^f |
| Transit ^g | 11.5 | 609 | 13,402 | 22.0 | 70,772 | 3,216 | 43.1 |
| Commuter | 4.9 | 251 | 8,038 | 32.0 | 112,351 | 3,508 | 28.2 |

Source:

See Appendix A for Table 2.11.

^aData are not available.

^bAmtrak only.

^cPassenger train cars.

^dPassenger train car-miles.

^eRevenue passenger-miles.

^fEstimated using vehicle travel data.

^gLight and heavy rail.

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 2.12
Energy Intensities of Passenger Modes, 1970–98

| Year | Automobiles | | Light truck ^a (Btu per vehicle-mile) | Buses | | | | Air | | Rail | |
|----------------------------------|------------------------|--------------------------|--|------------------------|--------------------------|---------------------------------------|----------------------------------|--|---|---|---|
| | (Btu per vehicle-mile) | (Btu per passenger-mile) | | Transit ^b | | Intercity (Btu per passenger-mile) | School (Btu per vehicle-mile) | Certificated air carriers (Btu per passenger-mile) | General aviation (Btu per passenger-mile) | Intercity Amtrak (Btu per passenger-mile) | Rail transit (Btu per passenger-mile) |
| | | | | (Btu per vehicle-mile) | (Btu per passenger-mile) | | | | | | |
| 1970 | 9,301 | 4,896 | 12,492 | 31,796 | 2,472 | 1,051 | 17,857 | 10,351 | 10,374 | ^c | 2,453 |
| 1975 | 9,015 | 4,745 | 11,890 | 33,748 | 2,814 | 976 | 17,040 | 7,883 | 10,658 | 3,677 | 2,962 |
| 1976 | 9,130 | 4,805 | 11,535 | 34,598 | 2,896 | 996 | 17,051 | 7,481 | 10,769 | 3,397 | 2,971 |
| 1977 | 8,961 | 4,716 | 11,171 | 35,120 | 2,889 | 961 | 16,983 | 7,174 | 11,695 | 3,568 | 2,691 |
| 1978 | 8,844 | 4,655 | 10,815 | 36,603 | 2,883 | 953 | 17,018 | 6,333 | 11,305 | 3,683 | 2,210 |
| 1979 | 8,647 | 4,551 | 10,473 | 36,597 | 2,795 | 963 | 16,980 | 5,858 | 10,787 | 3,472 | 2,794 |
| 1980 | 7,915 | 4,166 | 10,230 | 36,553 | 2,813 | 1,069 | 16,379 | 5,837 | 11,497 | 3,176 | 3,008 |
| 1981 | 7,672 | 4,038 | 10,001 | 37,745 | 3,027 | 1,155 | 16,385 | 5,743 | 11,123 | 2,957 | 2,946 |
| 1982 | 7,485 | 3,939 | 9,275 | 38,766 | 3,237 | 1,149 | 16,296 | 5,147 | 13,015 | 3,156 | 3,069 |
| 1983 | 7,376 | 4,098 | 9,141 | 37,962 | 3,177 | 1,174 | 16,236 | 5,107 | 11,331 | 2,957 | 3,212 |
| 1984 | 7,218 | 4,010 | 8,945 | 37,507 | 3,204 | 1,247 | 14,912 | 5,031 | 11,454 | 3,027 | 3,732 |
| 1985 | 7,182 | 3,990 | 8,754 | 38,862 | 2,421 | 1,324 | 16,531 | 5,679 | 11,707 | 2,800 | 3,461 |
| 1986 | 7,213 | 4,007 | 8,578 | 39,869 | 3,512 | 869 | 15,622 | 5,447 | 11,935 | 2,574 | 3,531 |
| 1987 | 6,975 | 3,875 | 8,376 | 38,557 | 3,542 | 939 | 15,615 | 4,753 | 11,496 | 2,537 | 3,534 |
| 1988 | 6,700 | 3,722 | 8,155 | 39,121 | 3,415 | 965 | 15,585 | 4,814 | 11,794 | 2,462 | 3,585 |
| 1989 | 6,602 | 3,668 | 7,779 | 36,583 | 3,711 | 963 | 15,575 | 4,796 | 10,229 | 2,731 | 3,397 |
| 1990 | 6,183 | 3,864 | 7,774 | 36,647 | 3,735 | 944 | 16,368 | 4,811 | 10,146 | 2,609 | 3,453 |
| 1991 | 5,925 | 3,703 | 7,381 | 36,939 | 3,811 | 978 | 16,419 | 4,560 | 9,869 | 2,503 | 3,710 |
| 1992 | 5,970 | 3,731 | 7,263 | 40,472 | 4,303 | 978 | 16,386 | 4,482 | 9,785 | 2,610 | 3,575 |
| 1993 | 6,103 | 3,814 | 7,208 | 39,005 | 4,257 | 972 | 19,093 | 4,304 | 9,653 | 2,646 | 3,687 |
| 1994 | 6,041 | 3,775 | 7,232 | 40,102 | 4,604 | 876 | 20,591 | 4,455 | 9,163 | 2,351 | 3,828 |
| 1995 | 5,923 | 3,702 | 7,237 | 40,175 | 4,650 | 804 | 13,680 | 4,236 | 10,152 | 2,314 | 3,818 |
| 1996 | 5,874 | 3,671 | 7,247 | 39,307 | 4,512 | 785 | 13,680 | 4,081 | 10,481 | 2,389 | 3,444 |
| 1997 | 5,822 | 3,639 | 6,981 | 38,101 | 4,318 | 726 | 16,432 | 4,047 | 9,688 | 2,458 | 3,253 |
| 1998 | 5,873 | 3,671 | 7,166 | 38,106 | 4,238 | 713 | 19,698 | 3,999 | 11,083 | 2,460 | 3,216 |
| Average annual percentage change | | | | | | | | | | | |
| 1970–98 | -1.6% | -1.0% | -2.0% | 0.6% | 1.9% | -1.4% | -0.3% | -3.3% | -0.2% | -1.5% ^d | 1.0% |
| 1988–98 | -1.3% | -0.1% | -1.3% | -0.3% | 2.2% | -3.0% | 2.4% | -1.9% | -0.6% | 0.0% | -1.1% |

Source:

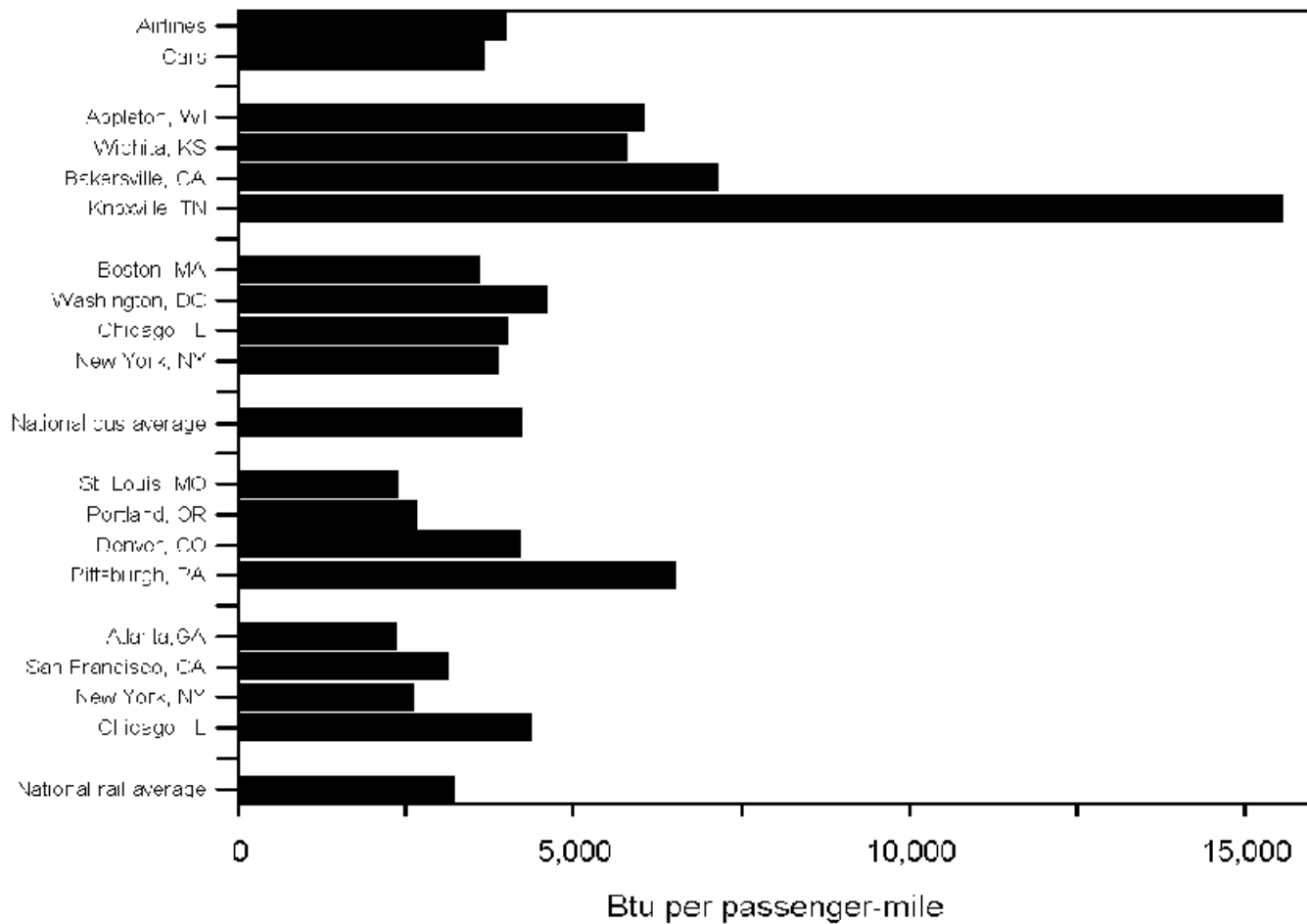
See Appendix A for Table 2.12.

^aAll two-axle, four-tire trucks.

^bSeries not continuous between 1983 and 1984 because of a change in data source by the American Public Transit Association (APTA).

^cData are not available.

^dAverage annual percentage change is from earliest year possible.

Figure 2.2. Energy Intensity for Transit in the U.S., 1998**Source:**

U.S. Department of Transportation, Federal Transit Administration, 1998 National Transit Database, Washington, DC.
 (Additional resources: www.fta.dot.gov/ntl)

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 2.13
Intercity Freight Movement and Energy Use in the United States, 1998

| | Number of vehicles (thousands) | Vehicle- miles (millions) | Ton-miles (millions) | Tons shipped (millions) | Average length of haul (miles) | Energy intensity (Btu/ton-mile) | Energy use (trillion Btu) |
|--|--------------------------------------|---------------------------------|-------------------------|----------------------------|-----------------------------------|---------------------------------------|------------------------------|
| Truck^a | 2,388 | 133,890 | 1,027,000 | 3,952 | 701^b | 2,990 | 3,070.6 |
| Waterborne commerce^c | 42 | ^d | 672,795 | 1,087 | 619 | 436 | 293.1 |
| Coastwise | ^d | ^d | 314,864 | 250 | 1,261 | ^d | ^d |
| Lakewise | ^d | ^d | 61,654 | 122 | 504 | ^d | ^d |
| Internal and local | ^d | ^d | 294,896 | 715 | 416 | ^d | ^d |
| Pipeline | d | d | d | d | d | d | 847.5 |
| Natural gas | ^d | ^d | ^d | ^d | ^d | ^d | 689.1 |
| Crude oil and products | ^d | ^d | 620,000 | 1,116 | ^d | 256 | 158.4 |
| Class I railroads^e | 576 | 32,657 | 1,376,802 | 1,649 | 835 | 365 | 502.0 |

Source:

See Appendix A for Table 2.13.

^aThe definition of intercity truck was “tightened” to exclude smaller trucks. See Appendix A for details.

^b701 miles is for general freight (less than truckload). Based on data from the Eno Transportation Foundation, the average length of haul for specialized freight (truckload) was 285 miles.

^cIncludes commerce by foreign and domestic carriers in the U.S.

^dData are not available.

^eRailroad measures are: number vehicles = number freight cars, vehicle-miles = car-miles, ton-miles = revenue ton-miles.

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

Table 2.14
Energy Intensities of Freight Modes, 1970–98

| Year | Heavy single-unit and combination trucks (Btu per vehicle-mile) | Class I freight railroad | | Domestic waterborne commerce (Btu per ton-mile) |
|---|---|----------------------------|--------------------|---|
| | | (Btu per freight car-mile) | (Btu per ton-mile) | |
| 1970 | 24,154 | 17,668 | 691 | 545 |
| 1971 | 23,694 | 18,814 | 717 | 506 |
| 1972 | 23,871 | 18,292 | 714 | 522 |
| 1973 | 23,977 | 18,468 | 677 | 576 |
| 1974 | 23,983 | 18,852 | 681 | 483 |
| 1975 | 23,836 | 18,741 | 687 | 549 |
| 1976 | 23,773 | 18,938 | 680 | 468 |
| 1977 | 23,873 | 19,225 | 669 | 458 |
| 1978 | 24,013 | 18,930 | 641 | 383 |
| 1979 | 24,260 | 19,187 | 618 | 457 |
| 1980 | 24,431 | 18,742 | 597 | 358 |
| 1981 | 24,892 | 18,628 | 572 | 360 |
| 1982 | 24,296 | 18,403 | 553 | 310 |
| 1983 | 23,740 | 17,863 | 525 | 319 |
| 1984 | 23,363 | 17,797 | 510 | 346 |
| 1985 | 23,015 | 17,500 | 497 | 446 |
| 1986 | 22,917 | 17,265 | 486 | 463 |
| 1987 | 22,391 | 16,791 | 456 | 402 |
| 1988 | 22,586 | 16,758 | 443 | 361 |
| 1989 | 22,391 | 16,896 | 437 | 403 |
| 1990 | 22,765 | 16,618 | 420 | 388 |
| 1991 | 22,710 | 15,834 | 391 | 386 |
| 1992 | 22,559 | 16,044 | 393 | 398 |
| 1993 | 22,308 | 16,055 | 389 | 389 |
| 1994 | 22,159 | 16,338 | 388 | 369 |
| 1995 | 22,172 | 15,993 | 372 | 374 |
| 1996 | 21,964 | 15,747 | 368 | 412 |
| 1997 | 21,340 | 15,783 | 370 | 415 |
| 1998 | 21,514 | 15,372 | 365 | 436 |
| <i>Average annual percentage change</i> | | | | |
| 1970–98 | -0.4% | -0.5% | -2.3% | -0.8% |
| 1988–98 | -0.5% | -0.9% | -1.9% | 1.9% |

Source:

See Appendix A for Table 2.14.

Chapter 3

Greenhouse Gas Emissions

Summary Statistics from Tables in this Chapter

| Source | | | |
|-----------|--|-------|-------|
| Table 3.1 | Greenhouse gas emissions (million metric tonnes) | 1990 | 1997 |
| | <i>France</i> | 554 | 550 |
| | <i>Germany</i> | 1,201 | 1,036 |
| | <i>United Kingdom</i> | 727 | 657 |
| | <i>Japan</i> | 1,175 | 1,280 |
| | <i>United States</i> | 5,903 | 6,514 |
| Table 3.5 | Transportation share of U.S. carbon dioxide emissions from fossil fuel consumption | | |
| | <i>1984</i> | | 30.5% |
| | <i>1990</i> | | 32.2% |
| | <i>1998</i> | | 32.6% |
| Table 3.6 | Carbon dioxide emissions from U.S. transportation energy use, 1998 | | |
| | <i>Motor gasoline</i> | | 60.8% |
| | <i>Liquified petroleum gas</i> | | 0.0% |
| | <i>Jet fuel</i> | | 13.2% |
| | <i>Distillate fuel</i> | | 20.0% |
| | <i>Residual fuel</i> | | 3.1% |
| | <i>Lubricants</i> | | 0.4% |
| | <i>Aviation gas</i> | | 0.2% |
| | <i>Natural gas</i> | | 2.2% |
| | <i>Electricity</i> | | 0.1% |

Table 3.1
International Man-Made Emissions of Greenhouse Gases, 1990–97^a
(CO₂ equivalent)

| | 1990 (million metric tonnes) | 1991 | 1992 | 1993 | 1994 | 1995 | 1996 | 1997 |
|--------------------|------------------------------------|---|--------------|--------------|------|--------------|--------------|------------------|
| | | (percentage relative to 1990, 1990=100) | | | | | | |
| Australia | 410.80 | 100 | 101 | 102 | 103 | 106 | 108 | ^b |
| Austria | 73.73 | 106 | 98 | 97 | 99 | 101 | 103 | 105 |
| Canada | 590.55 | 99 | 102 | 103 | 106 | 109 | 112 | 114 |
| Denmark | 71.66 | 115 | 108 | 110 | 115 | 110 | 129 | 117 |
| France | 553.58 | 104 | 102 | 98 | 97 | 99 | 101 | 99 |
| Germany | 1,201.12 | 96 | 91 | 89 | 88 | 88 | 89 | 86 |
| Greece | 103.80 | 100 | 101 | 102 | 103 | 105 | 107 | ^b |
| Ireland | 56.86 | 99 | 100 | 100 | 103 | 104 | 105 | ^b |
| Italy | 532.89 | ^b | ^b | ^b | 97 | 102 | ^b | ^b |
| Japan | 1,175.02 | 102 | 103 | 102 | 108 | 108 | 109 | 109 ^b |
| Netherlands | 208.31 | 103 | 102 | 103 | 103 | 107 | 111 | ^b |
| New Zealand | 71.89 | 100 | 101 | 101 | 101 | 101 | 103 | 105 |
| Norway | 47.13 | 97 | 97 | 102 | 106 | 107 | 113 | 114 |
| Poland | 459.05 | ^b | 96 | ^b | 96 | ^b | 95 | 93 |
| Portugal | 68.44 | 103 | 109 | 105 | 106 | ^b | ^b | ^b |
| Russian Federation | 2,998.77 | ^b | ^b | ^b | 70 | ^b | ^b | ^b |
| Spain | 301.43 | 100 | 103 | 100 | 104 | 108 | ^b | ^b |
| Sweden | 69.47 | 93 | 94 | 94 | 98 | 97 | 111 | 100 |
| Switzerland | 53.75 | 103 | 101 | 98 | 97 | 98 | 99 | 96 |
| United Kingdom | 726.64 | 100 | 97 | 93 | 93 | 91 | 94 | 90 |
| United States | 5,902.99 | 99 | 101 | 103 | 105 | 106 | 109 | 110 |

Source:

United Nations Framework Convention on Climate Change, Greenhouse Gas Inventory Database,
www.unfccc.de/resource, April 2000, October 1998. (Additional resources: www.unfccc.de)

^aIncludes National totals of CO₂, CH₄, and N₂O, excluding land-use change and forestry.

^bData are not available.

Table 3.2
International Man-Made Emissions of Carbon Dioxide, 1990–97^a

| | 1990 (million metric tonnes) | 1991 | 1992 | 1993 | 1994 | 1995 | 1996 | 1997 |
|--------------------|------------------------------------|---|--------------|--------------|------|--------------|--------------|--------------|
| | | (percentage relative to 1990, 1990=100) | | | | | | |
| Australia | 275.34 | 101 | 102 | 103 | 104 | 108 | 112 | ^b |
| Austria | 62.04 | 107 | 98 | 96 | 98 | 101 | 103 | 106 |
| Canada | 461.25 | 98 | 101 | 101 | 104 | 107 | 110 | 113 |
| Denmark | 52.28 | 120 | 110 | 114 | 121 | 114 | 140 | 123 |
| France | 395.51 | 106 | 104 | 99 | 98 | 100 | 103 | 102 |
| Germany | 1,014.50 | 96 | 91 | 90 | 89 | 89 | 91 | 88 |
| Greece | 85.35 | 100 | 102 | 102 | 104 | 106 | 108 | ^b |
| Ireland | 30.72 | 103 | 105 | 104 | 108 | 111 | 113 | ^b |
| Italy | 432.61 | ^b | ^b | ^b | 96 | 101 | ^b | ^b |
| Japan | 1,124.53 | 102 | 103 | 102 | 108 | 108 | 110 | 109 |
| Netherlands | 40.40 | 103 | 106 | 110 | 107 | 110 | 113 | 0 |
| New Zealand | 25.24 | 102 | 110 | 107 | 107 | 107 | 115 | 120 |
| Norway | 35.20 | 95 | 97 | 102 | 108 | 109 | 117 | 118 |
| Poland | 380.70 | ^b | 98 | ^b | 98 | ^b | 98 | 95 |
| Portugal | 47.12 | 104 | 112 | 107 | 108 | ^b | ^b | ^b |
| Russian Federation | 2,372.30 | ^b | ^b | ^b | 70 | ^b | ^b | ^b |
| Spain | 226.42 | 100 | 104 | 100 | 105 | 109 | ^b | ^b |
| Sweden | 55.44 | 100 | 101 | 101 | 106 | 105 | 114 | 102 |
| Switzerland | 45.07 | 104 | 101 | 98 | 96 | 98 | 100 | 96 |
| United Kingdom | 584.17 | 101 | 98 | 96 | 95 | 94 | 97 | 93 |
| United States | 4,928.90 | 99 | 100 | 103 | 104 | 106 | 109 | 111 |

Source:

United Nations Framework Convention on Climate Change, Greenhouse Gas Inventory Database,
www.unfccc.de/resource, April 2000. (Additional resources: www.unfccc.de)

^aIncludes National totals of CO₂, excluding land-use change and forestry.

^bData are not available.

Table 3.3
International Man-Made Emissions of Carbon Dioxide by Source Category, 1990 and 1997^a

| | Energy (excl transport) | | | | Transport | | | | Industrial processes | | | | Total | |
|---------------------------------|-------------------------|------|-------|------|-----------|------|-------|------|----------------------|------|-------|------|-------|-------|
| | 1990 | | 1997 | | 1990 | | 1997 | | 1990 | | 1997 | | 1990 | 1997 |
| | (MMT) | % | (MMT) | % | (MMT) | % | (MMT) | % | (MMT) | % | (MMT) | % | (MMT) | (MMT) |
| Australia ^b | 209 | 75.9 | 234 | 75.9 | 60 | 21.6 | 67 | 21.8 | 7 | 2.4 | 7 | 2.3 | 275 | 308 |
| Austria | 35 | 56.2 | 38 | 57.7 | 14 | 22.4 | 16 | 23.9 | 13 | 20.5 | 12 | 17.6 | 62 | 66 |
| Canada | 275 | 59.6 | 306 | 58.9 | 147 | 31.9 | 174 | 33.5 | 32 | 6.9 | 38 | 7.3 | 461 | 519 |
| Denmark | 41 | 77.8 | 51 | 78.7 | 10 | 20.0 | 12 | 18.8 | 1 | 1.9 | 2 | 2.4 | 52 | 64 |
| France | 241 | 61.8 | 241 | 59.8 | 123 | 31.5 | 138 | 34.3 | 21 | 5.4 | 18 | 4.4 | 391 | 402 |
| Germany | 824 | 81.3 | 694 | 77.6 | 162 | 16.0 | 175 | 19.6 | 28 | 2.7 | 25 | 2.8 | 1,014 | 894 |
| Greece ^b | 62 | 72.7 | 66 | 72.1 | 15 | 17.8 | 17 | 18.8 | 8 | 9.1 | 8 | 8.8 | 85 | 92 |
| Ireland ^b | 24 | 78.6 | 26 | 76.1 | 5 | 15.9 | 7 | 18.8 | 2 | 5.3 | 2 | 5.0 | 31 | 35 |
| Italy ^b | 307 | 70.9 | 303 | 69.1 | 96 | 22.1 | 110 | 25.1 | 28 | 6.4 | 23 | 5.2 | 433 | 438 |
| Japan | 846 | 75.2 | 899 | 73.1 | 207 | 18.4 | 251 | 20.4 | 59 | 5.2 | 60 | 4.8 | 1,125 | 1,231 |
| Netherlands ^b | 129 | 80.2 | 149 | 80.3 | 29 | 17.7 | 33 | 18.1 | 2 | 1.2 | 2 | 0.9 | 161 | 185 |
| New Zealand | 14 | 56.3 | 16 | 51.9 | 9 | 34.2 | 11 | 37.1 | 2 | 9.5 | 1 | 2.3 | 25 | 30 |
| Norway | 15 | 41.5 | 18 | 43.9 | 14 | 39.2 | 15 | 36.9 | 7 | 18.9 | 8 | 18.7 | 35 | 41 |
| Poland | 342 | 89.9 | 324 | 89.7 | 29 | 7.6 | 27 | 7.4 | 9 | 2.4 | 11 | 2.9 | 381 | 362 |
| Portugal | 29 | 62.3 | 30 | 59.6 | 14 | 29.8 | 17 | 33.1 | 3 | 7.3 | 3 | 6.7 | 47 | 51 |
| Russian Federation ^b | 2,326 | 98.0 | 1,619 | 97.5 | — | 0.0 | — | 0.0 | 46 | 2.0 | 24 | 1.4 | 2,372 | 1,660 |
| Spain ^b | 150 | 66.1 | 166 | 66.9 | 58 | 25.7 | 64 | 25.9 | 18 | 7.8 | 17 | 7.0 | 226 | 248 |
| Sweden | 33 | 59.0 | 33 | 58.8 | 19 | 33.6 | 20 | 34.6 | 4 | 6.8 | 4 | 6.6 | 55 | 56 |
| Switzerland | 26 | 57.1 | 24 | 56.5 | 15 | 32.5 | 15 | 35.2 | 3 | 7.5 | 2 | 5.1 | 45 | 43 |
| United Kingdom | 453 | 77.6 | 405 | 74.9 | 116 | 19.9 | 124 | 22.9 | 14 | 2.4 | 12 | 2.2 | 583 | 541 |
| United States | 3,390 | 68.6 | 3,756 | 68.8 | 1,499 | 30.3 | 1,635 | 30.0 | 55 | 1.1 | 65 | 1.2 | 4,943 | 5,456 |

Source:

United Nations Framework Convention on Climate Change, Greenhouse Gas Inventory Database, www.unfccc.de/resource, April 2000.

(Additional resources: www.unfccc.de)

^aNational totals excluding land-use change and forestry.

^b1997 data were not available. Australia, Greece, Ireland, and the Netherlands data are 1996; Italy and Spain data are 1995; and Russian Federation data are 1994.

Table 3.4
Estimated U.S. Emissions of Greenhouse Gases, 1990–98

| Greenhouse gas | Unit of measure ^a | 1990 | 1991 | 1992 | 1993 | 1994 | 1995 | 1996 | 1997 | 1998 |
|-------------------------------|-------------------------------|---------|---------|---------|---------|---------|---------|---------|---------|--------------------|
| Carbon dioxide | million metric tons of gas | 4,939.0 | 4,886.0 | 4,972.9 | 5,109.5 | 5,169.7 | 5,220.5 | 5,395.6 | 5,464.9 | 5,483.4 |
| | million metric tons of carbon | 1,347.0 | 1,333.0 | 1,356.0 | 1,389.0 | 1,410.0 | 1,424.0 | 1,472.0 | 1,490.0 | 1,495.0 |
| Methane | million metric tons of gas | 30.2 | 30.5 | 30.6 | 29.9 | 30.0 | 30.2 | 29.3 | 29.3 | 28.8 |
| | million metric tons of carbon | 173.0 | 174.0 | 175.0 | 171.0 | 172.0 | 173.0 | 168.0 | 168.0 | 165.0 |
| Nitrous oxide | million metric tons of gas | 1.2 | 1.2 | 1.2 | 1.2 | 1.3 | 1.3 | 1.2 | 1.2 | 1.2 |
| | million metric tons of carbon | 99.0 | 101.0 | 103.0 | 103.0 | 111.0 | 106.0 | 105.0 | 104.0 | 103.0 ^b |
| Carbon monoxide | million metric tons of gas | 86.8 | 88.6 | 85.5 | 85.6 | 89.5 | 80.7 | 82.3 | 79.2 | ^c |
| Nitrogen oxide | million metric tons of gas | 21.2 | 21.3 | 21.6 | 21.8 | 22.1 | 21.5 | 21.3 | 21.4 | ^c |
| Nonmethane VOCs ^c | million metric tons of gas | 18.9 | 19.0 | 18.6 | 18.8 | 19.4 | 18.6 | 17.4 | 17.3 | ^c |
| CFC-11,12,113 ^d | million metric tons of gas | 0.2 | 0.2 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.0 | 0.0 |
| HCFC-22 ^d | million metric tons of gas | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 |
| HCFC-23 and PFCs ^d | million metric tons of carbon | 22.0 | 22.0 | 23.0 | 24.0 | 26.0 | 32.0 | 36.0 | 38.0 | 40.0 |

Source:

U.S. Department of Energy, Energy Information Administration, *Emissions of Greenhouse Gases in the United States, 1998*, Washington, DC, October 1999, p. ix, x. (Additional resources: www.eia.doe.gov)

Criteria pollutants (CO, NO_x, VOC) – U.S. Environmental Protection Agency, *National Air Pollutant Emission Trends, 1900-1997*, 1998, pp. A-6, A-11, A-18. (Additional resources: www.epa.gov/oar/oaqps)

^aGases that contain carbon can be measured either in terms of the full molecular weight of the gas or just in terms of their carbon content. See Appendix B, Table B.5 for details.

^bData are not available.

^cVOC=volatile organic compounds. CFC=chlorofluorocarbons. HCFC=hydrochlorofluorocarbons. HFC=hydrofluorocarbons. PFC=perfluorocarbons.

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 content. The ratio of the weight of carbon to carbon dioxide is 0.2727.

Table 3.5
U.S. Carbon Dioxide Emissions from Fossil Energy Consumption
by End-Use Sector, 1984–98^a
(million metric tons of carbon)

| End use | 1984 | 1985 | 1986 | 1987 | 1988 | 1989 | 1990 | 1991 | 1992 | 1993 | 1994 | 1995 | 1996 | 1997 | 1998 |
|-----------------------------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|
| Energy consumption sectors | | | | | | | | | | | | | | | |
| Residential | 241.1 | 245.8 | 244.0 | 251.0 | 264.8 | 267.5 | 253.1 | 257.1 | 255.9 | 271.7 | 268.3 | 270.3 | 285.9 | 284.8 | 284.5 |
| Commercial | 188.8 | 189.6 | 190.4 | 197.2 | 207.6 | 210.1 | 206.7 | 206.4 | 205.4 | 211.3 | 213.8 | 217.9 | 226.0 | 238.0 | 238.4 |
| Industrial | 434.4 | 424.1 | 409.0 | 422.7 | 444.1 | 450.4 | 453.7 | 442.2 | 459.8 | 458.9 | 467.1 | 466.0 | 480.0 | 483.7 | 477.7 |
| Transportation | 379.0 | 384.4 | 399.1 | 411.1 | 427.5 | 432.7 | 432.8 | 424.3 | 431.1 | 436.4 | 449.1 | 457.6 | 468.7 | 473.4 | 484.9 |
| Percentage | 30.5% | 30.9% | 32.1% | 32.1% | 31.8% | 31.8% | 32.2% | 31.9% | 31.9% | 31.7% | 32.1% | 32.4% | 32.1% | 32.0% | 32.6% |
| Total energy | 1,243.3 | 1,243.9 | 1,242.5 | 1,282.0 | 1,344.0 | 1,360.9 | 1,345.2 | 1,330.0 | 1,351.3 | 1,378.2 | 1,398.3 | 1,411.7 | 1,460.5 | 1,478.0 | 1,485.4 |
| Electric utility sector | | | | | | | | | | | | | | | |
| Electric utility ^b | 427.9 | 438.9 | 435.4 | 452.6 | 475.9 | 484.0 | 476.7 | 473.3 | 472.8 | 490.5 | 494.0 | 495.2 | 513.0 | 532.8 | 549.8 |

Source:

U.S. Department of Energy, Energy Information Administration, *Emissions of Greenhouse Gases in the United States, 1998*, Washington, DC, October 1999, p. 22, and annual. (Additional resources: www.eia.doe.gov)

^aIncludes energy from petroleum, coal, and natural gas. Electric utility emissions are distributed across consumption sectors.

^bDoes not include estimates of carbon dioxide emissions from the use of flue gas desulfurization.

Table 3.6
U.S. Carbon Dioxide Emissions from Energy Use in the Transportation Sector, 1980–98
(million metric tons of carbon)

| Fuel | 1980 | | 1985 | | 1990 | | 1995 | | 1998 | |
|---------------------|--------------|---------------|--------------|---------------|--------------|---------------|--------------|---------------|--------------|---------------|
| | Emissions | Percentage | Emissions | Percentage | Emissions | Percentage | Emissions | Percentage | Emissions | Percentage |
| Petroleum | | | | | | | | | | |
| Motor gasoline | 238.1 | 62.9% | 245.1 | 63.8% | 260.9 | 60.4% | 279.9 | 61.1% | 294.6 | 60.8% |
| LPG ^a | 0.3 | 0.1% | 0.5 | 0.1% | 0.4 | 0.1% | 0.3 | 0.1% | 0.2 | 0.0% |
| Jet fuel | 42.0 | 11.1% | 48.0 | 12.5% | 60.1 | 13.9% | 60.0 | 13.1% | 64.2 | 13.2% |
| Distillate fuel | 55.3 | 14.6% | 63.3 | 16.5% | 75.7 | 17.5% | 85.1 | 18.6% | 96.9 | 20.0% |
| Residual fuel | 30.0 | 7.9% | 16.7 | 4.3% | 21.9 | 5.1% | 19.7 | 4.3% | 14.9 | 3.1% |
| Lubricants | 1.8 | 0.5% | 1.6 | 0.4% | 1.8 | 0.4% | 1.7 | 0.4% | 1.8 | 0.4% |
| Aviation gas | 1.2 | 0.3% | 0.9 | 0.2% | 0.8 | 0.2% | 0.7 | 0.2% | 0.7 | 0.2% |
| Total | 368.7 | 97.4% | 376.1 | 97.8% | 421.5 | 97.5% | 447.4 | 97.6% | 473.4 | 97.6% |
| Other energy | | | | | | | | | | |
| Natural gas | 9.4 | 2.5% | 7.5 | 2.0% | 9.8 | 2.3% | 10.4 | 2.3% | 10.8 | 2.2% |
| Electricity | 0.3 | 0.1% | 0.7 | 0.2% | 0.7 | 0.2% | 0.6 | 0.1% | 0.7 | 0.1% |
| Total | 378.4 | 100.0% | 384.4 | 100.0% | 432.1 | 100.0% | 458.5 | 100.0% | 484.9 | 100.0% |

Source:

U.S. Department of Energy, Energy Information Administration, *Emissions of Greenhouse Gases in the United States, 1998*, Washington, DC, October 1999, p. 24, and annual. (Additional resources: www.eia.doe.gov)

^aLiquified petroleum gas.

Global Warming Potentials (GWP) were developed to allow comparison of each greenhouse gas' ability 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, which are shown below. Most analysts use the 100-year time horizon.

Table 3.7
Numerical Estimates of Global Warming Potentials Compared With Carbon Dioxide
(kilogram of gas per kilogram of carbon dioxide)

| Gas | Lifetime (years) | Direct effect for time horizons of | | |
|-----------------------------|---------------------|------------------------------------|-----------|-----------|
| | | 20 years | 100 years | 500 years |
| Carbon Dioxide | Variable | 1 | 1 | 1 |
| Methane | 12 ± 3 | 56 | 21 | 7 |
| Nitrous Oxide | 120 | 280 | 310 | 170 |
| HFCs, PFCs, and other gases | | | | |
| HFC-23 | 264 | 9,200 | 12,100 | 9,900 |
| HFC-125 | 33 | 4,800 | 3,200 | 11 |
| HFC-134a | 15 | 3,300 | 1,300 | 420 |
| HFC-152a | 2 | 460 | 140 | 42 |
| HFC-227ea | 37 | 4,300 | 2,900 | 950 |
| Perfluoromethane | 50,000 | 4,400 | 6,500 | 10,000 |
| Perfluoroethane | 10,000 | 6,200 | 9,200 | 14,000 |
| Sulfur hexafluoride | 3,200 | 16,300 | 23,900 | 34,900 |

Source:

U.S. Department of Energy, Energy Information Administration, *Emissions of Greenhouse Gases in the United States 1998*, Washington, DC, October 1999, p. 8. Original source: Intergovernmental Panel on Climate Change. (Additional resources: www.eia.doe.gov, www.ipcc.ch)

Note:

The typical uncertainty for global warming potentials is estimated by the Intergovernmental Panel on Climate Change at ± 35 percent.

The Greenhouse Gases, Regulated Emissions, and Energy Use in Transportation (GREET) Model

The energy in greenhouse gas estimates of the most recent version (Version 1.5a) of the GREET model are displayed in the next two tables. The model estimates the full fuel-cycle emissions and energy use associated with various transportation fuels and advanced transportation technologies for light-duty vehicles. It calculates fuel-cycle emissions of **three greenhouse gases** (carbon dioxide, methane, and nitrous oxide) and five criteria pollutants (volatile organic compounds, carbon monoxide, nitrogen oxides, sulfur oxides, and particulate matter measuring 10 microns or less). **See Chapter 4 for the criteria pollutant data from GREET.** The model also calculates the total fuel-cycle energy consumption, fossil fuel consumption, and petroleum consumption using various transportation fuels. The fuel cycles that are included in the GREET model are:

- petroleum to conventional gasoline, reformulated gasoline, conventional diesel, reformulated diesel, liquefied petroleum gas, and electricity via residual oil;
- natural gas to compressed natural gas, liquefied natural gas, liquefied petroleum gas, methanol, Fischer-Tropsch diesel, dimethyl ether, hydrogen, and electricity;
- coal to electricity;
- uranium to electricity;
- renewable energy (hydropower, solar energy, and wind) to electricity;
- corn, woody biomass, and herbaceous biomass to ethanol;
- soybeans to biodiesel; and
- landfill gases to methanol.

Near-term technologies are ones which may be applied to 2000 model-year cars and *Long-term* technologies are ones which may be applied to 2010 model-year cars.

For additional information about the GREET model, see *GREET 1.5 – Transportation Fuel-Cycle Model, Volume 1: Methodology, Development, Use and Results*, ANL/ESD-39, Vol. 1, August 1999, or contact:

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GREET Web Site:
<http://www.transportation.anl.gov/ttrdc/greet/>

Acronyms Used on Tables 3.8 and 3.9

Emissions acronyms

| | |
|-----------------|------------------|
| CO ₂ | carbon dioxide |
| GHGs | greenhouse gases |

Geographical acronyms

| | |
|----|---------------|
| CA | California |
| NE | northeast |
| US | United States |

Technologies acronyms

| | |
|----------------|---|
| BD20 | mixture of 20% biodiesel and 80% conventional diesel (by volume) |
| CARFG2 | California Phase 2 reformulated gasoline |
| CD | conventional diesel |
| CIDI | compression ignition, direct injection |
| CNG | compressed natural gas |
| CNGV | compressed natural gas vehicle |
| Dedi. | dedicated |
| DME | dimethyl ether |
| E10 | mixture of 10% ethanol and 90% gasoline (by volume) |
| E85 | mixture of 85% ethanol and 15% gasoline (by volume) |
| E90 | mixture of 90% ethanol and 10% gasoline (by volume) |
| ETBE | ethyl tertiary butyl ether |
| EtOH | ethanol |
| EtOHV | ethanol vehicle |
| EV | electric vehicle |
| FCV | fuel-cell vehicle |
| FFV | flexible fuel vehicle |
| FRFG2 | Federal Phase 2 reformulated gasoline |
| FG | flared gas |
| FT50 | mixture of 50% Fischer-Tropsch diesel and 50% conventional diesel (by volume) |
| FT100 | 100% Fischer-Tropsch diesel |
| GC | grid-connected |
| GI | grid-independent |
| GHGs | greenhouse gases |
| GV | gasoline vehicle |
| H ₂ | hydrogen |
| HB | herbaceous biomass |
| HEV | hybrid electric vehicle |
| LFG | land-fill gas |
| LNG | liquefied natural gas |
| LNGV | liquefied natural gas vehicle |
| LPG | liquefied petroleum gas |
| LPGV | liquefied petroleum gas vehicle |
| M85 | mixture of 85% methanol and 15% gasoline by volume |
| M90 | mixture of 90% methanol and 10% gasoline by volume |
| MeOH | methanol |
| MeOHV | methanol vehicle |
| MTBE | methyl tertiary butyl ether |
| NG | natural gas |
| RFD | reformulated diesel |
| SI | spark ignition |
| SIDI | spark-ignition, direct-injection |
| WB | woody biomass |

Table 3.8
NEAR-TERM Technology (for MY 2000 vehicles)
Fuel-Cycle Energy and Greenhouse Gas Emission Changes of Alternative Transportation Fuels and Advanced Vehicle Technologies

(percentage relative to conventional gasoline vehicles fueled with conventional gasoline)

| | GV: FRFG2, MTBE | GV: FRFG2, EtOH | CIDI: CD | Bi-Fuel CNGV on CNG | Dedi. CNGV | Dedi. LPGV: NG | Dedi. LPGV: Crude | M85 FFV: NG | E85 FFV: Corn |
|-------------------------|--------------------------------|--------------------------------|-----------------|------------------------------------|-----------------------|-------------------------------|----------------------------------|------------------------|--------------------------|
| Total Emissions: | | | | | | | | | |
| Total Energy | 0.0% | 0.4% | -29.7% | 8.6% | 5.1% | -9.6% | -8.6% | 15.3% | 17.8% |
| Fossil fuels | 0.0% | -3.5% | -29.6% | 6.9% | 3.4% | -9.2% | -8.6% | 16.0% | -41.9% |
| Petroleum | -11.0% | -3.6% | -26.7% | -99.3% | -99.4% | -98.2% | -3.4% | -72.6% | -74.3% |
| CO2 | 1.8% | -5.0% | -23.5% | -9.9% | -12.8% | -11.6% | -9.8% | -1.9% | -36.3% |
| GHGs | 2.2% | -4.2% | -24.3% | -4.1% | -6.7% | -11.0% | -9.6% | -1.7% | -25.8% |

| | E10 GV: Corn | EV: US Mix | EV: NE US Mix | EV: CA Mix | GC SIDI HEV: CARFG2, EtOH, CA Mix | GI SIDI HEV: FRFG2, MTBE | GI SIDI HEV: FRFG2, EtOH | GI CIDI HEV: CD |
|-------------------------|-------------------------|-----------------------|--------------------------|-----------------------|--|---|---|----------------------------|
| Total Emissions: | | | | | | | | |
| Total Energy | 2.0% | -13.7% | -14.2% | -17.0% | -35.8% | -47.4% | -47.2% | -52.5% |
| Fossil fuels | -3.4% | -39.1% | -46.4% | -69.0% | -52.6% | -47.4% | -49.2% | -52.5% |
| Petroleum | -6.3% | -98.2% | -96.8% | -99.6% | -61.7% | -53.2% | -49.3% | -50.6% |
| CO2 | -2.9% | -25.5% | -41.5% | -70.3% | -54.0% | -46.5% | -50.0% | -48.4% |
| GHGs | -1.9% | -26.7% | -41.9% | -70.1% | -53.1% | -45.2% | -48.6% | -48.5% |

Source:

Wang, Michael Q., GREET 1.5a Model Results, Argonne National Laboratory, Argonne, IL, April 2000.

Note: See page preceding Table 3.8 for acronym definitions.

Table 3.9
LONG-TERM Technology (for MY 2010 vehicles)
Fuel-Cycle Energy and Greenhouse Gas Emission Changes of Alternative Transportation Fuels and Advanced Vehicle Technologies
 (percentage relative to gasoline vehicles fueled with reformulated gasoline)

| | Dedi. CNGV | Dedi. LNGV: NG | Dedi. LNGV: FG | Dedi. LPGV: NG | Dedi. LPGV: Crude | Dedi. MeOHV: M90, NG | Dedi. MeOHV: M90, FG | Dedi. EtOHV: E90, Corn | Dedi. EtOHV: E90, WB |
|-------------------------|---------------|----------------------|----------------------|----------------------|-------------------------|----------------------------|----------------------------|------------------------------|----------------------------|
| Total Emissions: | | | | | | | | | |
| Total Energy | -8.5% | -5.7% | -89.8% | -17.8% | -16.9% | 10.5% | -77.5% | 10.1% | 90.7% |
| Fossil fuels | -9.4% | -5.2% | -90.0% | -17.5% | -16.9% | 11.1% | -77.7% | -52.0% | -88.7% |
| Petroleum | -99.4% | -97.8% | -95.9% | -98.2% | -1.3% | -78.1% | -78.1% | -80.1% | -76.1% |
| CO2 | -25.0% | -24.5% | -93.3% | -21.0% | -19.5% | -8.1% | -77.1% | -49.8% | -122.8% |
| GHGs | -22.0% | -21.5% | -90.0% | -20.7% | -19.4% | -8.2% | -75.5% | -40.3% | -115.4% |

| | Dedi. EtOHV: E90, HB | SIDI: FRFG2, EtOH | Dedi. MeOH SIDI: M90, NG | Dedi. MeOH SIDI: M90, FG | Dedi. EtOH SIDI: E90, Corn | Dedi. EtOH SIDI: E90, WB | Dedi. EtOH SIDI: E90, HB | GI SIDI HEV: FRFG2, EtOH | GI SI HEV: CNG |
|-------------------------|----------------------------|-------------------------|-----------------------------------|-----------------------------------|-------------------------------------|-----------------------------------|-----------------------------------|-----------------------------------|----------------------|
| Total Emissions: | | | | | | | | | |
| Total Energy | 77.6% | -20.0% | -5.2% | -82.7% | -3.1% | 67.8% | 56.3% | -47.4% | -43.5% |
| Fossil fuels | -80.5% | -20.0% | -4.7% | -135.5% | -57.8% | -90.1% | -82.8% | -47.4% | -44.0% |
| Petroleum | -78.5% | -20.0% | -82.1% | -82.1% | -82.5% | -78.9% | -81.1% | -47.4% | -99.6% |
| CO2 | -94.9% | -20.0% | -21.4% | -82.1% | -55.8% | -120.1% | -95.5% | -47.4% | -53.7% |
| GHGs | -80.7% | -19.5% | -21.2% | -80.5% | -47.2% | -113.3% | -82.8% | -46.3% | -51.0% |

Table continued on next page. See page preceding Table 3.8 for acronym definitions.

Table 3.9 (continued)

LONG-TERM Technology (for MY 2010 vehicles)**Fuel-Cycle Energy and Greenhouse Gas Emission Changes of Alternative Transportation Fuels and Advanced Vehicle Technologies**

(percentage relative to gasoline vehicles fueled with reformulated gasoline)

| | GI SI HEV: LNG, NG | GI SI HEV: LNG, FG | GI SI HEV: LPG, NG | GI SI HEV: LPG, Crude | GI SIDI HEV: M90, NG | GI SIDI HEV: M90, FG | GI SIDI HEV: E90, Corn | GI SIDI HEV: E90, WB | GI SIDI HEV: E90, HB |
|-------------------------|--|--|---|---------------------------------|------------------------------------|---------------------------------|-------------------------------------|-------------------------------------|---|
| Total Emissions: | | | | | | | | | |
| Total Energy | -41.8% | -93.7% | -46.8% | -46.2% | -54.0% | -54.1% | -36.3% | 10.4% | 2.8% |
| Fossil fuels | -41.4% | -93.8% | -46.6% | -46.3% | -35.7% | -121.7% | -72.2% | -93.5% | -88.7% |
| Petroleum | -98.7% | -97.5% | -98.8% | -36.1% | -87.3% | -87.3% | -88.5% | -86.1% | -87.5% |
| CO2 | -53.4% | -95.9% | -48.9% | -47.9% | -46.8% | -86.8% | -71.0% | -113.3% | -97.1% |
| GHGs | -50.7% | -93.0% | -47.9% | -47.1% | -46.0% | -85.0% | -64.5% | -107.9% | -87.9% |
| | GC SIDI HEV: RFG2, EtOH, US Mix | GC SIDI HEV: RFG2, EtOH, NE US Mix | GC SIDI HEV: RFG2, EtOH, CA Mix | GC SI HEV: CNG, US Mix | GC SI HEV: CNG, NE US Mix | GC SI HEV: CNG, CA Mix | GC SI HEV: LNG, NG, US Mix | GC SI HEV: LNG, FG, US Mix | GC SI HEV: LNG, NG, NE US Mix |
| Total Emissions: | | | | | | | | | |
| Total Energy | -43.9% | -44.4% | -44.1% | -40.9% | -41.5% | -41.2% | -39.7% | -77.2% | -40.2% |
| Fossil fuels | -47.5% | -48.8% | -55.3% | -45.9% | -47.3% | -54.0% | -44.0% | -81.8% | -45.2% |
| Petroleum | -61.4% | -61.3% | -61.7% | -99.3% | -99.2% | -99.7% | -98.7% | -97.8% | -98.5% |
| CO2 | -44.5% | -48.1% | -55.6% | -50.2% | -53.9% | -61.6% | -50.0% | -80.7% | -53.2% |
| GHGs | -44.1% | -47.5% | -54.9% | -48.6% | -52.0% | -59.6% | -48.4% | -78.9% | -51.3% |

Table continued on next page. See page preceding Table 3.8 for acronym definitions.

Table 3.9 (continued)
LONG-TERM Technology (for MY 2010 vehicles)

Fuel-Cycle Energy and Greenhouse Gas Emission Changes of Alternative Transportation Fuels and Advanced Vehicle Technologies
 (percentage relative to gasoline vehicles fueled with reformulated gasoline)

| | GC SI HEV: LNG, FG, NE US Mix | GC SI HEV: LNG, NG, CA Mix | GC SI HEV: LNG, FG, CA Mix | GC SI HEV: LPG, NG, US. Mix | GC SI HEV: LPG, Crude, U.S. Mix | GC SI HEV: LPG, NG, NE US Mix | GC SI HEV: LPG, Crude, NE US Mix | GC SI HEV: LPG, NG, CA Mix | GC SI HEV: LPG, Crude, CA Mix |
|-------------------------|-------------------------------------|----------------------------------|----------------------------------|-----------------------------------|---------------------------------------|-------------------------------------|--|----------------------------------|-------------------------------------|
| Total Emissions: | | | | | | | | | |
| Total Energy | -77.7% | -40.0% | -77.4% | -43.3% | -42.9% | -43.9% | -43.5% | -43.6% | -43.2% |
| Fossil fuels | -83.1% | -51.0% | -89.4% | -47.7% | -47.5% | -49.0% | -48.8% | -55.0% | -55.0% |
| Petroleum | -97.6% | -98.9% | -98.1% | -98.8% | -53.6% | -98.6% | -53.4% | -99.1% | -53.8% |
| CO2 | -84.0% | -59.9% | -91.2% | -46.7% | -46.0% | -50.0% | -49.3% | -56.8% | -56.3% |
| GHGs | -82.1% | -57.9% | -89.1% | -46.4% | -45.8% | -49.4% | -48.9% | -56.1% | -55.8% |

| | GC SIDI HEV: M90, NG, US Mix | GC SIDI HEV: M90, FG, US Mix | GC SIDI HEV: M90, NG, NE US Mix | GC SIDI HEV: M90, FG, NE US Mix | GC SIDI HEV: M90, NG, CA Mix | GC SIDI HEV: M90, FG, CA Mix | GC SIDI HEV: E90, Corn, US Mix | GC SIDI HEV: E90, WB, US Mix | GC SIDI HEV: E90, HB, US Mix |
|-------------------------|------------------------------------|------------------------------------|--|--|------------------------------------|------------------------------------|---|------------------------------------|------------------------------------|
| Total Emissions: | | | | | | | | | |
| Total Energy | -35.7% | -72.3% | -36.2% | -72.9% | -35.9% | -72.6% | -35.9% | -2.3% | -7.8% |
| Fossil fuels | -40.0% | -101.8% | -41.2% | -103.2% | -47.1% | -109.7% | -66.2% | -81.5% | -78.1% |
| Petroleum | -90.5% | -90.5% | -90.3% | -90.3% | -90.8% | -90.8% | -91.3% | -89.7% | -90.7% |
| CO2 | -45.3% | -74.1% | -48.5% | -77.4% | -55.2% | -84.5% | -62.7% | -93.1% | -81.5% |
| GHGs | -45.1% | -73.1% | -48.1% | -76.3% | -54.6% | -83.2% | -58.4% | -89.6% | -75.2% |

Table continued on next page. See page preceding Table 3.8 for acronym definitions.

Table 3.9 (continued)
LONG-TERM Technology (for MY 2010 vehicles)
Fuel-Cycle Energy and Greenhouse Gas Emission Changes of Alternative Transportation Fuels and Advanced Vehicle Technologies
 (percentage relative to gasoline vehicles fueled with reformulated gasoline)

| | GC SIDI HEV: E90, Corn, NE US Mix | GC SIDI HEV: E90, WB, NE US Mix | GC SIDI HEV: E90, HB, NE US Mix | GC SIDI HEV: E90, Corn, CA Mix | GC SIDI HEV: E90, WB, CA Mix | GC SIDI HEV: E90, HB, CA Mix | CIDI: RFD | CIDI: DME, NG | CIDI: DME, FG |
|-------------------------|--|--|--|---|---------------------------------------|---------------------------------------|------------------------------|------------------------------|-------------------------|
| Total Emissions: | | | | | | | | | |
| Total Energy | -36.4% | -2.6% | -8.2% | -36.1% | -2.5% | -8.0% | -35.1% | -17.1% | -94.8% |
| Fossil fuels | -67.5% | -82.4% | -79.2% | -73.7% | -86.6% | -84.6% | -35.1% | -16.6% | -148.4% |
| Petroleum | -91.2% | -89.5% | -90.5% | -91.6% | -89.8% | -90.9% | -25.0% | -97.9% | -97.9% |
| CO2 | -66.0% | -95.4% | -84.4% | -73.0% | -100.4% | -90.6% | -30.7% | -33.5% | -94.5% |
| GHGs | -61.5% | -91.8% | -77.9% | -68.3% | -96.6% | -83.9% | -31.6% | -34.3% | -93.4% |
| | | | | | | | | | |
| | CIDI: FT100, NG | CIDI: FT100, FG | CIDI: BD20 | GI CIDI HEV: RFD | GI CIDI HEV: DME, NG | GI CIDI HEV: DME, FG | GI CIDI HEV: FT100, NG | GI CIDI HEV: FT100, FG | GI CIDI HEV: BD20 |
| Total Emissions: | | | | | | | | | |
| Total Energy | 4.0% | -92.0% | -31.5% | -57.7% | -45.9% | -96.6% | -32.2% | -94.8% | -55.3% |
| Fossil fuels | 4.7% | -145.6% | -31.7% | -57.7% | -45.6% | -131.6% | -31.7% | -129.8% | -55.5% |
| Petroleum | -97.5% | -97.5% | -36.7% | -51.1% | -98.6% | -98.6% | -98.4% | -98.4% | -58.7% |
| CO2 | -20.9% | -87.7% | -38.9% | -54.8% | -56.7% | -96.5% | -48.4% | -92.0% | -60.2% |
| GHGs | -22.3% | -87.3% | -39.3% | -55.0% | -56.7% | -95.3% | -48.9% | -91.3% | -60.0% |

Table continued on next page. See page preceding Table 3.8 for acronym definitions.

Table 3.9 (continued)

LONG-TERM Technology (for MY 2010 vehicles)**Fuel-Cycle Energy and Greenhouse Gas Emission Changes of Alternative Transportation Fuels and Advanced Vehicle Technologies**

(percentage relative to gasoline vehicles fueled with reformulated gasoline)

| | GC CIDI HEV: RFD, US Mix | GC CIDI HEV: RFD, NE US Mix | GC CIDI HEV: RFD, CA Mix | GC CIDI HEV: DME, NG, US Mix | GC CIDI HEV: DME, FG, US Mix | GC CIDI HEV: DME, NG, NE US Mix | GC CIDI HEV: DME, FG, NE US Mix | GC CIDI HEV: DME, NG, CA Mix | GC CIDI HEV: DME, FG, CA Mix |
|-------------------------|--|--|---|---|--|---|---|---------------------------------------|---------------------------------------|
| Total Emissions: | | | | | | | | | |
| Total Energy | -50.7% | -51.3% | -51.0% | -42.1% | -79.2% | -42.7% | -79.8% | -42.4% | -79.5% |
| Fossil fuels | -55.2% | -56.6% | -62.7% | -46.4% | -109.3% | -47.7% | -110.7% | -53.5% | -117.3% |
| Petroleum | -63.8% | -63.6% | -64.1% | -98.6% | -98.6% | -98.5% | -98.5% | -98.9% | -98.9% |
| CO2 | -50.5% | -53.8% | -60.7% | -51.9% | -81.0% | -55.0% | -84.3% | -61.7% | -91.4% |
| GHGs | -51.0% | -54.1% | -60.9% | -52.3% | -80.5% | -55.2% | -83.7% | -61.8% | -90.6% |
| | GC CIDI HEV: FT100, NG, US Mix | GC CIDI HEV: FT100, FG, US Mix | GC CIDI HEV: FT100, NG, NE US Mix | GC CIDI HEV: FT100, FG, NE US Mix | GC CIDI HEV: FT100, NG, CA Mix | GC CIDI HEV: FT100, FG, CA Mix | GC CIDI HEV: BD20, US Mix | GC CIDI HEV: BD20, NE US Mix | GC CIDI HEV: BD20, CA Mix |
| Total Emissions: | | | | | | | | | |
| Total Energy | -32.1% | -77.9% | -32.6% | -78.5% | -32.3% | -78.2% | -49.0% | -49.6% | -49.3% |
| Fossil fuels | -36.2% | -108.0% | -37.5% | -109.4% | -43.2% | -115.9% | -53.6% | -55.0% | -61.3% |
| Petroleum | -98.4% | -98.4% | -98.2% | -98.3% | -98.7% | -98.7% | -69.4% | -69.2% | -69.7% |
| CO2 | -45.8% | -77.7% | -48.9% | -81.0% | -55.5% | -88.1% | -54.4% | -57.8% | -65.0% |
| GHGs | -46.6% | -77.6% | -49.5% | -80.7% | -56.0% | -87.6% | -54.7% | -57.9% | -64.9% |

Table continued on next page. See page preceding Table 3.8 for acronym definitions.

Table 3.9 (continued)
LONG-TERM Technology (for MY 2010 vehicles)
Fuel-Cycle Energy and Greenhouse Gas Emission Changes of Alternative Transportation Fuels and Advanced Vehicle Technologies
 (percentage relative to gasoline vehicles fueled with reformulated gasoline)

| | Electric Vehicle, US Mix | Electric Vehicle, NE US Mix | Electric Vehicle, CA Mix | FCV: Gaseous H ₂ , NG, Central | FCV: Gaseous H ₂ , NG, Refueling Station | FCV: Gaseous H ₂ , Solar | FCV: Liquid H ₂ , NG | FCV: Liquid H ₂ , FG | FCV: Liquid H ₂ , Solar |
|-------------------------|--------------------------|-----------------------------|--------------------------|---|---|-------------------------------------|---------------------------------|---------------------------------|------------------------------------|
| Total Emissions: | | | | | | | | | |
| Total Energy | -39.0% | -40.9% | -39.9% | -53.8% | -48.3% | -62.6% | -38.9% | -86.9% | -71.9% |
| Fossil fuels | -54.0% | -58.4% | -79.0% | -55.8% | -49.8% | -91.4% | -39.4% | -87.1% | -71.7% |
| Petroleum | -98.7% | -98.2% | -99.6% | -99.6% | -96.5% | -99.8% | -99.1% | -99.2% | -98.5% |
| CO₂ | -45.3% | -56.3% | -79.7% | -62.3% | -58.3% | -90.5% | -51.4% | -90.1% | -99.1% |
| GHGs | -46.3% | -56.7% | -79.8% | -63.0% | -58.5% | -90.6% | -52.8% | -91.1% | -99.2% |

| | FCV: MeOH, NG | FCV: MeOH, FG | FCV: RFG2, EtOH | FCV: RFD | EtOH FCVs: Corn | EtOH FCVs: WB | EtOH FCVs: HB | NG FCV: CNG | FCV: LNG, NG |
|-------------------------|---------------|---------------|-----------------|----------|-----------------|---------------|---------------|-------------|--------------|
| Total Emissions: | | | | | | | | | |
| Total Energy | -45.1% | -96.4% | -50.0% | -51.4% | -37.7% | 13.9% | 5.5% | -51.9% | -50.5% |
| Fossil fuels | -44.8% | -131.4% | -50.0% | -51.3% | -77.5% | -101.0% | -95.7% | -52.4% | -50.2% |
| Petroleum | -98.4% | -98.4% | -50.0% | -43.7% | -96.5% | -93.9% | -95.5% | -99.7% | -98.9% |
| CO₂ | -56.0% | -96.2% | -50.0% | -48.0% | -76.1% | -122.8% | -104.9% | -60.5% | -60.3% |
| GHGs | -56.5% | -95.8% | -50.7% | -49.5% | -70.8% | -118.9% | -96.7% | -59.6% | -59.3% |

Table continued on next page. See page preceding Table 3.8 for acronym definitions.

Table 3.9 (continued)
LONG-TERM Technology (for MY 2010 vehicles)
Fuel-Cycle Energy and Greenhouse Gas Emission Changes of Alternative Transportation Fuels and Advanced Vehicle Technologies
 (percentage relative to gasoline vehicles fueled with reformulated gasoline)

| | FCV: LNG, FG | FCV: LPG, NG | FCV: LPG, Crude |
|-------------------------|-----------------|-----------------|--------------------|
| Total Emissions: | | | |
| Total Energy | -94.7% | -54.8% | -54.3% |
| Fossil fuels | -94.7% | -54.6% | -54.3% |
| Petroleum | -97.9% | -99.0% | -96.9% |
| CO₂ | -96.4% | -56.5% | -55.7% |
| GHGs | -95.3% | -57.2% | -56.5% |

Source:

Wang, Michael Q., GREET 1.5a Model Results, Argonne National Laboratory, Argonne, IL, April 2000.

Note: See page preceding Table 3.8 for acronym definitions.

Chapter 4 Criteria Pollutants

Summary Statistics from Tables in this Chapter

| Source | |
|------------|--|
| Table 4.1 | Transportation's share of U.S. emissions, 1998 |
| | <i>CO</i> 78.6% |
| | <i>NO_x</i> 53.4% |
| | <i>VOC</i> 43.5% |
| | <i>PM-10</i> 2.1% |
| | <i>PM-2.5</i> 7.2% |
| | <i>SO₂</i> 7.2% |
| | <i>NH₃</i> 5.2% |
| Table 4.10 | Transportation's share of lead emissions |
| | <i>1970</i> 82.3% |
| | <i>1998</i> 13.1% |

Table 4.1
Total National Emissions of the Criteria Air Pollutants by Sector, 1998
(millions of short tons/percentage)

| Sector | CO | NO _x | VOC | PM-10 | PM-2.5 | SO ₂ | NH ₃ |
|---|--------------|-----------------|--------------|--------------|-------------|-----------------|-----------------|
| Highway vehicles | 50.39 | 7.77 | 5.33 | 0.26 | 0.20 | 0.33 | 0.25 |
| | 56.3% | 31.8% | 29.7% | 0.7% | 2.4% | 1.7% | 5.1% |
| Aircraft | 0.96 | 0.16 | 0.18 | 0.04 | 0.03 | 0.01 | 0.00 |
| | 1.1% | 0.7% | 1.0% | 0.1% | 0.3% | 0.1% | 0.1% |
| Railroads | 0.12 | 0.95 | 0.05 | 0.03 | 0.03 | 0.11 | 0.00 |
| | 0.1% | 3.9% | 0.3% | 0.1% | 0.4% | 0.6% | 0.0% |
| Vessels | 0.14 | 1.00 | 0.04 | 0.04 | 0.04 | 0.26 | 0.00 |
| | 0.2% | 4.1% | 0.2% | 0.1% | 0.5% | 1.3% | 0.0% |
| Other off-highway | 18.71 | 3.17 | 2.19 | 0.35 | 0.31 | 0.70 | 0.00 |
| | 20.9% | 13.0% | 12.2% | 1.0% | 3.7% | 3.6% | 0.0% |
| Transportation total | 70.30 | 13.05 | 7.79 | 0.72 | 0.61 | 1.41 | 0.26 |
| | 78.6% | 53.4% | 43.5% | 2.1% | 7.2% | 7.2% | 5.2% |
| Stationary source fuel combustion | 5.37 | 10.19 | 0.89 | 1.09 | 0.79 | 16.72 | 0.06 |
| | 6.0% | 41.7% | 5.0% | 3.1% | 9.4% | 85.1% | 1.2% |
| Industrial processes | 3.71 | 0.80 | 8.02 | 0.71 | 0.39 | 1.46 | 0.25 |
| | 4.1% | 3.3% | 44.8% | 2.0% | 4.7% | 7.4% | 5.1% |
| Waste disposal and recycling total | 1.15 | 0.10 | 0.43 | 0.31 | 0.24 | 0.04 | 0.09 |
| | 1.3% | 0.4% | 2.4% | 0.9% | 2.8% | 0.2% | 1.7% |
| Miscellaneous | 8.92 | 0.33 | 0.79 | 31.92 | 6.35 | 0.01 | 4.28 |
| | 10.0% | 1.3% | 4.4% | 91.9% | 75.8% | 0.1% | 86.6% |
| Total of all sources | 89.45 | 24.45 | 17.92 | 34.74 | 8.38 | 19.65 | 4.94 |
| | 100.0% | 100.0% | 100.0% | 100.0% | 100.0% | 100.0% | 100.0 |

Source:

All other—U. S. Environmental Protection Agency, *National Air Pollutant Emission Trends, 1900–1998*, 2000, Appendix A. (Additional resources: www.epa.gov/oar/oaqps)

Note:

CO = Carbon monoxide. NO_x = Nitrogen oxides. PM-10 = Particulate matter less than 10 microns.

PM-2.5 = Particulate matter less than 2.5 microns. SO₂ = Sulfur dioxide. VOC = Volatile organic compounds. NH₃ = Ammonia.

The transportation sector accounted for more than three-fourths of the nation's carbon monoxide (CO) emissions in 1998. Highway vehicles are by far the source of the greatest amount of CO. For details on the highway emissions of CO, see Table 4.3.

Table 4.2
Total National Emissions of Carbon Monoxide, 1970–98^a
(million short tons)

| Source category | 1970 | 1980 | 1990 | 1995 | 1997 | 1998 | Percent of total, 1998 |
|------------------------------------|---------------|---------------|-------|-------|-------|-------|------------------------|
| Highway vehicles | 88.03 | 78.05 | 57.85 | 54.11 | 51.67 | 50.39 | 56.3% |
| Aircraft | 0.51 | 0.74 | 0.90 | 0.94 | 0.96 | 0.96 | 1.1% |
| Railroads | 0.07 | 0.10 | 0.12 | 0.11 | 0.12 | 0.12 | 0.1% |
| Vessels ^b | 0.02 | 0.06 | 0.13 | 0.13 | 0.14 | 0.14 | 0.2% |
| Other off-highway | 11.38 | 13.59 | 17.04 | 19.04 | 18.71 | 18.71 | 20.9% |
| Transportation total | 100.00 | 92.54 | 76.04 | 74.33 | 70.30 | 70.30 | 78.6% |
| Stationary fuel combustion total | 4.63 | 7.30 | 5.51 | 5.93 | 5.37 | 5.37 | 6.0% |
| Industrial processes total | 9.84 | 6.95 | 4.77 | 4.61 | 3.71 | 3.71 | 4.1% |
| Waste disposal and recycling total | 7.06 | 2.30 | 1.08 | 1.19 | 1.15 | 1.15 | 1.3% |
| Miscellaneous total | 7.91 | 8.34 | 11.21 | 7.05 | 8.92 | 8.92 | 10.0% |
| Total of all sources | 129.44 | 117.43 | 98.53 | 93.35 | 89.45 | 89.45 | 100.0% |

Source:

U. S. Environmental Protection Agency, *National Air Pollutant Emission Trends, 1900–1998*, 2000, pp. A-1–A-5, and annual. (Additional resources: www.epa/oar/oaqps)

Note:

Emission estimation methodology changes indicated by shaded areas. Transportation methodologies changed in 1970, while all others changed in 1990.

^aThe sums of subcategories may not equal total due to rounding.

^bRecreational marine vessels.

Table 4.3
Emissions of Carbon Monoxide from Highway Vehicles, 1970–98^a
(million short tons)

| Source category | 1970 | 1975 | 1980 | 1985 | 1990 | 1992 | 1993 | 1994 | 1995 | 1996 | 1997 | 1998 | Percent of total, 1998 |
|------------------------------|--------------|--------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|------------------------|
| Gasoline powered | | | | | | | | | | | | | |
| Light vehicles & motorcycles | 64.03 | 59.28 | 53.56 | 49.45 | 37.41 | 39.37 | 39.16 | 37.51 | 33.70 | 28.73 | 27.04 | 27.04 | 53.7% |
| Light trucks ^b | 16.57 | 15.77 | 16.14 | 18.96 | 13.82 | 14.57 | 15.20 | 17.35 | 14.83 | 19.27 | 18.36 | 18.73 | 37.2% |
| Heavy vehicles | 6.71 | 7.14 | 7.19 | 7.72 | 5.36 | 4.57 | 4.48 | 5.53 | 4.12 | 3.77 | 3.35 | 3.07 | 6.1% |
| Total | 87.31 | 82.19 | 76.89 | 76.13 | 56.58 | 58.51 | 58.84 | 60.38 | 52.65 | 51.77 | 48.75 | 48.83 | 96.9% |
| Diesel powered | | | | | | | | | | | | | |
| Light vehicles | ^c | 0.03 | 0.02 | 0.02 | 0.03 | 0.03 | 0.03 | 0.03 | 0.03 | 0.03 | 0.03 | 0.03 | 0.1% |
| Light trucks ^b | ^c | ^c | 0.00 | 0.00 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 | 0.0% |
| Heavy vehicles | 0.72 | 0.92 | 1.14 | 1.24 | 1.23 | 1.32 | 1.33 | 1.41 | 1.41 | 1.45 | 1.47 | 1.51 | 3.0% |
| Total | 0.72 | 0.95 | 1.16 | 1.26 | 1.27 | 1.35 | 1.37 | 1.45 | 1.45 | 1.49 | 1.51 | 1.55 | 3.1% |
| Total | | | | | | | | | | | | | |
| Highway vehicle total | 88.03 | 83.13 | 78.05 | 77.39 | 57.85 | 59.86 | 60.20 | 61.83 | 54.11 | 53.26 | 50.26 | 50.39 | 100.0% |
| Percent diesel | 0.8% | 1.1% | 1.5% | 1.6% | 2.2% | 2.3% | 2.3% | 2.3% | 2.7% | 2.8% | 3.0% | 3.1% | |

Source:

U. S. Environmental Protection Agency, *National Air Pollutant Emission Trends, 1900–1998*, 2000, p. A-3 and annual.
 (Additional resources: www.epa.gov/oar/oaqps)

^aThe sums of subcategories may not equal total due to rounding.

^bLess than 8,500 pounds.

^cData are not available.

The transportation sector accounted for over half of the nation's nitrogen oxide (NO_x) emissions in 1998, with the majority coming from highway vehicles. For details on the highway emissions of NO_x, see Table 4.5.

Table 4.4
Total National Emissions of Nitrogen Oxides, 1970–98^a
(million short tons)

| Source category | 1970 | 1980 | 1990 | 1995 | 1997 | 1998 | Percent of total, 1998 |
|------------------------------------|--------------|--------------|--------------|--------------|--------------|--------------|------------------------|
| Highway vehicles | 7.39 | 8.62 | 7.09 | 7.83 | 7.88 | 7.77 | 31.8% |
| Railroads | 0.50 | 0.73 | 0.93 | 0.99 | 0.95 | 0.95 | 3.9% |
| Other off-highway | 1.44 | 2.80 | 3.88 | 4.14 | 4.30 | 4.33 | 17.7% |
| Transportation total | 9.32 | 12.15 | 11.89 | 12.95 | 13.13 | 13.05 | 53.3% |
| Stationary fuel combustion total | 10.06 | 11.32 | 10.89 | 10.83 | 10.40 | 10.19 | 41.7% |
| Industrial processes total | 0.78 | 0.56 | 0.80 | 0.77 | 0.79 | 0.80 | 3.3% |
| Waste disposal and recycling total | 0.44 | 0.11 | 0.09 | 0.10 | 0.10 | 0.10 | 0.4% |
| Miscellaneous total | 0.33 | 0.25 | 0.37 | 0.27 | 0.41 | 0.33 | 1.3% |
| Total of all sources | 20.93 | 24.38 | 24.05 | 24.92 | 24.82 | 24.45 | 100.0% |

Source:

U. S. Environmental Protection Agency, *National Air Pollutant Emission Trends, 1900–1998*, 2000, pp. A-6–A-10, and annual. (Additional resources: www.epa/oar/oaqps)

Note:

Emission estimation methodology changes indicated by shaded areas. Transportation methodologies changed in 1970, while all others changed in 1990.

^aThe sums of subcategories may not equal total due to rounding.

Table 4.5
Emissions of Nitrogen Oxides from Highway Vehicles, 1970–98^a
(million short tons)

| Source category | 1970 | 1975 | 1980 | 1985 | 1990 | 1992 | 1993 | 1994 | 1995 | 1996 | 1997 | 1998 | Percent of total, 1998 |
|------------------------------|--------------|--------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|------------------------|
| Gasoline powered | | | | | | | | | | | | | |
| Light vehicles & motorcycles | 4.16 | 4.73 | 4.42 | 3.81 | 3.22 | 3.61 | 3.68 | 3.57 | 3.44 | 2.98 | 2.93 | 2.85 | 36.7% |
| Light trucks ^b | 1.28 | 1.46 | 1.41 | 1.53 | 1.26 | 1.36 | 1.42 | 1.66 | 1.52 | 1.95 | 1.96 | 1.95 | 24.7% |
| Heavy vehicles | 0.28 | 0.32 | 0.30 | 0.33 | 0.33 | 0.31 | 0.32 | 0.35 | 0.33 | 0.33 | 0.33 | 0.32 | 4.2% |
| Total | 5.71 | 6.51 | 6.13 | 5.67 | 4.80 | 5.28 | 5.42 | 5.58 | 5.30 | 5.26 | 5.22 | 5.09 | 65.5% |
| Diesel powered | | | | | | | | | | | | | |
| Light vehicles | ^c | 0.02 | 0.03 | 0.03 | 0.04 | 0.04 | 0.04 | 0.04 | 0.04 | 0.04 | 0.03 | 0.03 | 0.4% |
| Light trucks ^b | ^c | ^c | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 | 0.2% |
| Heavy vehicles | 1.68 | 2.12 | 2.46 | 2.39 | 2.24 | 2.30 | 2.34 | 2.45 | 2.48 | 2.54 | 2.61 | 2.63 | 33.9% |
| Total | 1.68 | 2.14 | 2.49 | 2.42 | 2.29 | 2.35 | 2.39 | 2.49 | 2.53 | 2.59 | 2.66 | 2.68 | 34.5% |
| Total | | | | | | | | | | | | | |
| Highway vehicle total | 7.39 | 8.65 | 8.62 | 8.09 | 7.09 | 7.62 | 7.81 | 8.08 | 7.83 | 7.85 | 7.87 | 7.77 | 100.0% |
| Percent diesel | 22.7% | 24.8% | 28.9% | 30.0% | 32.3% | 30.8% | 30.6% | 30.9% | 32.3% | 33.0% | 33.7% | 34.5% | |

Source:

U. S. Environmental Protection Agency, *National Air Pollutant Emission Trends, 1900–1998*, 2000, p. A-9 and annual.

(Additional resources: www.epa.gov/oar/oaqps)

^aThe sums of subcategories may not equal total due to rounding.

^bLess than 8,500 pounds.

^cData are not available.

The transportation sector accounted for over 40% of the nation's volatile organic compound (VOC) emissions in 1998, with the majority coming from highway vehicles. For details on the highway emissions of VOC, see Table 4.7.

Table 4.6
Total National Emissions of Volatile Organic Compounds, 1970–98^a
(million short tons)

| Source category | 1970 | 1980 | 1990 | 1995 | 1997 | 1998 | Percent of total, 1998 |
|------------------------------------|--------------|--------------|--------------|--------------|--------------|--------------|------------------------|
| Highway vehicles | 12.97 | 8.98 | 6.31 | 5.70 | 5.33 | 5.33 | 29.7% |
| Off-highway | 1.71 | 2.14 | 2.55 | 2.70 | 2.46 | 2.46 | 13.7% |
| Transportation total | 14.69 | 11.12 | 8.86 | 8.40 | 7.79 | 7.79 | 43.5% |
| Stationary fuel combustion total | 0.72 | 1.05 | 1.01 | 1.07 | 0.89 | 0.89 | 5.0% |
| Industrial processes total | 12.33 | 12.10 | 9.01 | 9.71 | 8.02 | 8.02 | 44.8% |
| Waste disposal and recycling total | 1.98 | 0.76 | 0.99 | 1.07 | 0.43 | 0.43 | 2.4% |
| Miscellaneous total | 1.10 | 1.13 | 1.07 | 0.57 | 1.26 | 0.79 | 4.4% |
| Total of all sources | 30.82 | 26.17 | 20.94 | 20.82 | 18.88 | 17.92 | 100.0% |

Source:

U. S. Environmental Protection Agency, *National Air Pollutant Emission Trends, 1900–1998*, 2000, pp. A-11–A-17, and annual. (Additional resources: www.epa.gov/oar/oaqps)

Note:

Emission estimation methodology changes indicated by shaded areas. Transportation methodologies changed in 1970, while all others changed in 1990.

^aThe 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.

Table 4.7
Emissions of Volatile Organic Compounds from Highway Vehicles, 1970–98^a
(thousand short tons)

| Source category | 1970 | 1975 | 1980 | 1985 | 1990 | 1992 | 1993 | 1994 | 1995 | 1996 | 1997 | 1998 | Percent of total, 1998 |
|------------------------------|--------------|--------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|------------------------|
| Gasoline powered | | | | | | | | | | | | | |
| Light vehicles & motorcycles | 9,193 | 7,248 | 5,907 | 5,864 | 3,947 | 3,832 | 3,812 | 3,748 | 3,426 | 2,875 | 2,796 | 2,832 | 47.6% |
| Light trucks ^b | 2,770 | 2,289 | 2,059 | 2,425 | 1,622 | 1,588 | 1,647 | 1,909 | 1,629 | 2,060 | 2,017 | 2,015 | 33.9% |
| Heavy vehicles | 1,206 | 1,038 | 830 | 988 | 662 | 739 | 772 | 906 | 735 | 917 | 889 | 877 | 14.7% |
| Total | 13,169 | 10,575 | 8,796 | 9,277 | 6,231 | 6,159 | 6,231 | 6,563 | 5,790 | 5,852 | 5,702 | 5,724 | 96.3% |
| Diesel powered | | | | | | | | | | | | | |
| Light vehicles | ^c | 15 | 8 | 8 | 13 | 13 | 13 | 13 | 14 | 12 | 12 | 12 | 0.2% |
| Light trucks ^b | ^c | ^c | 2 | 2 | 3 | 3 | 3 | 4 | 4 | 5 | 5 | 5 | 0.1% |
| Heavy vehicles | 266 | 335 | 392 | 360 | 297 | 302 | 301 | 313 | 302 | 245 | 227 | 205 | 3.4% |
| Total | 266 | 350 | 402 | 370 | 313 | 318 | 317 | 330 | 320 | 262 | 244 | 222 | 3.7% |
| Total | | | | | | | | | | | | | |
| Highway vehicle total | 13,435 | 10,925 | 9,198 | 9,647 | 6,544 | 6,477 | 6,548 | 6,893 | 6,110 | 6,114 | 5,946 | 5,946 | 100.0% |
| Percent diesel | 2.0% | 3.2% | 4.4% | 3.8% | 4.8% | 4.9% | 4.8% | 4.8% | 5.2% | 4.3% | 4.1% | 3.7% | |

Source:

U. S. Environmental Protection Agency, *National Air Pollutant Emission Trends, 1900–1998*, 2000, p. A-16 and annual.

(Additional resources: www.epa.gov/oar/oaqps)

^aThe sums of subcategories may not equal total due to rounding.

^bLess than 8,500 pounds.

^cData are not available.

The transportation sector accounted for only 2% of the nation's particulate matter (PM-10) emissions in 1998. For details on the highway emissions of PM-10, see Table 4.9.

Table 4.8
Total National Emissions of Particulate Matter (PM-10), 1970–98^a
 (million short tons)

| Source category | 1970 | 1980 | 1990 | 1995 | 1996 | 1997 | 1998 | Percent of total, 1998 |
|------------------------------------|--------------|-------------|--------------|--------------|--------------|--------------|--------------|------------------------|
| Highway vehicles | 0.44 | 0.40 | 0.34 | 0.29 | 0.28 | 0.27 | 0.26 | 0.7% |
| Off-highway | 0.22 | 0.40 | 0.49 | 0.46 | 0.46 | 0.46 | 0.46 | 1.3% |
| Transportation total | 0.66 | 0.80 | 0.83 | 0.75 | 0.74 | 0.73 | 0.72 | 2.1% |
| Stationary fuel combustion total | 2.87 | 2.45 | 1.20 | 1.18 | 1.17 | 1.09 | 1.09 | 3.1% |
| Industrial processes total | 7.67 | 2.75 | 1.04 | 0.95 | 0.68 | 0.70 | 0.71 | 2.0% |
| Waste disposal and recycling total | 1.00 | 0.27 | 0.27 | 0.29 | 0.30 | 0.31 | 0.31 | 0.9% |
| Miscellaneous total | 0.84 | 0.85 | 26.63 | 23.91 | 30.14 | 31.40 | 31.40 | 91.9% |
| Total of all sources | 13.04 | 7.12 | 29.96 | 27.07 | 33.04 | 34.23 | 34.74 | 100.0% |

Source:

U. S. Environmental Protection Agency, *National Air Pollutant Emission Trends, 1900–1998*, 2000, pp. A-22–A-26, and annual. (Additional resources: <http://www.epa.gov/oar/oaqps>)

Note:

Emission estimation methodology changes indicated by shaded areas. Transportation methodologies changed in 1970, while all others changed in 1990.

^aFine particle matter less than 10 microns. The sums of subcategories may not equal total due to rounding.

Table 4.9
Emissions of Particulate Matter (PM-10) from Highway Vehicles, 1970–98^a
 (thousand short tons)

| Source category | 1970 | 1975 | 1980 | 1985 | 1990 | 1992 | 1993 | 1994 | 1995 | 1996 | 1997 | 1998 | Percent of total, 1998 |
|------------------------------|--------------|--------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|------------------------|
| Gasoline powered | | | | | | | | | | | | | |
| Light vehicles & motorcycles | 225 | 207 | 120 | 77 | 61 | 64 | 65 | 62 | 62 | 55 | 56 | 56 | 21.8% |
| Light trucks ^b | 70 | 72 | 55 | 43 | 30 | 31 | 31 | 35 | 32 | 41 | 41 | 40 | 15.6% |
| Heavy vehicles | 13 | 15 | 15 | 14 | 10 | 9 | 10 | 10 | 9 | 9 | 9 | 8 | 3.1% |
| Total | 308 | 294 | 190 | 134 | 101 | 104 | 106 | 107 | 103 | 105 | 106 | 104 | 40.5% |
| Diesel powered | | | | | | | | | | | | | |
| Light vehicles | ^c | 10 | 12 | 8 | 9 | 9 | 8 | 8 | 8 | 7 | 6 | 6 | 2.3% |
| Light trucks ^b | ^c | ^c | 2 | 1 | 1 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 0.8% |
| Heavy vehicles | 136 | 166 | 194 | 219 | 224 | 228 | 205 | 204 | 181 | 168 | 158 | 144 | 56.0% |
| Total | 136 | 177 | 209 | 228 | 235 | 239 | 215 | 213 | 190 | 177 | 167 | 152 | 59.1% |
| Total | | | | | | | | | | | | | |
| Highway vehicle total | 443 | 471 | 397 | 363 | 336 | 343 | 321 | 320 | 293 | 282 | 272 | 257 | 100.0% |
| Percent diesel | 30.7% | 37.6% | 52.6% | 62.8% | 69.9% | 69.7% | 67.0% | 66.6% | 64.8% | 62.8% | 61.4% | 59.1% | |

Source:

U. S. Environmental Protection Agency, *National Air Pollutant Emission Trends, 1900–1998*, 2000, p. A-25 and annual.
 (Additional resources: www.epa.gov/oar/oaqps)

^aThe sums of subcategories may not equal total due to rounding.

^bLess than 8,500 pounds.

^cData are not available.

The transportation sector accounted for only 7% of the nation's particulate matter (PM-2.5) emissions in 1998. For details on the highway emissions of PM-2.5, see Table 4.11.

Table 4.10
Total National Emissions of Particulate Matter (PM-2.5), 1990–98
(million short tons)

| Source category | 1990 | 1991 | 1992 | 1993 | 1994 | 1995 | 1996 | 1997 | 1998 | Percent of total, 1998 |
|------------------------------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|------------------------|
| Highway vehicles | 0.28 | 0.29 | 0.28 | 0.26 | 0.26 | 0.23 | 0.22 | 0.21 | 0.20 | 2.4% |
| Off-highway | 0.44 | 0.43 | 0.43 | 0.43 | 0.42 | 0.40 | 0.41 | 0.41 | 0.41 | 4.9% |
| Transportation total | 0.71 | 0.72 | 0.71 | 0.68 | 0.68 | 0.63 | 0.63 | 0.62 | 0.61 | 7.3% |
| Stationary fuel combustion total | 0.91 | 0.89 | 0.93 | 0.85 | 0.84 | 0.90 | 0.86 | 0.79 | 0.79 | 9.4% |
| Industrial processes total | 0.56 | 0.57 | 0.58 | 0.50 | 0.50 | 0.50 | 0.38 | 0.39 | 0.39 | 4.7% |
| Waste disposal and recycling total | 0.23 | 0.24 | 0.24 | 0.29 | 0.27 | 0.25 | 0.23 | 0.24 | 0.24 | 2.8% |
| Miscellaneous total | 5.55 | 5.31 | 5.19 | 5.00 | 5.68 | 4.90 | 6.09 | 6.45 | 6.35 | 75.7% |
| Total of all sources | 7.96 | 7.74 | 7.65 | 7.33 | 7.98 | 7.18 | 8.20 | 8.48 | 8.38 | 100.0% |

Source:

U.S. Environmental Protection Agency, *National Air Pollutant Emission Trends*, 1900–1998, 2000, pp. A-27–A-31, and annual.
 (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 PM-2.5 emissions are from heavy diesel trucks.

Table 4.11
Emissions of Particulate Matter (PM-2.5) from Highway Vehicles, 1990–98^a
(thousand short tons)

| Source category | 1990 | 1991 | 1992 | 1993 | 1994 | 1995 | 1996 | 1997 | 1998 | Percent of total, 1998 |
|------------------------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|------------------------|
| Gasoline powered | | | | | | | | | | |
| Light vehicles & motorcycles | 37 | 38 | 38 | 38 | 36 | 36 | 32 | 32 | 33 | 16.8% |
| Light trucks ^b | 19 | 21 | 20 | 20 | 23 | 20 | 25 | 25 | 25 | 12.7% |
| Heavy vehicles | 7 | 6 | 6 | 7 | 7 | 6 | 6 | 6 | 5 | 2.5% |
| Total | 63 | 65 | 64 | 65 | 66 | 62 | 63 | 63 | 63 | 32.0% |
| Diesel powered | | | | | | | | | | |
| Light vehicles | 8 | 8 | 8 | 7 | 7 | 7 | 6 | 6 | 5 | 2.5% |
| Light trucks ^b | 1 | 1 | 2 | 1 | 2 | 2 | 2 | 2 | 2 | 1.0% |
| Heavy vehicles | 203 | 212 | 206 | 183 | 182 | 161 | 149 | 140 | 127 | 64.5% |
| Total | 212 | 221 | 216 | 192 | 190 | 169 | 157 | 147 | 134 | 68.0% |
| Total | | | | | | | | | | |
| Highway vehicle total | 275 | 286 | 280 | 257 | 256 | 231 | 221 | 211 | 197 | 100.0% |
| Percent diesel | 77.1% | 77.3% | 77.1% | 74.7% | 74.2% | 73.2% | 71.0% | 69.7% | 68.0% | |

Source:

U.S. Environmental Protection Agency, *National Air Pollutant Emission Trends, 1900–1998*, 2000, p. A-30 and annual.

(Additional resources: www.epa.gov/oar/oaqps)

^a The sums of subcategories may not equal total due to rounding.

^b Less than 8,500 pounds.

Historically the transportation sector, highway vehicles in particular, have been a major source of lead emissions in the U.S. Regulatory action in 1978 required a gradual reduction of the lead content of all gasoline over a period of many years. The transportation sector accounts for only 13% of lead emissions in 1998.

Table 4.12
National Lead Emission Estimates, 1970–98^a
(thousand short tons per year)

| Source category | 1970 | 1975 | 1980 | 1985 | 1990 | 1995 | 1996 | 1997 | 1998 | Percent of total, 1998 |
|------------------------------------|---------------|---------------|--------------|--------------|-------------|-------------|-------------|-------------|-------------|------------------------|
| Highway vehicles | 171.96 | 130.21 | 60.50 | 18.05 | 0.42 | 0.02 | 0.02 | 0.02 | 0.02 | 0.5% |
| Off-highway | 9.74 | 6.13 | 4.21 | 0.92 | 0.78 | 0.54 | 0.51 | 0.50 | 0.50 | 12.7% |
| Transportation total | 181.70 | 136.34 | 64.71 | 18.97 | 1.20 | 0.56 | 0.52 | 0.52 | 0.52 | 13.1% |
| Stationary source fuel combustion | 10.62 | 10.35 | 4.30 | 0.52 | 0.50 | 0.49 | 0.49 | 0.49 | 0.50 | 12.7% |
| Industrial processes | 26.36 | 11.38 | 3.94 | 2.53 | 2.47 | 2.27 | 2.27 | 2.32 | 2.33 | 58.6% |
| Waste disposal and recycling total | 2.20 | 1.60 | 1.21 | 0.87 | 0.80 | 0.60 | 0.61 | 0.62 | 0.62 | 15.6% |
| Total of all sources | 220.87 | 159.66 | 74.15 | 22.89 | 4.98 | 3.93 | 3.90 | 3.95 | 3.97 | 100.0% |

Source:

U. S. Environmental Protection Agency, *National Air Pollutant Emission Trends, 1900-1998*, 2000, pp. A-34–A-35, and annual.

(Additional resources: www.epa.gov/oar/oaqps)

^aThe sums of subcategories may not equal due to rounding.

Table 4.13
State-level Emissions for Criteria Pollutants, 1998
(thousand short tons)

| State | Carbon monoxide | Nitrogen oxides ¹ | Volatile organic compounds ^a | Sulfur dioxide | Particulate matter (PM-10) | Particulate matter (PM-2.5) |
|----------------------|--------------------|---------------------------------|---|-------------------|----------------------------------|-----------------------------------|
| Alabama | 2,361 | 619 | 419 | 764 | 619 | 184 |
| Alaska | 2,249 | 99 | 457 | 12 | 274 | 155 |
| Arizona | 1,370 | 450 | 281 | 225 | 336 | 145 |
| Arkansas | 1,147 | 267 | 223 | 125 | 529 | 132 |
| California | 8,072 | 1,456 | 1,215 | 182 | 1,973 | 535 |
| Colorado | 1,200 | 400 | 274 | 137 | 518 | 126 |
| Connecticut | 793 | 153 | 156 | 66 | 119 | 30 |
| District of Columbia | 100 | 23 | 22 | 11 | 6 | 2 |
| Delaware | 216 | 77 | 51 | 96 | 39 | 14 |
| Florida | 5,203 | 1,059 | 891 | 1,008 | 822 | 260 |
| Georgia | 3,998 | 730 | 576 | 660 | 1,103 | 320 |
| Hawaii | 321 | 59 | 53 | 35 | 35 | 11 |
| Idaho | 956 | 116 | 115 | 39 | 678 | 161 |
| Illinois | 2,890 | 1,076 | 748 | 1,153 | 1,028 | 261 |
| Indiana | 2,526 | 848 | 518 | 1,164 | 641 | 154 |
| Iowa | 1,045 | 343 | 239 | 283 | 602 | 130 |
| Kansas | 1,230 | 479 | 257 | 163 | 1,570 | 299 |
| Kentucky | 1,389 | 682 | 330 | 753 | 345 | 103 |
| Louisiana | 2,184 | 825 | 425 | 405 | 441 | 149 |
| Maine | 488 | 94 | 109 | 53 | 158 | 102 |
| Maryland | 1,107 | 344 | 183 | 339 | 227 | 57 |
| Massachusetts | 1,188 | 304 | 264 | 264 | 290 | 72 |
| Michigan | 3,309 | 880 | 765 | 628 | 569 | 153 |
| Minnesota | 1,552 | 476 | 381 | 162 | 1,011 | 222 |
| Mississippi | 1,414 | 353 | 304 | 305 | 458 | 130 |
| Missouri | 1,816 | 546 | 360 | 482 | 1,286 | 252 |
| Montana | 703 | 176 | 105 | 60 | 1,137 | 216 |
| Nebraska | 681 | 239 | 154 | 94 | 632 | 125 |
| Nevada | 520 | 157 | 98 | 66 | 143 | 39 |
| New Hampshire | 355 | 82 | 74 | 148 | 54 | 17 |
| New Jersey | 1,454 | 466 | 408 | 257 | 313 | 96 |
| New Mexico | 855 | 279 | 140 | 199 | 4,987 | 781 |
| New York | 3,337 | 723 | 753 | 688 | 767 | 222 |
| N. Carolina | 2,773 | 745 | 605 | 729 | 501 | 172 |
| N. Dakota | 380 | 235 | 105 | 327 | 430 | 92 |
| Ohio | 3,934 | 1,198 | 706 | 1,921 | 658 | 195 |
| Oklahoma | 1,518 | 440 | 295 | 157 | 1,033 | 193 |
| Oregon | 1,988 | 271 | 272 | 58 | 686 | 224 |
| Pennsylvania | 2,909 | 840 | 575 | 1,221 | 547 | 156 |
| Rhode Island | 221 | 35 | 49 | 12 | 25 | 8 |
| S. Carolina | 1,638 | 367 | 334 | 290 | 410 | 112 |
| S. Dakota | 333 | 119 | 78 | 53 | 349 | 73 |
| Tennessee | 2,037 | 761 | 528 | 789 | 375 | 130 |
| Texas | 5,644 | 2,140 | 1,388 | 1,096 | 3,655 | 733 |
| Utah | 942 | 233 | 161 | 79 | 238 | 69 |
| Vermont | 240 | 46 | 44 | 16 | 75 | 18 |
| Virginia | 2,149 | 532 | 471 | 373 | 409 | 118 |
| Washington | 2,035 | 364 | 347 | 155 | 430 | 149 |
| W. Virginia | 721 | 500 | 141 | 787 | 152 | 50 |
| Wisconsin | 1,600 | 480 | 400 | 378 | 391 | 112 |
| Wyoming | 361 | 270 | 68 | 179 | 663 | 122 |
| Total | 89,454 | 24,454 | 17,917 | 19,647 | 34,741 | 8,379 |

Source:

U.S. Environmental Protection Agency, *National Air Pollutant Emission Trends, 1900–1998*, 2000, p. 2-8.

(Additional resources: www.epa.gov/oar/oaqps)

Note:

The sums of the States may not equal national totals due to rounding.

¹ Excluding biogenics.

The Greenhouse Gases, Regulated Emissions, and Energy Use in Transportation (GREET) Model

The energy and criteria pollutant estimates of the most recent version (Version 1.5a) of the GREET model are displayed in the next two tables. The model estimates the full fuel-cycle emissions and energy use associated with various transportation fuels and advanced transportation technologies for light vehicles. It calculates fuel-cycle emissions of **five criteria pollutants** (volatile organic compounds, carbon monoxide, nitrogen oxides, sulfur oxides, and particulate matter measuring 10 microns or less) and three greenhouse gases (carbon dioxide, methane, and nitrous oxide). **See Chapter 3 for the greenhouse gas data from GREET.** The model also calculates the total fuel-cycle energy consumption, fossil fuel consumption, and petroleum consumption using various transportation fuels. The fuel cycles that are included in the GREET model are:

- petroleum to conventional gasoline, reformulated gasoline, conventional diesel, reformulated diesel, liquefied petroleum gas, and electricity via residual oil;
- natural gas to compressed natural gas, liquefied natural gas, liquefied petroleum gas, methanol, Fischer-Tropsch diesel, dimethyl ether, hydrogen, and electricity;
- coal to electricity;
- uranium to electricity;
- renewable energy (hydropower, solar energy, and wind) to electricity;
- corn, woody biomass, and herbaceous biomass to ethanol;
- soybeans to biodiesel; and
- landfill gases to methanol.

Near-term technologies are ones which may be applied to 2000 model-year cars and *long-term* technologies are ones which may be applied to 2010 model-year cars.

For additional information about the GREET model, see *GREET 1.5 – Transportation Fuel-Cycle Model, Volume 1: Methodology, Development, Use and Results*, ANL/ESD-39, Vol. 1, August 1999, or contact:

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GREET Web Site:
<http://www.transportation.anl.gov/ttrdc/greet/>

Acronyms Used on Tables 4.14 and 4.15

Emissions acronyms

| | |
|------------------|---|
| CO | carbon monoxide |
| NO _x | nitrogen oxides |
| PM ₁₀ | particulate matter measuring 10 microns or less |
| SO _x | sulfur oxides |
| VOC | volatile organic compounds |

Geographical acronyms

| | |
|----|---------------|
| CA | California |
| NE | northeast |
| US | United States |

Technologies acronyms

| | |
|----------------|---|
| BD20 | mixture of 20% biodiesel and 80% conventional diesel (by volume) |
| CARFG2 | California Phase 2 reformulated gasoline |
| CD | conventional diesel |
| CIDI | compression ignition, direct injection |
| CNG | compressed natural gas |
| CNGV | compressed natural gas vehicle |
| Dedi. | dedicated |
| DME | dimethyl ether |
| E10 | mixture of 10% ethanol and 90% gasoline (by volume) |
| E85 | mixture of 85% ethanol and 15% gasoline (by volume) |
| E90 | mixture of 90% ethanol and 10% gasoline (by volume) |
| ETBE | ethyl tertiary butyl ether |
| EtOH | ethanol |
| EtOHV | ethanol vehicle |
| EV | electric vehicle |
| FCV | fuel-cell vehicle |
| FFV | flexible fuel vehicle |
| FRFG2 | federal Phase 2 reformulated gasoline |
| FG | flared gas |
| FT50 | mixture of 50% Fischer-Tropsch diesel and 50% conventional diesel (by volume) |
| FT100 | 100% Fischer-Tropsch diesel |
| GC | grid-connected |
| GI | grid-independent |
| GHGs | greenhouse gases |
| GV | gasoline vehicle |
| H ₂ | hydrogen |
| HB | herbaceous biomass |
| HEV | hybrid electric vehicle |
| LFG | land-fill gas |
| LNG | liquefied natural gas |
| LNGV | liquefied natural gas vehicle |
| LPG | liquefied petroleum gas |
| LPGV | liquefied petroleum gas vehicle |
| M85 | mixture of 85% methanol and 15% gasoline by volume |
| M90 | mixture of 90% methanol and 10% gasoline by volume |
| MeOH | methanol |
| MeOHV | methanol vehicle |
| MTBE | methyl tertiary butyl ether |
| NG | natural gas |
| RFD | reformulated diesel |
| SI | spark ignition |
| SIDI | spark-ignition, direct-injection |
| WB | woody biomass |

Table 4.14
NEAR-TERM Technology (for MY 2000 vehicles)

Fuel-Cycle Energy and Criteria Pollutant Emission Changes of Alternative Transportation Fuels and Advanced Vehicle Technologies
(percentage relative to conventional gasoline vehicles fueled with conventional gasoline)

| | GV: FRFG2, MTBE | GV: FRFG2, EtOH | CIDI: CD | Bi-Fuel CNGV on CNG | Dedi. CNGV | Dedi. LPGV: NG | Dedi. LPGV: Crude | M85 FFV: NG | E85 FFV: Corn |
|------------------|--------------------|--------------------|----------|---------------------------|---------------|-------------------|-------------------------|----------------|------------------|
| Total Emissions: | | | | | | | | | |
| Total Energy | 0.0% | 0.4% | -29.7% | 8.6% | 5.1% | -9.6% | -8.6% | 15.3% | 17.8% |
| Fossil fuels | 0.0% | -3.5% | -29.6% | 6.9% | 3.4% | -9.2% | -8.6% | 16.0% | -41.9% |
| Petroleum | -11.0% | -3.6% | -26.7% | -99.3% | -99.4% | -98.2% | -3.4% | -72.6% | -74.3% |
| VOC | -15.6% | -11.1% | -61.5% | -52.0% | -75.0% | -64.2% | -59.3% | -19.3% | 55.6% |
| CO | -19.1% | -19.5% | -79.4% | -19.0% | -19.0% | -25.0% | -24.6% | -22.7% | -37.4% |
| NOx | 0.7% | 2.8% | 55.8% | 35.0% | 26.6% | -20.5% | -15.4% | 1.4% | 103.3% |
| PM10 | -1.6% | 38.9% | 158.8% | -33.0% | -34.9% | -42.2% | -32.8% | -26.5% | 619.9% |
| SOx | -28.8% | -16.2% | -31.3% | -28.3% | -30.6% | -77.3% | -57.3% | -58.7% | 168.7% |
| Urban Emissions: | | | | | | | | | |
| VOC | -19.7% | -20.2% | -62.8% | -47.7% | -76.6% | -60.3% | -63.2% | -20.2% | -19.1% |
| CO | -20.0% | -20.0% | -80.5% | -19.5% | -19.5% | -24.9% | -24.9% | -25.0% | -39.9% |
| NOx | -4.2% | -4.6% | 111.5% | 29.8% | 19.1% | -9.3% | -9.1% | -12.0% | -7.6% |
| PM10 | -1.4% | -1.7% | 258.6% | -29.8% | -31.7% | -31.3% | -31.3% | -22.8% | -20.7% |
| SOx | -82.7% | -82.9% | -4.0% | -96.0% | -96.1% | -98.1% | -98.0% | -73.7% | -79.0% |

Table continued on next page. See page preceding Table 4.14 for acronym definitions.

Table 4.14 (continued)
NEAR-TERM Technology (for MY 2000 vehicles)

Fuel-Cycle Energy and Criteria Pollutant Emission Changes of Alternative Transportation Fuels and Advanced Vehicle Technologies
(percentage relative to conventional gasoline vehicles fueled with conventional gasoline)

| | E10 GV: Corn | EV: US Mix | EV: NE US Mix | EV: CA Mix | GC SIDI HEV: CARFG2, EtOH, CA Mix | GI SIDI HEV: FRFG2, MTBE | GI SIDI HEV: FRFG2, EtOH | GI CIDI HEV: CD |
|------------------|-----------------|------------|------------------|------------|---|-----------------------------------|-----------------------------------|--------------------|
| Total Emissions: | | | | | | | | |
| Total Energy | 2.0% | -13.7% | -14.2% | -17.0% | -35.8% | -47.4% | -47.2% | -52.5% |
| Fossil fuels | -3.4% | -39.1% | -46.4% | -69.0% | -52.6% | -47.4% | -49.2% | -52.5% |
| Petroleum | -6.3% | -98.2% | -96.8% | -99.6% | -61.7% | -53.2% | -49.3% | -50.6% |
| VOC | 14.7% | -88.7% | -91.5% | -96.1% | -50.6% | -34.1% | -31.7% | -65.2% |
| CO | -42.8% | -98.1% | -98.0% | -98.7% | -44.0% | -20.4% | -20.6% | -80.0% |
| NOx | 10.1% | 64.3% | 14.3% | -50.5% | -24.5% | -17.2% | -16.1% | 47.4% |
| PM10 | 57.7% | 48.9% | 12.3% | -30.3% | -3.0% | -12.2% | 9.1% | 151.8% |
| SOx | 15.7% | 464.9% | 242.4% | -5.9% | -40.1% | -62.6% | -55.9% | -53.7% |
| Urban Emissions: | | | | | | | | |
| VOC | 10.5% | -99.8% | -99.5% | -99.6% | -51.1% | -30.4% | -30.6% | -63.7% |
| CO | -43.9% | -99.9% | -99.9% | -99.9% | -44.0% | -20.0% | -20.0% | -80.6% |
| NOx | 0.2% | -95.8% | -90.8% | -93.2% | -29.3% | -1.8% | -2.0% | 110.6% |
| PM10 | 0.1% | -35.9% | -33.3% | -34.7% | -6.3% | 6.0% | 5.8% | 258.0% |
| SOx | -6.7% | -96.2% | -90.4% | -99.1% | -93.2% | -90.9% | -91.0% | -35.2% |

Source:

Wang, Michael Q., GREET 1.5a Model Results, Argonne National Laboratory, Argonne, IL, April 2000.

Note: See page preceding Table 4.14 for acronym definitions.

Table 4.15
LONG-TERM Technology (for MY 2010 vehicles)

Fuel-Cycle Energy and Criteria Pollutant Emission Changes of Alternative Transportation Fuels and Advanced Vehicle Technologies
(percentage relative to gasoline vehicles fueled with reformulated gasoline)

| | Dedi. CNGV | Dedi. LNGV: NG | Dedi. LNGV: FG | Dedi. LPGV: NG | Dedi. LPGV: Crude | Dedi. MeOHV: M90, NG | Dedi. MeOHV: M90, FG | Dedi. EtOHV: E90, Corn | Dedi. EtOHV: E90, WB |
|------------------|------------|----------------|----------------|----------------|-------------------|----------------------|----------------------|------------------------|----------------------|
| Total Emissions: | | | | | | | | | |
| Total Energy | -8.5% | -5.7% | -89.8% | -17.8% | -16.9% | 10.5% | -77.5% | 10.1% | 90.7% |
| Fossil fuels | -9.4% | -5.2% | -90.0% | -17.5% | -16.9% | 11.1% | -77.7% | -52.0% | -88.7% |
| Petroleum | -99.4% | -97.8% | -95.9% | -98.2% | -1.3% | -78.1% | -78.1% | -80.1% | -76.1% |
| VOC | -63.3% | -54.1% | -59.8% | -56.8% | -50.8% | -13.8% | -20.0% | 87.4% | 20.2% |
| CO | -38.8% | -36.7% | -40.8% | -40.1% | -39.5% | 2.4% | -2.2% | 1.7% | 15.1% |
| NOx | 31.0% | 77.6% | -23.3% | -38.4% | -29.8% | 4.5% | -115.6% | 156.9% | 287.7% |
| PM10 | -33.4% | -29.5% | -68.5% | -38.4% | -30.1% | -22.4% | -62.5% | 601.2% | 147.6% |
| SOx | -32.6% | -76.9% | -77.1% | -71.8% | -48.4% | -59.1% | -60.6% | 140.8% | -159.8% |
| Urban Emissions: | | | | | | | | | |
| VOC | -57.1% | -58.2% | -58.6% | -47.4% | -51.1% | -11.1% | -11.1% | -9.4% | -9.4% |
| CO | -39.3% | -39.9% | -40.0% | -39.9% | -39.9% | -0.2% | -0.2% | 0.0% | -0.1% |
| NOx | 106.3% | -8.3% | -11.0% | -3.7% | -2.8% | -17.2% | -17.2% | 7.4% | 0.4% |
| PM10 | -24.5% | -25.9% | -26.1% | -25.2% | -25.1% | -14.5% | -14.5% | -12.4% | -12.9% |
| SOx | -80.6% | -98.1% | -98.3% | -91.5% | -91.3% | -77.9% | -77.9% | -83.0% | -85.4% |

Table continued on next page. See page preceding Table 4.14 for acronym definitions.

Table 4.15 (continued)
LONG-TERM Technology (for MY 2010 vehicles)

Fuel-Cycle Energy and Criteria Pollutant Emission Changes of Alternative Transportation Fuels and Advanced Vehicle Technologies
(percentage relative to gasoline vehicles fueled with reformulated gasoline)

| | Dedi. EtOHV: E90, HB | SIDI: FRFG2, EtOH | Dedi. MeOH SIDI: M90, NG | Dedi. MeOH SIDI: M90, FG | Dedi. EtOH SIDI: E90, Corn | Dedi. EtOH SIDI: E90, WB | Dedi. EtOH SIDI: E90, HB | GI SIDI HEV: FRFG2, EtOH | GI SI HEV: CNG |
|------------------|----------------------------|-------------------------|--------------------------------|--------------------------------|----------------------------------|--------------------------------|--------------------------------|-----------------------------------|-------------------|
| Total Emissions: | | | | | | | | | |
| Total Energy | 77.6% | -20.0% | -5.2% | -82.7% | -3.1% | 67.8% | 56.3% | -47.4% | -43.5% |
| Fossil fuels | -80.5% | -20.0% | -4.7% | -135.5% | -57.8% | -90.1% | -82.8% | -47.4% | -44.0% |
| Petroleum | -78.5% | -20.0% | -82.1% | -82.1% | -82.5% | -78.9% | -81.1% | -47.4% | -99.6% |
| VOC | 13.9% | -11.4% | -22.8% | -28.3% | 69.1% | 10.0% | 4.5% | -28.7% | -66.3% |
| CO | 12.4% | -0.8% | 1.2% | -2.9% | 0.9% | 12.7% | 10.4% | -2.0% | -40.4% |
| NOx | 307.8% | -16.6% | -14.0% | -119.6% | 128.2% | 243.2% | 261.0% | -39.2% | -12.4% |
| PM10 | 129.9% | -4.2% | -20.2% | -55.4% | 532.5% | 133.3% | 117.7% | -21.5% | -33.7% |
| SOx | -97.5% | -20.0% | -75.6% | -76.8% | 111.9% | -152.6% | -97.8% | -47.4% | -58.3% |
| Urban Emissions: | | | | | | | | | |
| VOC | -9.5% | -7.3% | -15.8% | -15.8% | -14.4% | -14.4% | -14.5% | -32.1% | -58.3% |
| CO | 0.0% | -0.1% | -0.2% | -0.2% | 0.0% | -0.1% | -0.1% | -0.1% | -39.6% |
| NOx | 3.3% | -4.9% | -18.3% | -18.3% | 3.4% | -2.8% | -0.2% | -11.7% | 55.7% |
| PM10 | -12.7% | 12.0% | -2.1% | -2.1% | -0.3% | -0.7% | -0.5% | 5.0% | -16.5% |
| SOx | -84.0% | -20.0% | -80.6% | -80.6% | -85.0% | -87.1% | -85.9% | -47.4% | -88.0% |

Table continued on next page. See page preceding Table 4.14 for acronym definitions.

Table 4.15 (continued)
LONG-TERM Technology (for MY 2010 vehicles)

Fuel-Cycle Energy and Criteria Pollutant Emission Changes of Alternative Transportation Fuels and Advanced Vehicle Technologies
(percentage relative to gasoline vehicles fueled with reformulated gasoline)

| | GI SI HEV: LNG, NG | GI SI HEV: LNG, FG | GI SI HEV: LPG, NG | GI SI HEV: LPG, Crude | GI SIDI HEV: M90, NG | GI SIDI HEV: M90, FG | GI SIDI HEV: E90, Corn | GI SIDI HEV: E90, WB | GI SIDI HEV: E90, HB |
|------------------|-----------------------|-----------------------|-----------------------|--------------------------|----------------------------|----------------------------|------------------------------|----------------------------|----------------------------|
| Total Emissions: | | | | | | | | | |
| Total Energy | -41.8% | -93.7% | -46.8% | -46.2% | -54.0% | -54.1% | -36.3% | 10.4% | 2.8% |
| Fossil fuels | -41.4% | -93.8% | -46.6% | -46.3% | -35.7% | -121.7% | -72.2% | -93.5% | -88.7% |
| Petroleum | -98.7% | -97.5% | -98.8% | -36.1% | -87.3% | -87.3% | -88.5% | -86.1% | -87.5% |
| VOC | -60.6% | -64.1% | -60.5% | -56.6% | -33.5% | -37.1% | 25.0% | -13.9% | -17.6% |
| CO | -39.1% | -41.6% | -41.1% | -40.7% | -0.7% | -3.3% | -1.1% | 6.7% | 5.1% |
| NOx | 16.3% | -46.0% | -54.0% | -48.4% | -32.2% | -101.7% | 56.1% | 131.8% | 143.5% |
| PM10 | -31.3% | -55.4% | -36.5% | -31.1% | -25.6% | -48.7% | 335.5% | 72.9% | 62.6% |
| SOx | -85.8% | -85.9% | -81.7% | -66.6% | -76.3% | -77.2% | 39.4% | -134.6% | -98.6% |
| Urban Emissions: | | | | | | | | | |
| VOC | -58.9% | -59.2% | -50.0% | -52.4% | -25.7% | -25.7% | -24.7% | -24.7% | -24.8% |
| CO | -40.0% | -40.1% | -40.0% | -40.0% | -0.2% | -0.2% | -0.1% | -0.2% | -0.1% |
| NOx | -15.2% | -16.8% | -11.6% | -11.1% | -21.0% | -21.0% | -6.7% | -10.8% | -9.1% |
| PM10 | -17.3% | -17.5% | -16.8% | -16.8% | -7.1% | -7.1% | -5.9% | -6.2% | -6.0% |
| SOx | -98.8% | -98.9% | -94.5% | -94.4% | -87.2% | -87.2% | -90.1% | -91.5% | -90.7% |

Table continued on next page. See page preceding Table 4.14 for acronym definitions.

Table 4.15 (continued)
LONG-TERM Technology (for MY 2010 vehicles)

Fuel-Cycle Energy and Criteria Pollutant Emission Changes of Alternative Transportation Fuels and Advanced Vehicle Technologies
(percentage relative to gasoline vehicles fueled with reformulated gasoline)

| | GC SIDI HEV: RFG2, EtOH, US Mix | GC SIDI HEV: RFG2, EtOH, NE US Mix | GC SIDI HEV: RFG2, EtOH, CA Mix | GC SI HEV: CNG, US Mix | GC SI HEV: CNG, NE US Mix | GC SI HEV: CNG, CA Mix | GC SI HEV: LNG, NG, US Mix | GC SI HEV: LNG, FG, US Mix | GC SI HEV: LNG, NG, NE US Mix |
|------------------|---------------------------------------|---------------------------------------|------------------------------------|---------------------------|------------------------------|---------------------------|-------------------------------|-------------------------------|----------------------------------|
| Total Emissions: | | | | | | | | | |
| Total Energy | -43.9% | -44.4% | -44.1% | -40.9% | -41.5% | -41.2% | -39.7% | -77.2% | -40.2% |
| Fossil fuels | -47.5% | -48.8% | -55.3% | -45.9% | -47.3% | -54.0% | -44.0% | -81.8% | -45.2% |
| Petroleum | -61.4% | -61.3% | -61.7% | -99.3% | -99.2% | -99.7% | -98.7% | -97.8% | -98.5% |
| VOC | -46.7% | -47.6% | -48.8% | -72.0% | -73.1% | -74.5% | -67.9% | -70.5% | -68.8% |
| CO | -30.6% | -30.6% | -30.9% | -44.2% | -44.1% | -44.5% | -43.2% | -45.0% | -43.2% |
| NOx | 4.9% | -12.3% | -37.0% | 25.1% | 6.9% | -19.5% | 45.8% | 0.9% | 31.2% |
| PM10 | -18.7% | -24.2% | -30.3% | -17.8% | -26.1% | -35.3% | -16.1% | -33.5% | -23.2% |
| SOx | 68.1% | 11.4% | -40.4% | 73.3% | 5.1% | -61.3% | 53.5% | 53.4% | -6.2% |
| Urban Emissions: | | | | | | | | | |
| VOC | -43.7% | -43.6% | -43.7% | -69.2% | -69.1% | -69.2% | -69.7% | -69.8% | -69.6% |
| CO | -30.1% | -30.0% | -30.0% | -43.7% | -43.7% | -43.7% | -44.0% | -44.0% | -44.0% |
| NOx | -32.2% | -26.4% | -30.8% | 16.3% | 21.9% | 17.7% | -34.8% | -36.0% | -29.4% |
| PM10 | -6.1% | -5.6% | -6.0% | -21.2% | -20.6% | -21.1% | -21.8% | -21.9% | -21.3% |
| SOx | -59.2% | -55.9% | -61.4% | -88.1% | -84.4% | -90.7% | -95.9% | -96.0% | -92.7% |

Table continued on next page. See page preceding Table 4.14 for acronym definitions.

Table 4.15 (continued)
LONG-TERM Technology (for MY 2010 vehicles)

Fuel-Cycle Energy and Criteria Pollutant Emission Changes of Alternative Transportation Fuels and Advanced Vehicle Technologies
(percentage relative to gasoline vehicles fueled with reformulated gasoline)

| | GC SI HEV: LNG, FG, NE US Mix | GC SI HEV: LNG, NG, CA Mix | GC SI HEV: LNG, FG, CA Mix | GC SI HEV: LPG, NG, U.S. Mix | GC SI HEV: LPG, Crude, U.S. Mix | GC SI HEV: LPG, NG, NE US Mix | GC SI HEV: LPG, Crude, NE US Mix | GC SI HEV: LPG, NG, CA Mix | GC SI HEV: LPG, Crude, CA Mix |
|------------------|-------------------------------------|----------------------------------|----------------------------------|------------------------------------|---------------------------------------|-------------------------------------|--|----------------------------------|-------------------------------------|
| Total Emissions: | | | | | | | | | |
| Total Energy | -77.7% | -40.0% | -77.4% | -43.3% | -42.9% | -43.9% | -43.5% | -43.6% | -43.2% |
| Fossil fuels | -83.1% | -51.0% | -89.4% | -47.7% | -47.5% | -49.0% | -48.8% | -55.0% | -55.0% |
| Petroleum | -97.6% | -98.9% | -98.1% | -98.8% | -53.6% | -98.6% | -53.4% | -99.1% | -53.8% |
| VOC | -71.4% | -70.1% | -72.7% | -68.2% | -65.3% | -69.1% | -66.3% | -70.4% | -67.6% |
| CO | -45.0% | -43.5% | -45.3% | -44.7% | -44.4% | -44.6% | -44.3% | -45.0% | -44.7% |
| NOx | -15.5% | 10.0% | -39.3% | -4.9% | -0.9% | -21.9% | -18.2% | -46.5% | -43.5% |
| PM10 | -40.9% | -31.1% | -49.1% | -19.8% | -15.9% | -27.1% | -23.4% | -35.3% | -31.7% |
| SOx | -6.5% | -64.3% | -65.0% | 56.4% | 67.3% | -4.6% | 5.8% | -64.0% | -54.1% |
| Urban Emissions: | | | | | | | | | |
| VOC | -69.8% | -69.6% | -69.8% | -63.6% | -65.3% | -63.5% | -65.2% | -63.6% | -65.3% |
| CO | -44.0% | -44.0% | -44.0% | -44.0% | -44.0% | -44.0% | -44.0% | -44.0% | -44.0% |
| NOx | -30.6% | -33.5% | -34.7% | -32.3% | -31.9% | -26.8% | -26.2% | -30.9% | -30.4% |
| PM10 | -21.4% | -21.7% | -21.8% | -21.5% | -21.4% | -20.9% | -20.9% | -21.3% | -21.3% |
| SOx | -92.7% | -98.2% | -98.3% | -92.8% | -92.7% | -89.5% | -89.3% | -95.1% | -95.1% |

Table continued on next page. See page preceding Table 4.14 for acronym definitions.

Table 4.15 (continued)
LONG-TERM Technology (for MY 2010 vehicles)

Fuel-Cycle Energy and Criteria Pollutant Emission Changes of Alternative Transportation Fuels and Advanced Vehicle Technologies
(percentage relative to gasoline vehicles fueled with reformulated gasoline)

| | GC SIDI HEV: M90, NG, US Mix | GC SIDI HEV: M90, FG, US Mix | GC SIDI HEV: M90, NG, NE US Mix | GC SIDI HEV: M90, FG, NE US Mix | GC SIDI HEV: M90, NG, CA Mix | GC SIDI HEV: M90, FG, CA Mix | GC SIDI HEV: E90, Corn, US Mix | GC SIDI HEV: E90, WB, US Mix | GC SIDI HEV: E90, HB, US Mix |
|------------------|------------------------------------|------------------------------------|--|--|------------------------------------|------------------------------------|---|---------------------------------------|------------------------------------|
| Total Emissions: | | | | | | | | | |
| Total Energy | -35.7% | -72.3% | -36.2% | -72.9% | -35.9% | -72.6% | -35.9% | -2.3% | -7.8% |
| Fossil fuels | -40.0% | -101.8% | -41.2% | -103.2% | -47.1% | -109.7% | -66.2% | -81.5% | -78.1% |
| Petroleum | -90.5% | -90.5% | -90.3% | -90.3% | -90.8% | -90.8% | -91.3% | -89.7% | -90.7% |
| VOC | -50.0% | -52.6% | -50.9% | -53.5% | -52.1% | -54.7% | -7.9% | -35.9% | -38.5% |
| CO | -29.7% | -31.6% | -29.6% | -31.5% | -29.9% | -31.8% | -30.0% | -24.4% | -25.5% |
| NOx | 10.7% | -39.2% | -5.5% | -57.3% | -29.0% | -83.6% | 74.2% | 128.6% | 137.0% |
| PM10 | -12.1% | -28.8% | -19.2% | -36.2% | -27.1% | -44.4% | 247.5% | 58.7% | 51.3% |
| SOx | 60.2% | 59.6% | 0.7% | 0.0% | -57.3% | -58.2% | 143.4% | 18.3% | 44.3% |
| Urban Emissions: | | | | | | | | | |
| VOC | -47.9% | -47.9% | -47.8% | -47.8% | -47.8% | -47.8% | -47.2% | -47.2% | -47.2% |
| CO | -30.1% | -30.1% | -30.1% | -30.1% | -30.1% | -30.1% | -30.1% | -30.1% | -30.1% |
| NOx | -39.0% | -39.0% | -33.5% | -33.5% | -37.7% | -37.7% | -28.8% | -31.7% | -30.5% |
| PM10 | -14.7% | -14.7% | -14.2% | -14.2% | -14.6% | -14.6% | -13.8% | -14.0% | -13.9% |
| SOx | -87.6% | -87.6% | -84.3% | -84.3% | -89.8% | -89.8% | -89.7% | -90.7% | -90.1% |

Table continued on next page. See page preceding Table 4.14 for acronym definitions.

Table 4.15 (continued)
LONG-TERM Technology (for MY 2010 vehicles)

Fuel-Cycle Energy and Criteria Pollutant Emission Changes of Alternative Transportation Fuels and Advanced Vehicle Technologies
(percentage relative to gasoline vehicles fueled with reformulated gasoline)

| | GC SIDI HEV: E90, Corn, NE US Mix | GC SIDI HEV: E90, WB, NE US Mix | GC SIDI HEV: E90, HB, NE US Mix | GC SIDI HEV: E90, Corn, CA Mix | GC SIDI HEV: E90, WB, CA Mix | GC SIDI HEV: E90, HB, CA Mix | CIDI: RFD | CIDI: DME, NG | CIDI: DME, FG |
|------------------|--|--|--|---|---------------------------------------|------------------------------------|-----------|------------------|------------------|
| Total Emissions: | | | | | | | | | |
| Total Energy | -36.4% | -2.6% | -8.2% | -36.1% | -2.5% | -8.0% | -35.1% | -17.1% | -94.8% |
| Fossil fuels | -67.5% | -82.4% | -79.2% | -73.7% | -86.6% | -84.6% | -35.1% | -16.6% | -148.4% |
| Petroleum | -91.2% | -89.5% | -90.5% | -91.6% | -89.8% | -90.9% | -25.0% | -97.9% | -97.9% |
| VOC | -8.7% | -36.4% | -39.3% | -9.9% | -37.2% | -40.3% | -62.4% | -73.5% | -83.9% |
| CO | -29.9% | -24.3% | -25.4% | -30.2% | -24.5% | -25.7% | -2.2% | -0.1% | -4.1% |
| NOx | 60.4% | 123.6% | 128.5% | 40.4% | 116.4% | 116.1% | -22.1% | -18.3% | -124.2% |
| PM10 | 244.5% | 55.5% | 46.4% | 241.1% | 51.9% | 40.9% | -12.7% | -34.5% | -69.7% |
| SOx | 97.1% | -19.9% | -6.0% | 52.0% | -57.2% | -55.0% | -34.1% | -81.9% | -83.4% |
| Urban Emissions: | | | | | | | | | |
| VOC | -47.1% | -47.1% | -47.1% | -47.2% | -47.2% | -47.2% | -63.4% | -76.0% | -76.0% |
| CO | -30.0% | -30.1% | -30.0% | -30.0% | -30.1% | -30.1% | -0.1% | -0.3% | -0.3% |
| NOx | -23.4% | -28.3% | -25.9% | -27.4% | -30.9% | -29.3% | 43.1% | 32.7% | 32.7% |
| PM10 | -13.3% | -13.7% | -13.5% | -13.7% | -14.0% | -13.8% | -1.4% | -12.0% | -12.0% |
| SOx | -86.4% | -88.5% | -87.3% | -92.0% | -92.2% | -92.1% | 6.8% | -95.7% | -95.7% |

Table continued on next page. See page preceding Table 4.14 for acronym definitions.

Table 4.15 (continued)
LONG-TERM Technology (for MY 2010 vehicles)

Fuel-Cycle Energy and Criteria Pollutant Emission Changes of Alternative Transportation Fuels and Advanced Vehicle Technologies
(percentage relative to gasoline vehicles fueled with reformulated gasoline)

| | CIDI: FT100, NG | CIDI: FT100, FG | CIDI: BD20 | GI CIDI HEV: RFD | GI CIDI HEV: DME, NG | GI CIDI HEV: DME, FG | GI CIDI HEV: FT100, NG | GI CIDI HEV: FT100, FG | GI CIDI HEV: BD20 |
|------------------|--------------------|--------------------|------------|---------------------|----------------------------|----------------------------|------------------------------|------------------------------|----------------------|
| Total Emissions: | | | | | | | | | |
| Total Energy | 4.0% | -92.0% | -31.5% | -57.7% | -45.9% | -96.6% | -32.2% | -94.8% | -55.3% |
| Fossil fuels | 4.7% | -145.6% | -31.7% | -57.7% | -45.6% | -131.6% | -31.7% | -129.8% | -55.5% |
| Petroleum | -97.5% | -97.5% | -36.7% | -51.1% | -98.6% | -98.6% | -98.4% | -98.4% | -58.7% |
| VOC | -71.5% | -77.8% | -37.8% | -67.1% | -76.9% | -83.7% | -73.1% | -77.2% | -51.1% |
| CO | -0.2% | -4.9% | 0.0% | -3.1% | -1.7% | -4.4% | -1.8% | -4.9% | -1.7% |
| NOx | -24.4% | -145.8% | 20.9% | -38.6% | -36.1% | -105.2% | -40.1% | -119.3% | -10.6% |
| PM10 | -34.3% | -74.9% | -5.9% | -20.1% | -36.5% | -59.5% | -35.7% | -62.2% | -16.4% |
| SOx | -82.6% | -83.5% | -32.6% | -57.0% | -88.2% | -89.2% | -88.6% | -89.3% | -56.1% |
| Urban Emissions: | | | | | | | | | |
| VOC | -66.7% | -66.7% | -61.3% | -64.6% | -76.3% | -76.3% | -66.8% | -66.8% | -63.2% |
| CO | -0.3% | -0.3% | 0.5% | -0.2% | -0.3% | -0.3% | -0.3% | -0.3% | 0.2% |
| NOx | 33.0% | 33.0% | 78.6% | 38.3% | 31.5% | 31.5% | 31.7% | 31.7% | 61.4% |
| PM10 | -8.9% | -8.9% | -0.8% | -2.0% | -12.1% | -12.1% | -9.0% | -9.0% | -2.7% |
| SOx | -94.9% | -94.9% | -9.6% | -30.4% | -97.2% | -97.2% | -96.7% | -96.7% | -41.1% |

Table continued on next page. See page preceding Table 4.14 for acronym definitions.

Table 4.15 (continued)
LONG-TERM Technology (for MY 2010 vehicles)

Fuel-Cycle Energy and Criteria Pollutant Emission Changes of Alternative Transportation Fuels and Advanced Vehicle Technologies
(percentage relative to gasoline vehicles fueled with reformulated gasoline)

| | GC CIDI HEV: RFD, US Mix | GC CIDI HEV: RFD, NE US Mix | GC CIDI HEV: RFD, CA Mix | GC CIDI HEV: DME, NG, US Mix | GC CIDI HEV: DME, FG, US Mix | GC CIDI HEV: DME, NG, NE US Mix | GC CIDI HEV: DME, FG, NE US Mix | GC CIDI HEV: DME, NG, CA Mix | GC CIDI HEV: DME, FG, CA Mix |
|------------------|--------------------------------|-----------------------------------|--------------------------------|------------------------------------|------------------------------------|--|--|------------------------------------|------------------------------------|
| Total Emissions: | | | | | | | | | |
| Total Energy | -50.7% | -51.3% | -51.0% | -42.1% | -79.2% | -42.7% | -79.8% | -42.4% | -79.5% |
| Fossil fuels | -55.2% | -56.6% | -62.7% | -46.4% | -109.3% | -47.7% | -110.7% | -53.5% | -117.3% |
| Petroleum | -63.8% | -63.6% | -64.1% | -98.6% | -98.6% | -98.5% | -98.5% | -98.9% | -98.9% |
| VOC | -73.5% | -74.5% | -75.8% | -80.5% | -85.4% | -81.4% | -86.3% | -82.7% | -87.6% |
| CO | -31.4% | -31.3% | -31.7% | -30.4% | -32.3% | -30.3% | -32.3% | -30.6% | -32.6% |
| NOx | 6.3% | -10.4% | -34.7% | 8.1% | -42.5% | -7.9% | -60.4% | -31.1% | -86.4% |
| PM10 | -8.0% | -15.2% | -23.3% | -19.9% | -36.7% | -27.0% | -44.1% | -34.9% | -52.3% |
| SOx | 74.7% | 16.0% | -41.3% | 51.9% | 51.2% | -7.7% | -8.5% | -65.8% | -66.7% |
| Urban Emissions: | | | | | | | | | |
| VOC | -75.1% | -75.0% | -75.0% | -83.3% | -83.3% | -83.2% | -83.2% | -83.3% | -83.3% |
| CO | -30.2% | -30.1% | -30.2% | -30.2% | -30.2% | -30.1% | -30.1% | -30.1% | -30.1% |
| NOx | -3.8% | 1.2% | -2.6% | -2.4% | -2.4% | 2.6% | 2.6% | -1.1% | -1.1% |
| PM10 | -11.8% | -11.3% | -11.7% | -18.2% | -18.2% | -17.7% | -17.7% | -18.1% | -18.1% |
| SOx | -48.3% | -45.3% | -50.4% | -94.7% | -94.7% | -91.5% | -91.5% | -97.0% | -97.0% |

Table continued on next page. See page preceding Table 4.14 for acronym definitions.

Table 4.15 (continued)
LONG-TERM Technology (for MY 2010 vehicles)

Fuel-Cycle Energy and Criteria Pollutant Emission Changes of Alternative Transportation Fuels and Advanced Vehicle Technologies
(percentage relative to gasoline vehicles fueled with reformulated gasoline)

| | GC CIDI HEV: FT100, NG, US Mix | GC CIDI HEV: FT100, FG, US Mix | GC CIDI HEV: FT100, NG, NE US Mix | GC CIDI HEV: FT100, FG, NE US Mix | GC CIDI HEV: FT100, NG, CA Mix | GC CIDI HEV: FT100, FG, CA Mix | GC CIDI HEV: BD20, US Mix | GC CIDI HEV: BD20, NE US Mix | GC CIDI HEV: BD20, CA Mix |
|------------------|---|---|--|--|---|---|---------------------------------|------------------------------------|---------------------------------|
| Total Emissions: | | | | | | | | | |
| Total Energy | -32.1% | -77.9% | -32.6% | -78.5% | -32.3% | -78.2% | -49.0% | -49.6% | -49.3% |
| Fossil fuels | -36.2% | -108.0% | -37.5% | -109.4% | -43.2% | -115.9% | -53.6% | -55.0% | -61.3% |
| Petroleum | -98.4% | -98.4% | -98.2% | -98.3% | -98.7% | -98.7% | -69.4% | -69.2% | -69.7% |
| VOC | -77.9% | -80.9% | -78.8% | -81.8% | -80.1% | -83.1% | -61.8% | -62.7% | -64.0% |
| CO | -30.4% | -32.7% | -30.4% | -32.6% | -30.7% | -32.9% | -30.3% | -30.3% | -30.6% |
| NOx | 5.2% | -52.8% | -10.8% | -71.0% | -34.1% | -97.5% | 26.8% | 10.3% | -13.6% |
| PM10 | -19.3% | -38.7% | -26.4% | -46.1% | -34.3% | -54.3% | -5.3% | -12.7% | -20.9% |
| SOx | 51.5% | 51.1% | -7.9% | -8.5% | -65.8% | -66.5% | 75.4% | 14.5% | -44.7% |
| Urban Emissions: | | | | | | | | | |
| VOC | -76.6% | -76.6% | -76.6% | -76.6% | -76.6% | -76.6% | -74.1% | -74.0% | -74.0% |
| CO | -30.2% | -30.2% | -30.1% | -30.1% | -30.1% | -30.1% | -29.8% | -29.8% | -29.8% |
| NOx | -2.2% | -2.2% | 2.8% | 2.8% | -0.9% | -0.9% | 19.6% | 24.6% | 20.8% |
| PM10 | -16.0% | -16.0% | -15.5% | -15.5% | -15.9% | -15.9% | -11.5% | -11.0% | -11.4% |
| SOx | -94.4% | -94.4% | -91.1% | -91.1% | -96.6% | -96.6% | -53.7% | -50.5% | -55.9% |

Table continued on next page. See page preceding Table 4.14 for acronym definitions.

Table 4.15 (continued)
LONG-TERM Technology (for MY 2010 vehicles)

Fuel-Cycle Energy and Criteria Pollutant Emission Changes of Alternative Transportation Fuels and Advanced Vehicle Technologies
(percentage relative to gasoline vehicles fueled with reformulated gasoline)

| | Electric Vehicle, US Mix | Electric Vehicle, NE US Mix | Electric Vehicle, CA Mix | FCV: Gaseous H ₂ , NG, Central | FCV: Gaseous H ₂ , NG, Refueling Station | FCV: Gaseous H ₂ , Solar | FCV: Liquid H ₂ , NG | FCV: Liquid H ₂ , FG | FCV: Liquid H ₂ , Solar |
|------------------|--------------------------------|-----------------------------------|--------------------------------|---|---|---|------------------------------------|------------------------------------|---------------------------------------|
| Total Emissions: | | | | | | | | | |
| Total Energy | -39.0% | -40.9% | -39.9% | -53.8% | -48.3% | -62.6% | -38.9% | -86.9% | -71.9% |
| Fossil fuels | -54.0% | -58.4% | -79.0% | -55.8% | -49.8% | -91.4% | -39.4% | -87.1% | -71.7% |
| Petroleum | -98.7% | -98.2% | -99.6% | -99.6% | -96.5% | -99.8% | -99.1% | -99.2% | -98.5% |
| VOC | -89.4% | -92.5% | -96.9% | -95.4% | -92.8% | -96.4% | -94.3% | -99.9% | -96.2% |
| CO | -97.6% | -97.4% | -98.5% | -96.9% | -95.6% | -98.8% | -96.3% | -99.8% | -99.4% |
| NOx | 107.7% | 49.7% | -34.4% | -30.8% | 0.8% | -39.3% | -32.5% | -109.3% | -85.7% |
| PM10 | 18.6% | -7.0% | -35.5% | -39.7% | -37.2% | -42.0% | -37.4% | -62.8% | -49.4% |
| SOx | 377.4% | 178.8% | -14.6% | -22.6% | -33.6% | -28.4% | -87.6% | -93.1% | -98.8% |
| Urban Emissions: | | | | | | | | | |
| VOC | -99.7% | -99.5% | -99.7% | -99.7% | -94.7% | -99.4% | -99.5% | -99.5% | -99.0% |
| CO | -99.9% | -99.8% | -99.9% | -99.9% | -97.1% | -99.8% | -100.0% | -100.0% | -99.9% |
| NOx | -81.5% | -61.6% | -76.5% | -85.4% | 102.7% | -72.7% | -94.5% | -94.6% | -88.2% |
| PM10 | -32.5% | -30.6% | -32.0% | -33.7% | -26.1% | -33.4% | -33.5% | -33.5% | -32.6% |
| SOx | -89.3% | -78.5% | -96.7% | -98.3% | -98.0% | -98.3% | -99.4% | -99.4% | -98.7% |

Table continued on next page. See page preceding Table 4.14 for acronym definitions.

Table 4.15 (continued)
LONG-TERM Technology (for MY 2010 vehicles)

Fuel-Cycle Energy and Criteria Pollutant Emission Changes of Alternative Transportation Fuels and Advanced Vehicle Technologies
(percentage relative to gasoline vehicles fueled with reformulated gasoline)

| | FCV: MeOH, NG | FCV: MeOH, FG | FCV: RFG2, EtOH | FCV: RFD | EtOH FCVs: Corn | EtOH FCVs: WB | EtOH FCVs: HB | NG FCV: CNG | FCV: LNG, NG |
|------------------|------------------|------------------|--------------------|----------|--------------------|------------------|------------------|----------------|-----------------|
| Total Emissions: | | | | | | | | | |
| Total Energy | -45.1% | -96.4% | -50.0% | -51.4% | -37.7% | 13.9% | 5.5% | -51.9% | -50.5% |
| Fossil fuels | -44.8% | -131.4% | -50.0% | -51.3% | -77.5% | -101.0% | -95.7% | -52.4% | -50.2% |
| Petroleum | -98.4% | -98.4% | -50.0% | -43.7% | -96.5% | -93.9% | -95.5% | -99.7% | -98.9% |
| VOC | -70.7% | -74.3% | -52.8% | -85.0% | -4.0% | -47.0% | -51.1% | -88.3% | -83.4% |
| CO | -77.2% | -79.9% | -78.7% | -79.0% | -77.2% | -68.6% | -70.3% | -78.8% | -77.7% |
| NOx | -53.6% | -123.6% | -55.2% | -58.3% | 50.1% | 133.8% | 146.7% | -36.9% | -12.4% |
| PM10 | -46.8% | -70.2% | -41.5% | -39.3% | 354.1% | 63.7% | 52.3% | -46.0% | -44.0% |
| SOx | -85.7% | -86.5% | -53.7% | -55.6% | 45.9% | -146.5% | -106.6% | -65.4% | -87.9% |
| Urban Emissions: | | | | | | | | | |
| VOC | -73.5% | -73.5% | -54.1% | -90.8% | -72.0% | -72.0% | -72.0% | -87.9% | -88.5% |
| CO | -80.0% | -80.0% | -79.9% | -79.9% | -79.8% | -79.9% | -79.9% | -79.6% | -79.9% |
| NOx | -82.5% | -82.5% | -72.6% | -63.7% | -55.1% | -62.1% | -59.2% | -15.7% | -75.9% |
| PM10 | -34.0% | -34.0% | -32.7% | -33.1% | -31.6% | -32.0% | -31.8% | -32.4% | -33.2% |
| SOx | -96.6% | -96.6% | -95.6% | -75.7% | -95.8% | -98.2% | -96.8% | -99.1% | -99.0% |

Table continued on next page. See page preceding Table 4.14 for acronym definitions.

Table 4.15 (continued)
LONG-TERM Technology (for MY 2010 vehicles)

Fuel-Cycle Energy and Criteria Pollutant Emission Changes of Alternative Transportation Fuels and Advanced Vehicle Technologies
(percentage relative to gasoline vehicles fueled with reformulated gasoline)

| | FCV: LNG, FG | FCV: LPG, NG | FCV: LPG, Crude |
|------------------|-----------------|-----------------|--------------------|
| Total Emissions: | | | |
| Total Energy | -94.7% | -54.8% | -54.3% |
| Fossil fuels | -94.7% | -54.6% | -54.3% |
| Petroleum | -97.9% | -99.0% | -96.9% |
| VOC | -86.5% | -86.2% | -82.9% |
| CO | -79.9% | -79.4% | -79.1% |
| NO _x | -65.4% | -72.2% | -67.5% |
| PM ₁₀ | -64.5% | -48.3% | -43.8% |
| SO _x | -88.0% | -84.5% | -71.6% |
| Urban Emissions: | | | |
| VOC | -88.7% | -84.8% | -86.8% |
| CO | -80.0% | -79.9% | -79.9% |
| NO _x | -77.3% | -72.9% | -72.4% |
| PM ₁₀ | -33.3% | -32.7% | -32.7% |
| SO _x | -99.1% | -95.3% | -95.2% |

Source:

Wang, Michael Q., GREET 1.5a Model Results, Argonne National Laboratory, Argonne, IL, April 2000.

Note: See page preceding Table 4.14 for acronym definitions.

The average light truck pollutes 40 percent more than the average car, according to the American Council for an Energy-Efficient Economy. One reason for the difference is that cars and light trucks have not been held to the same emissions standards. However, that is beginning to change.

Early in 2000, the Environmental Protection Agency issued a final rule for more stringent tailpipe emission standards for all new passenger vehicles, including sport utility vehicles (SUVs), minivans, vans, and pick-up trucks. This is the first time that SUVs and other light-duty trucks are subjected to the same national pollution standards as passenger cars.

Table 4.16
Pollution from a Typical New Car and Light Truck, 2000 Model Year
(pounds of pollutant per 15,000 miles of travel)

| | Car | Light truck |
|--------------------|--------|-------------|
| Carbon dioxide | 15,200 | 21,200 |
| Carbon monoxide | 420 | 547 |
| Nitrogen oxide | 50 | 83 |
| Hydrocarbons | 55 | 74 |
| Particulate matter | 2.7 | 3.3 |

Source:
DeCicco, John, and Martin Thomas, *Green Guide to Cars and Trucks: Model Year 2000*, American Council for an Energy-Efficient Economy, Washington, DC, 2000, p. 113. (Additional resources: www.aceee.org)

Note:
Includes both tailpipe and fuel-cycle emissions. Assumes 15,000 miles driven per year.

Table 4.17
Tier 2 Federal Emission Standards

| Vehicle types | Standard | Time frame |
|---|-------------------------------------|---------------------|
| Light-duty vehicles and light light-duty trucks (less than 6,000 lbs. GVW) | 0.07 grams per mile NO _x | Phased in 2004–2007 |
| Heavy light-duty trucks (6,000–8,500 lbs. GVW) and medium-duty passenger vehicles (8,500–10,000 lbs. GVW) | 0.07 grams per mile NO _x | Phased in 2004–2009 |

Source:
U.S. Environmental Protection Agency, Office of Mobile Sources, Regulatory Announcement, “EPA’s Program for Cleaner Vehicles and Cleaner Gasoline,” EPA420-F-99-051, December 1999. (*Federal Register*, Vol. 65, No. 28, Thursday, February 10, 2000.) (Additional resources: www.epa.gov/oms/tr2home.htm)

Table 4.18
Federal Exhaust Emission Certification Standards for Gasoline- and Diesel-Powered Light Vehicles *a,b*
(grams per mile)

| Engine Type & Pollutant | Prior to control | 1968-69 | 1970-71 | 1972 | 1973-74 | 1975-76 | 1977-79 | 1980 | 1981 | 1982-86 | 1987-93 | 1994-2004 ^b |
|--|------------------|--------------|---------|------|---------|---------|---------|------|------|---------|---------|------------------------|
| Gasoline | | | | | | | | | | | | |
| Hydrocarbons (total) | 11 | ^c | 2.2 | 3.4 | | 1.5 | | 0.41 | | | | 0.41 (e) |
| Non-methane hydrocarbons | ^d | ^e | | | | | | | | | | 0.25 (0.31) |
| Carbon monoxide | 80 | ^c | 23 | 39 | | 15 | | 7.0 | 3.4 | | | 3.4 (4.2) |
| Cold-temp. carbon monoxide ^f | ^d | ^e | | | | | | | | | | 10 (e) |
| Nitrogen oxides | 4 | ^e | | | 3.0 | 3.1 | 2.0 | | 1.0 | | | 0.4 (0.6) |
| Particulates | ^d | ^e | | | | | | | | | | 0.08 (0.10) |
| Diesel | | | | | | | | | | | | |
| Hydrocarbons (total) | 11 | ^e | | | | | 1.5 | 0.41 | | | | 0.41 (e) |
| Non-methane hydrocarbons | ^d | ^e | | | | | | | | | | 0.25 (0.31) |
| Carbon monoxide | 80 | ^e | | | | 15 | | 7.0 | 3.4 | | | 3.4 (4.2) |
| Nitrogen oxides | 4 | ^e | | | | | 3.1 | 2.0 | 1.0 | | | 1.0 (1.25) |
| Particulates | ^d | ^e | | | | | | | | | | 0.08 (0.10) |
| Test Procedure | | | | | | | | | | | | |
| CVS-72 | | | | | | | | | | | | |
| CVS-75 | | | | | | | | | | | | |
| CVS-75 | | | | | | | | | | | | |
| Useful Life (intermediate) ^b | | | | | | | | | | | | |
| ^e | | | | | | | | | | | | |
| (full) | | | | | | | | | | | | |
| 5 yrs/50,000 mi | | | | | | | | | | | | |
| 10 yrs/100,000 mi | | | | | | | | | | | | |

Source:

40 CFR 86.085-2; 40 CFR 86.090-2; 40 CFR 86.090-S; 40 CFR 86.094-8; 40 CFR 86.096-2; 40 CFR 86.096-8; 40 CFR 86.098-8; 40 CFR 86.099-8; 40 CFR 86.082-2; 40 CFR 86.000-8. Lisa Snapp, Office of Air and Radiation, Environmental Protection Agency, Personal communication, April 1999.

^aThe test procedure for measuring exhaust emissions has changed several times over the course of vehicle emissions regulation. The 7-mode procedure was used through model year 1971 and was replaced by the CVS-72 procedure beginning in model year 1972. The CVS-75 became the test procedure as of model year 1975. While it may appear that the total hydrocarbon and carbon monoxide standards were relaxed in 1972-74, these standards were actually more stringent due to the more stringent nature of the CVS-72 test procedure. Additional standards for carbon monoxide and composite standards for non-methane hydrocarbons and nitrogen oxides tested over the new Supplemental Federal Test Procedure will be phased-in during model years 2000-02; these standards are not shown in this table.

^bAll emission standards must be met for a useful life of 5 years/50,000 miles. Beginning in with model year 1994, a second set of emission standards must also be met for a full useful life of 10 years/100,000 miles (these standards are shown in parentheses). Tier 1 exhaust standards were phased-in during 1994-96 at a rate of 40, 80, and 100 percent, respectively.

^cIn 1968-69, exhaust emission standards were issued in parts per million (ppm) rather than grams per mile and are, therefore, incompatible with this table.

^dNo estimate available.

^eNo standard set.

^fThe cold CO emission standard is measured at 20 degrees F (rather than 75 degrees F) and is applicable for a 5-year/50,000-mile useful life.



Table 4.19
Federal Exhaust Emission Certification Standards for Gasoline- and Diesel-Powered Light Trucks (Category LDT1) *a,b,c*
(grams per mile)

| Engine Type & Pollutant | | Prior to control | 1968-69 | 1970-71 | 1972 | 1973-74 | 1975 | 1976-78 | 1979-81 | 1982-83 | 1984 | 1985-86 | 1987 | 1988-93 | 1994 | 1995-2004 |
|--|----------|------------------|---------------------------|---------|--------|---------|---------------------------|---------|---------|---------|--|-------------------|------|-------------------|-----------------|-------------|
| Gasoline | | | | | | | | | | | | | | | | |
| Hydrocarbons (total) | 11 | <i>d</i> | 2.2 | 3.4 | | 2.0 | | 1.7 | | 0.80 | | | | <i>f</i> | (0.80) | |
| Non-methane hydrocarbons | <i>e</i> | | | | | | | | | | | | | | 0.25 | (0.31) |
| Carbon monoxide | 80 | <i>d</i> | 23 | 39 | | 20 | | 18 | | 10 | | | | 3.4 | (4.2) | |
| Cold-temp. carbon monoxide <i>g</i> | <i>e</i> | | | | | | | | | | | | | 10 | (<i>f</i>) | |
| Nitrogen oxides <i>i</i> | 4 | <i>d</i> | | | 3.0 | 3.1 | | 2.3 | | | | | 1.2 | 0.4 | (0.6) | |
| Particulates | <i>e</i> | | | | | | | | | | | | | | | 0.08 (0.10) |
| Diesel | | | | | | | | | | | | | | | | |
| Hydrocarbons (total) | 11 | <i>f</i> | | | | 2.0 | | 1.7 | | 0.80 | | | | <i>f</i> | (0.80) | |
| Non-methane hydrocarbons | <i>e</i> | | | | | | | | | | | | | | 0.25 | (0.31) |
| Carbon monoxide | 80 | <i>f</i> | | | | 20 | | 18 | | 10 | | | | 3.4 | (4.2) | |
| Nitrogen oxides | 4 | <i>f</i> | | | | 3.1 | | 2.3 | | | | | 1.2 | 1.0 | (1.25) | |
| Particulates | <i>e</i> | | | | | | | | | 0.60 | | | 0.26 | | | 0.08 (0.10) |
| LDT1 Weight Criteria <i>h</i> | | | GVWR up through 6,000 lbs | | | | GVWR up through 8,500 lbs | | | | GVWR up through 6,000 lbs; LVW up through 3,750 lbs | | | | | |
| Test Procedure <i>b</i> | | | 7-mode | CVS-72 | CVS-75 | | | | | | | | | | | |
| Useful Life (intermediate) <i>c</i> | | | <i>f</i> | | | | | | | | | | | | 5 yrs/50,000 mi | |
| (full) | | | 5 yrs/50,000 mi | | | | | | | | | 11 yrs/120,000 mi | | 11 yrs/120,000 mi | | |

Source:

40 CFR 86.082-2; 40 CFR 86.085-2; 40 CFR 86.090-2; 40 CFR 86.090-g; 40 CFR 86.091-g; 40 CFR 86.094-g; 40 CFR 86.096-2; 40 CFR 86.096-g; 40 CFR 86.099-g; 40 CFR 86.000-g; 40 CFR 86.001-g; 40 CFR 86.004-g. Lisa Snapp, Office of Air and Radiation, Environmental Protection Agency, Personal communication.

^aLight truck categories LDT1-LDT4 were not actually created until 1994. From 1968 to 1978 all trucks with a Gross Vehicle Weight Rating (GVWR) up to 6,000 lbs were classified as light trucks and were required to meet the same standards. As of 1979, the maximum weight was raised to 8,500 lbs GVWR. During 1988 through 1993, light trucks were divided into two subcategories that coincide with the current LDT1 and LDT2/3/4 categories.

^bThe test procedure for measuring exhaust emissions has changed several times over the course of vehicle emissions regulation. The 7-mode procedure was used through model year 1971 and was replaced by the CVS-72 procedure beginning in model year 1972. The CVS-75 became the test procedure as of model year 1975. While it may appear that the total hydrocarbon and carbon monoxide standards were relaxed in 1972-74, these standards were actually more stringent due to the more stringent nature of the CVS-72 test procedure. Additional standards for carbon monoxide and composite standards for non-methane hydrocarbons and nitrogen oxides tested over the new Supplemental Federal Test Procedure will be phased-in during model years 2000-02; these standards are not shown in this table.

^cEmission standards had to be met for a useful life of 5 years/50,000 miles through model year 1983, and a full useful life of 11 years/120,000 miles was defined for 1985-93 (several useful life options were available for 1984). Beginning in model year 1994, emission standards were established for an intermediate useful life of 5 years/50,000 miles as well as a full useful life of 11 years/120,000 miles (these standards are shown in parentheses). Hydrocarbon standards, however, were established only for full useful life. Tier 1 exhaust standards, except PM standards, were phased-in during 1994-96 at a rate of 40, 80, and 100 percent, respectively. PM standards were phased-in at a rate of 40, 80, and 100 percent during 1995-97.

^dIn 1968-69, exhaust emission standards were issued in parts per million (ppm) rather than grams per mile and are, therefore, incompatible with this table.

^eNo estimate available.

^fNo standard set.

^gThe cold CO emission standard is measured at 20 degrees F (rather than 75 degrees F) and is applicable for a 5-year/50,000-mile useful life.

^hGross vehicle weight rating (GVWR) is the maximum design loaded weight. Loaded vehicle weight (LVW) is the curb weight (nominal vehicle weight) plus 300 lbs.

Table 4.20
Federal Exhaust Emission Certification Standards for Gasoline- and Diesel-Powered Light Trucks (Category LDT2) *a,b,c*
(grams per mile)

| Engine Type & Pollutant | Prior to control | 1968-69 | 1970-71 | 1972 | 1973-74 | 1975 | 1976-78 | 1979-81 | 1982-83 | 1984 | 1985-86 | 1987 | 1988-90 | 1991-93 | 1994 | 1995-2004 |
|-------------------------------------|------------------|---------------------------|---------|--------|---------|--------|---------------------------|---------|---------|------|---------|--|---------|---------|-------------------|-------------|
| Gasoline | | | | | | | | | | | | | | | | |
| Hydrocarbons (total) | 11 | d | 2.2 | 3.4 | | 2.0 | | 1.7 | | 0.80 | | | | f | (0.80) | |
| Non-methane hydrocarbons | e | f | | | | | | | | | | | | 0.32 | (0.40) | |
| Carbon monoxide | 80 | d | 23 | 39 | | 20 | | 18 | | 10 | | | | 4.4 | (5.5) | |
| Cold-temp. carbon monoxide g | e | f | | | | | | | | | | | | 12.5 | (f) | |
| Nitrogen oxides | 4 | f | | | 3.0 | 3.1 | | 2.3 | | | | | 1.7 | 0.7 | (0.97) | |
| Particulates | e | f | | | | | | | | | | | | | | 0.08 (0.10) |
| Diesel | | | | | | | | | | | | | | | | |
| Hydrocarbons (total) | 11 | f | | | | | 2.0 | 1.7 | | 0.80 | | | | f | (0.80) | |
| Non-methane hydrocarbons | e | f | | | | | | | | | | | | 0.32 | (0.40) | |
| Carbon monoxide | 80 | f | | | | | 20 | 18 | | 10 | | | | 4.4 | (5.5) | |
| Nitrogen oxides | 4 | f | | | | | 3.1 | 2.3 | | | | | 1.7 | f | (0.97) | |
| Particulates | e | f | | | | | | | 0.60 | | 0.50 | 0.45 | 0.13 | | | 0.08 (0.10) |
| LDT2 Weight Criteria h | | GVWR up through 6,000 lbs | | | | | GVWR up through 8,500 lbs | | | | | GVWR up through 6,000 lbs and LVW over 3,750 lbs | | | | |
| Test Procedure b | | 7-mode | | CVS-72 | | CVS-75 | | | | | | | | | | |
| Useful Life (intermediate) c (full) | | f | | | | | | | | | | | | | 5 yrs/50,000 mi | |
| | | 5 yrs/50,000 mi | | | | | | | | | | 11 yrs/120,000 mi | | | 11 yrs/120,000 mi | |

Source:

40 CFR 86.082-2; 40 CFR 86.085-2; 40 CFR 86.090-2; 40 CFR 86.090-g; 40 CFR 86.091-g; 40 CFR 86.094-g; 40 CFR 86.096-2; 40 CFR 86.096-g; 40 CFR 86.099-g; 40 CFR 86.000-g; 40 CFR 86.001-9; 40 CFR 86.004-g. Lisa Snapp, Office of Air and Radiation, Environmental Protection Agency, Personal communication, April 1999.

^aLight truck categories LDT1-LDT4 were not actually created until 1994. From 1968 to 1978 all trucks with a Gross Vehicle Weight Rating (GVWR) up to 6,000 lbs were classified as light trucks and were required to meet the same standards. As of 1979, the maximum weight was raised to 8,500 lbs GVWR. During 1988-93, light trucks were divided into two subcategories that coincide with the current LDT1 and LDT2/3/4 categories.

^bThe test procedure for measuring exhaust emissions has changed several times over the course of vehicle emissions regulation. The 7-mode procedure was used through model year 1971 and was replaced by the CVS-72 procedure beginning in model year 1972. The CVS-75 became the test procedure as of model year 1975. While it may appear that the total hydrocarbon and carbon monoxide standards were relaxed in 1972-74, these standards were actually more stringent due to the more stringent nature of the CVS-72 test procedure. Additional standards for carbon monoxide and composite standards for non-methane hydrocarbons and nitrogen oxides tested over the new Supplemental Federal Test Procedure will be phased-in during model years 2000-02; these standards are not shown in this table.

^cEmission standards had to be met for a useful life of 5 years/50,000 miles through model year 1983, and a full useful life of 11 years 120,000 miles was defined for 1985-93 (several useful life options were available for 1984). Beginning in model year 1994, emission standards were established for an intermediate useful life of 5 years/50,000 miles as well as a full useful life of 11 years/120,000 miles (these standards are shown in parentheses). Hydrocarbon standards, however, were established only for full useful life. Tier 1 exhaust standards, except PM standards, were phased-in during 1994-96 at a rate of 40, 80, and 100 percent, respectively. PM standards were phased-in at a rate of 40, 80, and 100 percent during 1995-97.

^dIn 1968-69, exhaust emission standards were issued in parts per million (ppm) rather than grams per mile and are, therefore, incompatible with this table.

^eNo estimate available.

^fNo standard set.

^gThe cold CO emission standard is measured at 20 degrees F (rather than 75 degrees F) and is applicable for a 5-year/50,000-mile useful life.

^hGross vehicle weight rating (GVWR) is the maximum design loaded weight. Loaded vehicle weight (LVW) is the curb weight (nominal vehicle weight) plus 300 lbs.

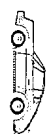


Table 4.21
Federal Exhaust Emission Certification Standards for Gasoline- and Diesel-Powered Light Trucks (Category LDT3) *a,b,c*
(grams per mile)

| Engine Type & Pollutant | Prior to control | 1968-69 | 1970-71 | 1972 | 1973-74 | 1975 | 1976-78 | 1979-81 | 1982-83 | 1984 | 1985-86 | 1987 | 1988-89 | 1990 | 1991-95 | 1996-2004 | |
|---|------------------|---------------------------|---------|--------|---------|--------|---------|---------------------------|---------|------|---------|-------------------|----------------------|------|--------------------------|-----------------|--|
| Gasoline | | | | | | | | | | | | | | | | | |
| Hydrocarbons (total) | 11 | <i>d</i> | 2.2 | 3.4 | | 2.0 | | 1.7 | | 0.80 | | | | | <i>f</i> | (0.80) | |
| Non-methane hydrocarbons | <i>e</i> | <i>f</i> | | | | | | | | | | | | | 0.32 | (0.46) | |
| Carbon monoxide | 80 | <i>d</i> | 23 | 39 | | 20 | | 18 | | 10 | | | | | 4.4 | (6.4) | |
| Cold-temp. carbon monoxide <i>g</i> | <i>e</i> | <i>f</i> | | | | | | | | | | | | | 12.5 | (<i>h</i>) | |
| Nitrogen oxides | 4 | <i>f</i> | | | 3.0 | 3.1 | | 2.3 | | | | | 2.3 | 1.7 | 0.7 | (0.98) | |
| Particulates | <i>e</i> | <i>f</i> | | | | | | | | | | | | | <i>f</i> | (0.10) | |
| Diesel | | | | | | | | | | | | | | | | | |
| Hydrocarbons (total) | 11 | <i>f</i> | | | | | 2.0 | 1.7 | | 0.80 | | | | | <i>f</i> | (0.80) | |
| Non-methane hydrocarbons | <i>e</i> | <i>f</i> | | | | | | | | | | | | | 0.32 | (0.46) | |
| Carbon monoxide | 80 | <i>f</i> | | | | 20 | | 18 | | 10 | | | | | 4.4 | (6.4) | |
| Nitrogen oxides | 4 | <i>f</i> | | | | 3.1 | | 2.3 | | | | | 2.3 | 1.7 | <i>f</i> | (0.98) | |
| Particulates | <i>e</i> | <i>f</i> | | | | | | | 0.60 | | 0.50 | | 0.45 | | 0.13 | <i>f</i> (0.10) | |
| LDT3 Weight Criteria <i>h</i> | | GVWR up through 6,000 lbs | | | | | | GVWR up through 8,500 lbs | | | | | Any ALW | | ALW up through 5,750 lbs | | |
| | | | | | | | | | | | | | GVWR 6,001-8,500 lbs | | | | |
| Test Procedure <i>b</i> | | 7- mode | | CVS-72 | | CVS-75 | | | | | | | | | | | |
| Useful Life (intermediate) <i>c</i> (full) | | | | | | | | | | | | | | | | 5 yrs/50,000 mi | |
| | | 5 yrs/50,000 mi | | | | | | | | | | 11 yrs/120,000 mi | | | | 11 yrs/120,000 | |

Source:

40 CFR 86.082-2; 40 CFR 86.085-2; 40 CFR 86.090-2; 40 CFR 86.090-g; 40 CFR 86.091-g; 40 CFR 86.094-g; 40 CFR 86.096-2; 40 CFR 86.096-g; 40 CFR 86.099-g; 40 CFR 86.000-g; 40 CFR 86.001-g; 40 CFR 86.004-g. Lisa Snapp, Office of Air and Radiation, Environmental Protection Agency, Personal communication, April 1999.

^aLight truck categories LDT1-LDT4 were not actually created until 1994. From 1968 to 1978 all trucks with a Gross Vehicle Weight Rating (GVWR) up to 6,000 lbs were classified as light trucks and were required to meet the same standards. As of 1979, the maximum weight was raised to 8,500 lbs GVWR. During 1988-93, light trucks were divided into two subcategories that coincide with the current LDT1 and LDT2/3/4 categories.

^bThe test procedure for measuring exhaust emissions has changed several times over the course of vehicle emissions regulation. The 7-mode procedure was used through model year 1971 and was replaced by the CVS-72 procedure beginning in model year 1972. The CVS-75 became the test procedure as of model year 1975. While it may appear that the total hydrocarbon and carbon monoxide standards were relaxed in 1972-74, these standards were actually more stringent due to the more stringent nature of the CVS-72 test procedure. Additional standards for carbon monoxide and composite standards for non-methane hydrocarbons and nitrogen oxides tested over the new Supplemental Federal Test Procedure will be phased-in during model years 2002-04; these standards are not shown in this table.

^cEmission standards had to be met for a full useful life of 5 years/50,000 miles through model year 1983, and a full useful life of 11 years/120,000 miles was defined for 1985-93 (several useful life options were available for 1984). Beginning in model year 1996, emission standards were established for an intermediate useful life of 5 years/50,000 miles as well as a full useful life of 11 years/120,000 miles (these standards are shown in parentheses). This applied to all pollutants except hydrocarbons and particulates for all LDT3s and NOx for diesel-powered LDT3s, which were only required to meet full useful life standards. Tier 1 exhaust standards were phased-in during 1996-97 at a rate of 50 and 100 percent, respectively.

^dIn 1968-69, exhaust emission standards were issued in parts per million (ppm) rather than grams per mile and are, therefore, incompatible with this table.

^eNo estimate available.

^fNo standard set.

^gThe cold CO emission standard is measured at 20 degrees F (rather than 75 degrees F) and is applicable for a 5-year/50,000-mile useful life.

^hGross vehicle weight rating (GVWR) is the maximum design loaded weight. Loaded vehicle weight (LVW) is the curb weight (nominal vehicle weight) plus 300 lbs.

Table 4.22
Federal Exhaust Emission Certification Standards for Gasoline- and Diesel-Powered Light Trucks (Category LDT4) *a,b,c*
(grams per mile)

| Engine Type & Pollutant | Prior to control | 1968-69 | 1970-71 | 1972 | 1973-74 | 1975 | 1976-78 | 1979-81 | 1982-83 | 1984 | 1985-86 | 1987 | 1988-89 | 1990 | 1991-95 | 1996-2004 | |
|---|------------------|---------------------------|---------|--------|---------|------|---------|---------------------------|---------|-------|---------|-------------------|----------------------|------|---------------------|-------------------|-----------------|
| Gasoline | | | | | | | | | | | | | | | | | |
| Hydrocarbons (total) | 11 | <i>d</i> | 2.2 | 3.4 | | 2.0 | | 1.7 | | 10.80 | | | | | | <i>f</i> (0.80) | |
| Non-methane hydrocarbons | <i>e</i> | | | | | | | | | | | | | | | 0.39 (0.56) | |
| Carbon monoxide | 80 | <i>d</i> | 23 | 39 | Go | | | 18 | | 10 | | | | | | 5.0 (7.3) | |
| Cold-temp. carbon monoxide <i>g</i> | <i>e</i> | <i>f</i> | | | | | | | | | | | | | | 12.5 (<i>f</i>) | |
| Nitrogen oxides | 4 | <i>f</i> | | | 3.0 | 3.1 | | 2.3 | | | | 2.3 | 1.7 | | | 1.1 (1.53) | |
| Particulates | <i>e</i> | | | | | | | | | | | | | | | (0.12) | |
| Diesel | | | | | | | | | | | | | | | | | |
| Hydrocarbons (total) | 11 | <i>f</i> | | | | | 2.0 | 1.7 | | 0.80 | | | | | | <i>f</i> (0.80) | |
| Non-methane hydrocarbons | <i>e</i> | <i>f</i> | | | | | | | | | | | | | | 0.39 (0.56) | |
| Carbon monoxide | 80 | <i>f</i> | | | | | 20 | 18 | | 10 | | | | | | 5.0 (7.3) | |
| Nitrogen oxides | 4 | <i>f</i> | | | | | 3.1 | 2.3 | | | | 2.3 | 1.7 | | | <i>f</i> (1.53) | |
| Particulates | <i>e</i> | <i>f</i> | | | | | | | 0.60 | | 0.50 | 0.45 | | 0.13 | | <i>f</i> (0.12) | |
| LDT4 Weight Criteria <i>h</i> | | GVWR up through 6,000 lbs | | | | | | GVWR up through 8,500 lbs | | | | | Any ALVW | | ALVW over 5,750 lbs | | |
| | | | | | | | | | | | | | GVWR 6,001-8,500 lbs | | | | |
| Test Procedure <i>b</i> | | 7-mode | I | CVS-72 | CVS-75 | | | | | | | | | | | | |
| Useful Life (intermediate) <i>c</i> (full ^a) | | | | | | | | | | | | | | | | | 5 yrs/50,000 mi |
| | | 5 yrs/50,000 mi | | | | | | | | | | 11 yrs/120,000 mi | | | | | 11 yrs/120,000 |

Source:

40 CFR 86.082-2; 40 CFR 86.085-2; 40 CFR 86.090-2; 40 CFR 86.090-g; 40 CFR 86.091-g; 40 CFR 86.094-g; 40 CFR 86.096-2; 40 CFR 86.096-g; 40 CFR 86.099-g; 40 CFR 86.000-g; 40 CFR 86.001-g; 40 CFR 86.004-g. Lisa Snapp, Office of Air and Radiation, Environmental Protection Agency, Personal communication, April 1999.

^aLight truck categories LDT1-LDT4 were not actually created until 1994. From 1968 to 1978 all trucks with a Gross Vehicle Weight Rating (GVWR) up to 6,000 lbs were classified as light trucks and were required to meet the same standards. As of 1979, the maximum weight was raised to 8,500 lbs GVWR. During 1988-93, light trucks were divided into two subcategories that coincide with the current LDT1 and LDT2/3/4 categories.

^bThe test procedure for measuring exhaust emissions has changed several times over the course of vehicle emissions regulation. The 7-mode procedure was used through model year 1971 and was replaced by the CVS-72 procedure beginning in model year 1972. The CVS-75 became the test procedure as of model year 1975. While it may appear that the total hydrocarbon and carbon monoxide standards were relaxed in 1972-74, these standards were actually more stringent due to the more stringent nature of the CVS-72 test procedure. Additional standards for carbon monoxide and composite standards for non-methane hydrocarbons and nitrogen oxides tested over the new Supplemental Federal Test Procedure will be phased-in during model years 2002-04; these standards are not shown in this table.

^cEmission standards had to be met for a full useful life of 5 years/50,000 miles through model year 1983, and a full useful life of 11 years/120,000 miles was defined for 1985-93 (several useful life options were available for 1984). Beginning in model year 1996, emission standards were established for an intermediate useful life of 5 years/50,000 miles as well as a full useful life of 11 years/120,000 miles (these standards are shown in parentheses). This applied to all pollutants except hydrocarbons and particulates for all LDT3s and NO_x for diesel-powered LDT3s, which were only required to meet full useful life standards. Tier 1 exhaust standards were phased-in during 1996-97 at a rate of 50 and 100 percent, respectively.

^dIn 1968-69, exhaust emission standards were issued in parts per million (ppm) rather than grams per mile and are, therefore, incompatible with this table.

^eNo estimate available.

^fNo standard set.

^gThe cold CO emission standard is measured at 20 degrees F (rather than 75 degrees F) and is applicable for a 5-year/50,000-mile useful life.

^hGross vehicle weight rating (GVWR) is the maximum design loaded weight. Adjusted loaded vehicle weight (ALVW) is the numerical average of the GVWR and the curb weight.





Table 4.23
Federal Exhaust Emission Certification Standards for Gasoline- and Diesel-Powered Light Heavy Trucks
(Grams per brake horsepower-hour)

| Engine Type & Pollutant | (Grams per brake horsepower hour) | | | | | | | | | | | |
|---|-----------------------------------|----------|---------|---------------------|------------------------|------|-------------------------------|------|---------|---------|-----------|-------|
| | 1970-73 | 1974-78 | 1979-83 | 1984 | 1985-86 | 1987 | 1988-89 | 1990 | 1991-93 | 1994-97 | 1998-2003 | 2004+ |
| Gasoline | | | | | | | | | | | | |
| Hydrocarbons + nitrogen oxides (HC + NOx) | a | 16 | 10 | a | | | | | | | | |
| Hydrocarbons (HC) | b | a | 1.5 | 1.9 | 1.1 | | | | | | | |
| Nitrogen oxides (NOx) | a | | | | 110.6 | | 6.0 | 15.0 | 14.0 | | | |
| Carbon Monoxide (CO) | b | (40 | 25 | 137.1 | 114.4 | | | | | | | |
| Diesel | | | | | | | | | | | | |
| Hydrocarbons + nitrogen oxides (HC + NOx) | a | 16 | 10 | a | | | | | | | | |
| Hydrocarbons (HC) | b | a | 1.5 | 1.3 | | | | | | | | |
| Nitrogen oxides (NOx) | a | | | | 10.7 | | 6.0 | 5.0 | 4.0 | | | |
| Non-methane hydrocarbons + nitrogen oxides | a | 2.4c | | | | | | | | | | |
| Carbon Monoxide (CO) | b | 40 | (2 5 | 115.5 | | | | | | | | |
| Particulates | a | | | | | | | 0.60 | 0.25 | (0.10 | | |
| Smoke Opacity (acceleration/lugging/peak) d | 40/20/a | 20/15/50 | | | | | | | | | | |
| Weight Criteria for Light Heavy Trucks e | GVWR over 6,000 lbs | | | GVWR over 8,500 lbs | | | GVWR 8,501 through 14,000 lbs | | | | | |
| Test Procedure (gasoline)f | 9-mode steady-state | | | | MVMA transient | | | | | | | |
| (diesel) f | 13-mode steady-state | | | EPA transient | | | | | | | | |
| Useful Life (gasoline) g | 5 years/50,000 miles | | | | 8 years/1 10,000 miles | | | | | | | |

Sources:

40 CFR 86.082-2; 40 CFR 86.085-2; 40 CFR 86.088-10; 40 CFR 86.090-2; 40 CFR 86.090-10; 40 CFR 86.090-1 1; 40 CFR 86.091-10; 40 CFR 86.091-1 1; 40 CFR 86.093-1 1; 40 CFR 86.094-1 1; 40 CFR 86.096-2; 40 CFR 86.096-10; 40 CFR 86.096-1 1; 40 CFR 86.098-10; 40 CFR 86.098-1 1; 40 CFR 86.099-10; 40 CFR 86.099-1 1; 40 CFR 86.004-1 1; 40 CFR 86.004-15. Lisa Snapp, Office of Air and Radiation, Environmental Protection Agency, Personal communication, April 1999. Rob French, Office of Air and Radiation, Environmental Protection Agency, Personal communication, April 1999.

^aNo standard set.

^bAlthough emission standards for hydrocarbons and carbon monoxide were in effect for these years, they were not measured in grams/brake horsepower-hour and are, therefore, incompatible with this table.

^cVehicles can meet a composite non-methane hydrocarbon and nitrogen oxide standard of 2.5, if they meet a non-methane hydrocarbon standard of no more than 0.5.

^dSmoke opacity is expressed in percentage for acceleration, lugging, and peak modes (acceleration/lugging/peak). Lugging is when a vehicle is carrying a load.

^eGross vehicle weight rating (GVWR) is the maximum design loaded weight.

^fSeveral testing procedures have been used during the course of exhaust emission control. A steady-state 9-mode test procedure (13-mode for diesel) was used for 1970-83 standards. For 1984, either the steady-state tests or the EPA transient test procedure could be used. For diesels, the EPA transient test was required from 1985 to the present. For gasoline-powered vehicles, either the EPA or MVMA (Motor Vehicle Manufacturers Association) transient test procedure could be used during 1985-86, and the MVMA procedure was required thereafter.

^gEmissions standards apply to the useful life of the vehicle. Useful life was 5 years/50,000 miles through 1983, and 8 years/1 10,000 miles for model year 1985 and after. 1984 was a transitional year in which vehicles could meet the older standard (and test procedure) or the newer one. Useful life requirement for gasoline-powered trucks meeting NOx standards for 1998 and after is 10 years/1 10,000 miles. The useful life requirements for heavy diesel truck standards are more complex and vary by vehicle weight, pollutant, test procedure, and year. Consult the U.S. Code of Federal Regulations for further information.

Table 4.24
Federal Exhaust Emission Certification Standards for Gasoline- and Diesel-Powered Heavy Heavy Trucks
(Grams per brake horsepower-hour)

| Engine Type & Pollutant | 1970-73 1974-78 1979-83 1984 1985-86 1987 1988-89 1990 1991-93 1994-97 1998-2003 2004+ | | | | | | | | | | | |
|---|--|----------|---------------------|-----------------------|-----|----------------------|------|------|--|--|--|------|
| Gasoline | | | | | | | | | | | | |
| Hydrocarbons + nitrogen oxides (HC + NOx) | a | 16 | 10 | a | | | | | | | | |
| Hydrocarbons (HC) | b | a | 1.5 | 1.9 | | | | | | | | |
| Nitrogen oxides (NOx) | a | | | 10.6 | 6.0 | 5.0 | 4.0 | | | | | |
| Carbon Monoxide (CO) | b | 40 | 25 | 37.1 | | | | | | | | |
| Diesel | | | | | | | | | | | | |
| Hydrocarbons + nitrogen oxides (HC + NOx) | a | 16 | 10 | a | | | | | | | | |
| Hydrocarbons (HC) | b | a | 1.5 | 1.3 | | | | | | | | |
| Nitrogen oxides (NOx) | a | | | 10.7 | 6.0 | 5.0 | 4.0 | | | | | |
| Non-methane hydrocarbons + nitrogen oxides | a | | | | | | | | | | | 2.4c |
| Carbon Monoxide (CO) | b | 40 | 25 | 15.5 | | | | | | | | |
| Particulates | a | | | | | 0.60 | 0.25 | 0.10 | | | | |
| Smoke Opacity (acceleration/lugging/peak) d | 40/20/a | 20/15/50 | | | | | | | | | | |
| Weight Criteria for Heavy Heavy Trucks e | GVWR over 6,000 lbs | | GVWR over 8,500 lbs | | | GVWR over 14,000 lbs | | | | | | |
| Test Procedure (gasoline) f (diesel)f | 13-mode steady-state | | | MVMA | | | | | | | | |
| | 13-mode steady-state | | | EPA transient | | | | | | | | |
| Useful Life (gasoline) g | 5 years/50,000 miles | | | 8 years/110,000 miles | | | | | | | | |

Sources:

40 CFR 86.082-2; 40 CFR 86.085-2; 40 CFR 86.088-10; 40 CFR 86.090-2; 40 CFR 86.090-10; 40 CFR 86.090-11; 40 CFR 86.091-10; 40 CFR 86.091-11; 40 CFR 86.093-11; 40 CFR 86.094-11; 40 CFR 86.096-2; 40 CFR 86.096-10; 40 CFR 86.096-11; 40 CFR 86.098-10; 40 CFR 86.098-11; 40 CFR 86.099-10; 40 CFR 86.099-11; 40 CFR 86.004-11; 40 CFR 86.004-15. Lisa Snapp, Office of Air and Radiation, Environmental Protection Agency, Personal communication, April 1999. Rob French, Office of Air and Radiation, Environmental Protection Agency, Personal communication, April 1999.

^aNo standard set

^bAlthough emission standards for hydrocarbons and carbon monoxide were in effect for these years, they were not measured in grams/brake horsepower-hour and are, therefore, incompatible with this table.

^cVehicles can meet a composite non-methane hydrocarbons and nitrogen oxides standard of 2.5, if they meet a non-methane hydrocarbon standard of no more than 0.5.

^dSmoke opacity is expressed in percentage for acceleration, lugging, and peak modes (acceleration/lugging/peak). Lugging is when a vehicle is carrying a load.

^eGross vehicle weight rating (GVWR) is the maximum design loaded weight.

^fSeveral testing procedures have been used during the course of exhaust emission control. A steady-state 9-mode test procedure (13-mode for diesel) was used for 1970-83 standards. For 1984, either the steady-state tests or the EPA transient test procedure could be used. For diesels, the EPA transient test was required from 1985 to the present. For gasoline-powered vehicles, either the EPA or MVMA (Motor Vehicle Manufacturers Association) transient test procedure could be used during 1985-86, and the MVMA procedure was required thereafter.

^gEmissions standards apply to the useful life of the vehicle. Useful life was 5 years/50,000 miles through 1983, and 8 years/110,000 miles for model year 1985 and after. 1984 was a transitional year in which vehicles could meet the older standard (and test procedure) or the newer one. Useful life requirement for gasoline-powered trucks meeting NOx standards for 1998 and after is 10 years/110,000 miles. The useful life requirements for heavy diesel truck standards are more complex and vary by vehicle weight, pollutant, test procedure, and year. Consult the U.S. Code of Federal Regulations for further information.



Table 4.25
California Passenger Cars and Light Trucks Emission Certification Standards
(grams/mile)

| Vehicle Type | Emission Category | Vehicle Useful Life | | | | | | | | | | | | | |
|---------------|-------------------|------------------------|-------------------|-------------------|-----|-----------------|-------------------|--------------------|--------------------------|-------------------|-------------------|-----|-----------------|-------------------|-------|
| | | 5 Years / 50,000 Miles | | | | | | | 10 Years / 100,000 Miles | | | | | | |
| | | THC ¹ | NMHC ² | NMOG ³ | CO | NO _x | PM | HCHO | THC ^a | NMHC ^b | NMOG ^c | CO | NO _x | PM | HCHO |
| Passenger car | Tier 0 | – | 0.39 | – | 7.0 | 0.4 | 0.08 ⁴ | 0.015 ⁵ | | | | | | | |
| | Tier 1 | – | 0.25 | – | 3.4 | 0.4 | 0.08 ^d | 0.015 ^e | – | 0.31 | – | 4.2 | 0.6 | – | – |
| | TLEV | – | – | 0.125 | 3.4 | 0.4 | – | 0.015 | – | – | 0.156 | 4.2 | 0.6 | 0.08 ^d | 0.018 |
| | LEV | – | – | 0.075 | 3.4 | 0.2 | – | 0.015 | – | – | 0.090 | 4.2 | 0.3 | 0.08 ^d | 0.018 |
| | ULEV | – | – | 0.040 | 1.7 | 0.2 | – | 0.008 | – | – | 0.055 | 2.1 | 0.3 | 0.04 ^d | 0.011 |
| | ZEV | 0.0 | 0.00 | 0.000 | 0.0 | 0.0 | 0.00 | 0.000 | 0.00 | 0.00 | 0.000 | 0.0 | 0.0 | 0.00 | 0.000 |
| LDT1 | Tier 0 | – | 0.39 | – | 9.0 | 0.4 | 0.08 ^d | 0.015 ^e | | | | | | | |
| | Tier 1 | – | 0.25 | – | 3.4 | 0.4 | 0.08 ^d | 0.015 ^e | – | 0.31 | – | 4.2 | 0.6 | – | – |
| | TLEV | – | – | 0.125 | 3.4 | 0.4 | – | 0.015 | – | – | 0.156 | 4.2 | 0.6 | 0.08 ^d | 0.018 |
| | LEV | – | – | 0.075 | 3.4 | 0.2 | – | 0.015 | – | – | 0.090 | 4.2 | 0.3 | 0.08 ^d | 0.018 |
| | ULEV | – | – | 0.040 | 1.7 | 0.2 | – | 0.008 | – | – | 0.055 | 2.1 | 0.3 | 0.04 ^d | 0.011 |
| | ZEV | 0.0 | 0.00 | 0.000 | 0.0 | 0.0 | 0.00 | 0.000 | 0.00 | 0.00 | 0.000 | 0.0 | 0.0 | 0.00 | 0.000 |
| LDT2 | Tier 0 | – | 0.50 | – | 9.0 | 1.0 | 0.08 ^d | 0.018 ^e | | | | | | | |
| | Tier 1 | – | 0.32 | – | 4.4 | 0.7 | 0.08 ^d | 0.018 ^e | – | 0.40 | – | 5.5 | 0.97 | – | – |
| | TLEV | – | – | 0.160 | 4.4 | 0.7 | – | 0.018 | – | – | 0.200 | 5.5 | 0.9 | 0.10 ^d | 0.023 |
| | LEV | – | – | 0.100 | 4.4 | 0.4 | – | 0.018 | – | – | 0.130 | 5.5 | 0.5 | 0.10 ^d | 0.023 |
| | ULEV | – | – | 0.050 | 2.2 | 0.4 | – | 0.009 | – | – | 0.070 | 2.8 | 0.5 | 0.05 ^d | 0.013 |

Source:

U.S. Environmental Protection Agency, Office of Mobile Sources, EPA 420-B-98-001. (Additional resources: www.epa.gov/OMSWWW)

Note:

LDT1 = light truck up through 3,750 lbs. loaded vehicle weight; LDT2 = light truck greater than 3,750 lbs. loaded vehicle weight.

¹ THCE for methanol vehicles. Does not apply to CNG vehicles.

² THCE for Tier 0 methanol vehicles. NMHCE for other alcohol vehicles.

³ NMHC for diesel-fueled vehicles.

⁴ Diesel-fueled vehicles only.

⁵ Ethanol- and methanol-fueled vehicles only.

California's Low-Emission Vehicle regulations provide for reduced emission vehicles to be available to consumers. Vehicles meeting these standards have even lower emissions than the basic standards for all new vehicles sold in California. Currently, there is a wide array of TLEVs and LEVs, and a few ULEVs and ZEVs on the market. For a listing of the available low emission vehicles, see the California Air Resources Board web site referenced below.

Table 4.26
California Vehicle Emission Reduction for
Passenger Cars and Light Trucks

| | Emission reduction from the basic California standards ¹ | | |
|--|--|------|------|
| | HC | CO | NOx |
| Transitional Low-Emission Vehicle (TLEV) | 50% | = | = |
| Low-Emission Vehicle (LEV) | 70% | = | 50% |
| Ultra-Low-Emission Vehicle (ULEV) | 85% | 50% | 50% |
| Zero-Emission Vehicles (ZEV) | 100% | 100% | 100% |

Source:

California Air Resources Board web site, www.arb.ca.gov/msprog/ccbg/ccbg.htm
(Additional resources: www.arb.ca.gov)

Note:

= indicates equivalent emissions to vehicles meeting the basic California standard.

¹See Table 4.23.

The California Air Resources Board adopted requirements in 1991 for fleet mixture in order to meet the emission standards. By the year 2001, it is proposed that 90% of each vehicle manufacturer's fleet be low-emission vehicles. A March 1996 amendment to the plan allows the marketplace to determine the number of zero emission vehicles from 1998 to 2002.

Table 4.27
California Air Resources Board Requirements for Meeting Emission Standards

| Year | Conventional vehicles | Transitional low- emission vehicles | Low-emission vehicles | Ultra-low- emission vehicles | Zero emission vehicles |
|------|--------------------------|---|--------------------------|------------------------------------|------------------------------|
| 1993 | 100% | | | | |
| 1994 | 90% | 10% | | | |
| 1995 | 85% | 15% | | | |
| 1996 | 80% | 20% | | | |
| 1997 | 73% | | 25% | 2% | |
| 1998 | 48% | | 48% | 2% | |
| 1999 | 25% | | 73% | 2% | |
| 2000 | | | 90% | 2% | |
| 2001 | | | 90% | 5% | |
| 2002 | | | 85% | 10% | |
| 2003 | | | 75% | 15% | 10% |

Source:

California Air Resources Board, Mobile Sources Division, El Monte, CA, 1996.
(Additional resources: www.arb.ca.gov)

Chapter 5

Transportation and the Economy

Summary Statistics from Tables/Figures in this Chapter

| Source | | |
|------------|---|--------|
| Figure 5.1 | Share of gasoline cost attributed to taxes, 1998 | |
| | <i>Canada</i> | 47% |
| | <i>France</i> | 80% |
| | <i>Germany</i> | 74% |
| | <i>Japan</i> | 60% |
| | <i>United Kingdom</i> | 76% |
| | <i>United States</i> | 36% |
| Table 5.4 | Retail prices for motor fuel in the U.S., 1999 (current cents per gallon) | |
| | <i>Gasoline, average for all types</i> | 122.1 |
| | <i>Diesel fuel</i> | 97.0 |
| Table 5.10 | Average price of a new car, 1999 (current dollars) | 21,022 |
| | <i>Domestic</i> | 18,725 |
| | <i>Import</i> | 30,350 |
| Table 5.12 | Automobile operating costs, 1999 | |
| | <i>Variable costs (constant 1998 dollars per 10,000 miles)</i> | 1,039 |
| | <i>Fixed costs (constant 1998 dollars per 10,000 miles)</i> | 4,635 |
| Table 5.18 | Transportation share of total employment | |
| | <i>1960</i> | 13.5% |
| | <i>1980</i> | 11.3% |
| | <i>1998</i> | 10.5% |

Table 5.1
Gasoline Prices for Selected Countries, 1978–99

| | Current dollars per gallon | | | | | | | | | Average annual percentage change | |
|----------------------------|---|-------------------|-------------------|-------------------|-------------------|-------------------|-------------------|-------------------|-------------------|----------------------------------|---------|
| | 1978 ^a | 1982 ^a | 1986 ^a | 1990 ^b | 1994 ^b | 1996 ^b | 1997 ^b | 1998 ^b | 1999 ^b | 1978–99 | 1990–99 |
| China | d | d | d | d | d | 0.93 ^b | d | d | 1.05 ^d | d | d |
| India | d | d | d | 1.92 | 2.28 | 2.25 ^c | 2.65 ^c | 2.32 ^c | | d | d |
| Japan | 2.00 ^c | 2.60 ^c | 2.79 ^c | 3.05 ^c | 4.14 | 3.77 | 3.28 ^c | 2.94 | 3.13 ^c | 2.2% | 0.3% |
| France | 2.15 | 2.56 | 2.58 | 3.40 | 3.31 | 4.41 | 4.22 | 3.82 | 3.79 | 2.7% | 1.2% |
| United Kingdom | 1.22 | 2.42 | 2.07 | 2.55 | 2.86 | 3.47 | 4.25 | 3.90 | 3.97 | 5.8% | 5.0% |
| Germany | 1.75 | 2.17 | 1.88 | 2.72 | 3.34 | 4.32 | 3.87 | 3.33 | 3.36 | 3.2% | 2.4% |
| Canada | 0.69 ^c | 1.37 ^c | 1.31 ^c | 1.92 ^c | 1.57 | 1.80 | 1.92 | 1.55 | 1.54 | 3.9% | -2.4% |
| United States ^d | 0.66 ^c | 1.32 ^c | 0.93 ^c | 1.04 ^c | 1.24 | 1.28 | 1.42 | 1.27 | 1.13 | 2.6% | 0.9% |
| | Constant 1998 dollars ^e per gallon | | | | | | | | | Average annual percentage change | |
| | 1978 ^a | 1982 ^a | 1986 ^a | 1990 ^b | 1994 ^b | 1996 ^b | 1997 ^b | 1998 ^b | 1999 ^b | 1978–99 | 1990–99 |
| China | d | d | d | d | d | 0.97 | d | d | 1.03 ^d | d | d |
| India | d | d | d | 2.40 | 2.51 | 2.34 | 2.69 ^c | 2.32 ^c | | d | d |
| Japan | 5.00 ^c | 4.39 ^c | 4.15 ^c | 3.81 ^c | 4.55 | 3.92 | 3.33 ^c | 2.94 | 3.06 ^c | -2.3% | -2.4% |
| France | 5.37 | 4.32 | 3.84 | 4.24 | 3.64 | 4.58 | 4.29 | 3.82 | 3.71 | -1.7% | -1.5% |
| United Kingdom | 3.05 | 4.09 | 3.08 | 3.18 | 3.15 | 3.61 | 4.32 | 3.90 | 3.88 | 1.2% | 2.2% |
| Germany | 4.37 | 3.67 | 2.80 | 3.39 | 3.67 | 4.49 | 3.93 | 3.33 | 3.29 | -1.3% | -0.2% |
| Canada | 1.72 ^c | 2.31 ^c | 1.95 ^c | 2.40 ^c | 1.73 | 1.87 | 1.95 | 1.55 | 1.51 | -0.6% | -5.0% |
| United States ^e | 1.65 ^c | 2.23 ^c | 1.38 ^c | 1.30 ^c | 1.36 | 1.33 | 1.44 | 1.27 | 1.11 | -1.9% | -1.7% |

Source:

U.S. Department of Energy, Energy Information Administration, *International Energy Annual 1998* Washington, DC, January 2000, Table 7.2 and annual.

(Additional resources: www.eia.doe.gov)

Note:

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

^a Prices represent the retail prices (including taxes) for premium leaded gasoline. Prices are representative for each country based on quarterly data averaged for the year.

^b Regular gasoline.

^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.

Figure 5.1. Gasoline Prices for Selected Countries, 1990 and 1998

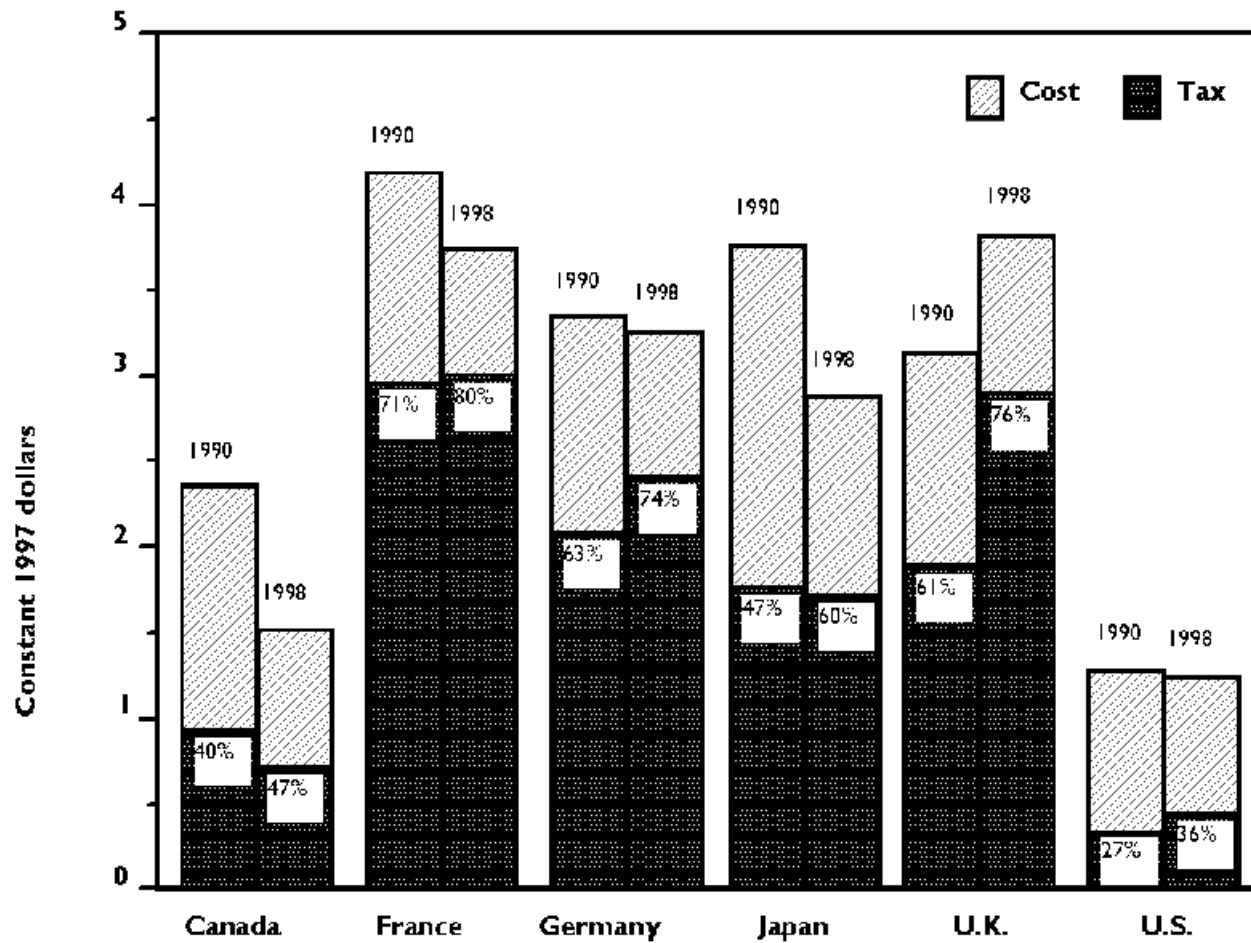
**Source:**

Table 5.1 and International Energy Agency, *Energy Prices and Taxes, Fourth Quarter 1998*, Paris, France, 1999.

(Additional resources: www.iea.org)

Table 5.2
Diesel Fuel Prices for Selected Countries, 1978–99

| | Current dollars per gallon | | | | | | | | | Average annual percentage change | |
|----------------------------|---|-------------------|-------------------|-------------------|-------------------|-------------------|-------------------|-------------------|-------------------|----------------------------------|--------------|
| | 1978 ^a | 1982 ^a | 1986 ^a | 1990 ^b | 1994 ^b | 1996 ^b | 1997 ^b | 1998 ^b | 1999 ^b | 1978–99 | 1990–99 |
| China | ^c | ^c | ^c | ^c | ^c | 0.88 | ^c | ^c | 2.73 ^c | ^c | ^c |
| India | ^c | ^c | ^c | 0.78 | 0.74 | 0.92 | 1.11 | 1.01 | | ^c | ^c |
| Japan | ^c | 1.78 | 1.90 | 1.75 | 2.48 | 2.51 | 2.34 | 2.40 | 1.95 | ^c | 1.2% |
| France | 1.30 | 1.88 | 1.69 | 1.78 | 2.10 | 3.10 | 3.08 | 2.71 | 2.23 | 2.6% | 2.5% |
| United Kingdom | 1.24 | 2.05 | 1.71 | 2.04 | 2.46 | 3.26 | 3.78 | 3.92 | 3.47 | 5.0% | 6.1% |
| Germany | 1.48 ^c | 1.81 | 1.51 | 2.72 | 2.16 | 3.02 | 2.91 | 2.43 | 2.03 | 1.5% ^c | -3.2% |
| Canada | | 1.27 | 1.27 | 1.55 | 1.47 | 1.43 | 1.56 | 1.46 | 1.32 | | -1.8% |
| United States ^c | 0.54 | 1.16 | 0.94 | 0.99 | 0.96 | 1.15 | 1.29 | 1.12 | 0.97 | 2.8% | -0.2% |
| | Constant 1998 dollars ^d per gallon | | | | | | | | | Average annual percentage change | |
| | 1978 ^a | 1982 ^a | 1986 ^a | 1990 ^b | 1994 ^b | 1996 ^b | 1997 ^b | 1998 ^b | 1999 ^b | 1978–99 | 1990–99 |
| China | ^c | ^c | ^c | ^c | ^c | 0.91 | ^c | ^c | 2.67 ^c | ^c | ^c |
| India | ^c | ^c | ^c | 0.97 | 0.81 | 0.96 | 1.13 | 1.01 | | ^c | ^c |
| Japan | ^c | 3.01 | 2.83 | 2.18 | 2.73 | 2.61 | 2.38 | 2.40 | 1.91 | ^c | 1.5% |
| France | 3.25 | 3.18 | 2.51 | 2.22 | 2.31 | 3.22 | 3.13 | 2.71 | 2.18 | -1.9% | -0.2% |
| United Kingdom | 3.10 | 3.46 | 2.54 | 2.55 | 2.71 | 3.39 | 3.84 | 3.92 | 3.40 | 0.4% | 3.2% |
| Germany | 3.70 | 3.06 | 2.25 | 3.39 | 2.38 | 3.14 | 2.96 | 2.43 | 1.99 | -2.9% | -5.7% |
| Canada | ^c | 2.15 | 1.89 | 1.93 | 1.62 | 1.49 | 1.58 | 1.46 | 1.29 | ^c | -4.4% |
| United States ^d | 1.35 | 1.96 | 1.40 | 1.24 | 1.06 | 1.20 | 1.31 | 1.12 | 0.95 | -1.7% | -2.9% |

Source:

U.S. Department of Energy, Energy Information Administration, *International Energy Annual 1998*, Washington, DC, January 2000, Table 7.2 and annual.

(Additional resources: www.eia.doe.gov)

Note:

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

^a Prices represent the retail prices (including taxes) for diesel fuel. Prices are representative for each country based on quarterly data averaged for the year.

^b Data are not available.

^c These estimates are for international comparisons only and do not necessarily correspond to gasoline price estimates in other sections of the book.

^d Adjusted by the U.S. Consumer Price Inflation Index.

Figure 5.2. Diesel Prices for Selected Countries, 1990 and 1998

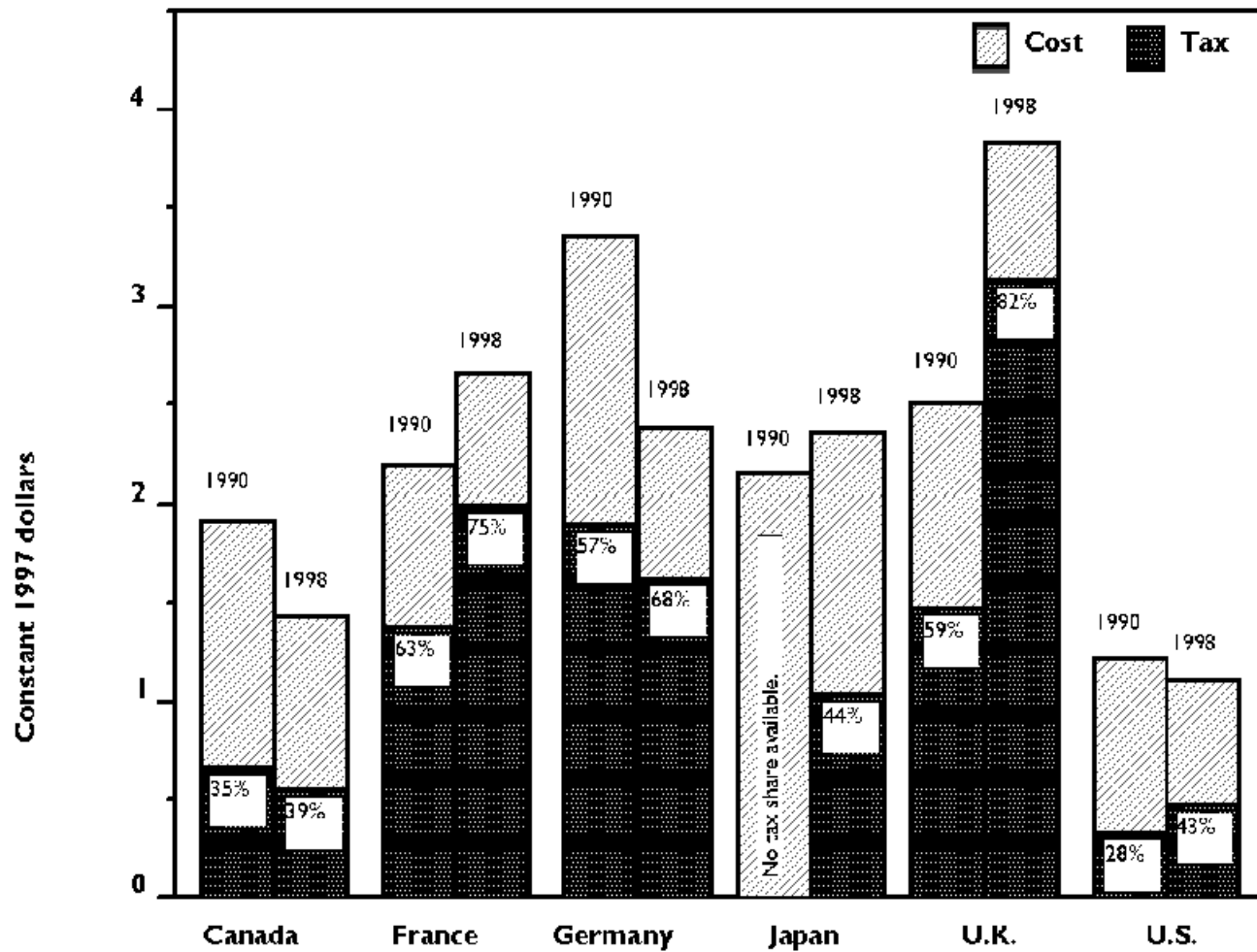
**Source:**

Table 5.2 and International Energy Agency, *Energy Prices and Taxes, Fourth Quarter 1998*, Paris, France, 1999.
 (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 1990 dollars) declined by 38% from 1990 to 1999, while the average price of a gallon of gasoline declined 22% in this same time period.

Table 5.3
Prices for a Barrel of Crude Oil and a Gallon of Gasoline, 1978–99

| Year | Crude oil ^a (dollars per barrel) | | Gasoline ^b (cents per gallon) | | Ratio of gasoline to crude oil |
|---|--|----------------------------|---|----------------------------|---|
| | Current | Constant 1998 ^c | Current | Constant 1998 ^c | |
| 1978 | 12.5 | 31.1 | 65.2 | 162.9 | 219.8 |
| 1979 | 17.7 | 39.8 | 88.2 | 198.1 | 209.1 |
| 1980 | 28.1 | 55.5 | 122.1 | 241.6 | 182.7 |
| 1981 | 35.2 | 63.2 | 135.3 | 242.5 | 161.3 |
| 1982 | 31.9 | 53.8 | 128.1 | 216.4 | 168.8 |
| 1983 | 29.0 | 47.4 | 122.5 | 200.5 | 177.5 |
| 1984 | 28.6 | 44.9 | 119.8 | 188.0 | 175.7 |
| 1985 | 26.8 | 40.5 | 119.6 | 181.3 | 187.8 |
| 1986 | 14.6 | 21.6 | 93.1 | 138.4 | 268.7 |
| 1987 | 17.9 | 25.7 | 95.7 | 137.3 | 224.5 |
| 1988 | 14.7 | 20.2 | 96.3 | 132.7 | 275.7 |
| 1989 | 18.0 | 23.6 | 106.0 | 139.4 | 247.7 |
| 1990 | 22.2 | 27.7 | 121.7 | 151.8 | 230.0 |
| 1991 | 19.1 | 22.8 | 119.6 | 143.1 | 263.5 |
| 1992 | 18.4 | 21.4 | 119.0 | 138.3 | 271.2 |
| 1993 | 16.4 | 18.5 | 117.3 | 132.4 | 300.2 |
| 1994 | 15.6 | 17.2 | 117.4 | 129.1 | 316.3 |
| 1995 | 17.2 | 18.4 | 120.5 | 128.9 | 293.7 |
| 1996 | 20.7 | 21.5 | 128.8 | 133.8 | 261.2 |
| 1997 | 19.0 | 19.3 | 129.1 | 131.1 | 284.8 |
| 1998 | 12.5 | 12.6 | 111.5 | 111.5 | 372.6 |
| 1999 | 17.5 | 17.1 | 122.1 | 118.5 | 291.3 |
| <i>Average annual percentage change</i> | | | | | |
| 1978–99 | 1.6% | -2.8% | 3.0% | -1.5% | |
| 1989–99 | -0.3% | -3.2% | 1.3% | -1.6% | |

Sources:

Crude oil - U.S. Department of Energy, Energy Information Administration, *Monthly Energy Review*, March 2000, Washington, DC, Table 9.1.

Gasoline - U.S. Department of Energy, Energy Information Administration, *Monthly Energy Review*, March 2000, Washington, DC, Table 9.4.

(Additional resources: www.eia.doe.gov)

^aRefiner acquisition cost of composite (domestic and imported) crude oil.

^bAverage 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.

^cAdjusted by the Consumer Price Inflation Index.

Table 5.4
Retail Prices for Motor Fuel, 1978–99
(cents per gallon, including tax)

| Year | Diesel fuel ^a | | Unleaded regular gasoline ^b (87 to 88.9 octane) | | Unleaded premium gasoline ^b (91 octane and above) | | Average for all gasoline types ^b | |
|---|--------------------------|-------------------------------|---|-------------------------------|---|-------------------------------|--|-------------------------------|
| | Current | Constant 1998 ^c | Current | Constant 1998 ^c | Current | Constant 1998 ^c | Current | Constant 1998 ^c |
| 1978 | ^d | ^d | 67.0 | 167.4 | ^d | 0.0 | 65.2 | 162.9 |
| 1979 | ^d | ^d | 90.3 | 202.8 | ^d | 0.0 | 88.2 | 198.1 |
| 1980 | 101 | 200 | 124.5 | 246.3 | ^d | 0.0 | 122.1 | 241.6 |
| 1981 | 118 | 212 | 137.8 | 247.0 | 147.0 | 263.5 | 135.3 | 242.5 |
| 1982 | 116 | 196 | 129.6 | 218.9 | 141.5 | 239.0 | 128.1 | 216.4 |
| 1983 | 120 | 196 | 124.1 | 203.1 | 138.3 | 226.3 | 122.5 | 200.5 |
| 1984 | 122 | 191 | 121.2 | 190.2 | 136.6 | 214.4 | 119.8 | 188.0 |
| 1985 | 122 | 185 | 120.2 | 182.2 | 134.0 | 203.1 | 119.6 | 181.3 |
| 1986 | 94 | 0 | 92.7 | 137.8 | 108.5 | 161.3 | 93.1 | 138.4 |
| 1987 | 96 | 138 | 94.8 | 136.0 | 109.3 | 156.8 | 95.7 | 137.3 |
| 1988 | 95 | 131 | 94.6 | 130.4 | 110.7 | 152.6 | 96.3 | 132.7 |
| 1989 | 102 | 134 | 102.1 | 134.3 | 119.7 | 157.4 | 106.0 | 139.4 |
| 1990 | 107 | 0 | 116.4 | 145.2 | 134.9 | 168.3 | 121.7 | 151.8 |
| 1991 | 91 | 109 | 114.0 | 136.4 | 132.1 | 158.1 | 119.6 | 143.1 |
| 1992 | 106 | 123 | 112.7 | 130.9 | 131.6 | 152.9 | 119.0 | 138.3 |
| 1993 | 98 | 111 | 110.8 | 125.0 | 130.2 | 146.9 | 117.3 | 132.4 |
| 1994 | 96 | 0 | 111.2 | 122.3 | 130.5 | 143.5 | 117.4 | 129.1 |
| 1995 | 97 | 0 | 114.7 | 122.7 | 133.6 | 142.9 | 120.5 | 128.9 |
| 1996 | 115 | 120 | 123.1 | 127.9 | 141.3 | 146.8 | 128.8 | 133.8 |
| 1997 | 129 | 131 | 123.4 | 125.3 | 141.6 | 143.8 | 129.1 | 131.1 |
| 1998 | 112 | 112 | 105.9 | 105.9 | 125.0 | 125.0 | 111.5 | 111.5 |
| 1999 | 97 | 95 | 116.5 | 114.0 | 135.7 | 132.8 | 122.1 | 119.5 |
| <i>Average annual percentage change</i> | | | | | | | | |
| 1978–99 | -0.2% ^e | -3.8% ^e | 2.7% | -1.8% | -0.4% ^e | -3.7% ^e | 3.0% | -1.5% |
| 1989–99 | -0.5% | -3.4% | 1.3% | -1.6% | 1.3% | -1.7% | 1.4% | -1.5% |

Source:Gasoline - U.S. Department of Energy, Energy Information Administration, *Monthly Energy Review*, 2000, Washington, DC, Table 9.4.Diesel - U.S. Department of Energy, Energy Information Administration, *International Energy Annual 1998*, Washington, DC, January 2000, Table 7.2.(Additional resources: www.eia.doe.gov)^aCollected from a survey of prices on January 1 of the current year.^bThese 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.^cAdjusted by the Consumer Price Inflation Index.^dData are not available.^eAverage annual percentage change is from the earliest year possible to 1999.

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 5.5
Prices for Selected Transportation Fuels, 1978–99
(cents per gallon, excluding tax)

| Year | Propane ^a | | Finished aviation gasoline | | Kerosene-type jet fuel | | No. 2 diesel fuel | |
|----------------------------------|----------------------|----------------------------|----------------------------|----------------------------|------------------------|----------------------------|-------------------|----------------------------|
| | Current | Constant 1998 ^b | Current | Constant 1998 ^b | Current | Constant 1998 ^b | Current | Constant 1998 ^b |
| 1978 | 33.5 | 83.7 | 51.6 | 128.9 | 38.7 | 96.7 | 37.7 | 94.2 |
| 1979 | 35.7 | 80.2 | 68.9 | 154.8 | 54.7 | 122.9 | 58.5 | 131.4 |
| 1980 | 48.2 | 95.4 | 108.4 | 214.5 | 86.6 | 171.3 | 81.8 | 161.8 |
| 1981 | 56.5 | 101.3 | 130.3 | 233.6 | 102.4 | 183.6 | 99.5 | 178.4 |
| 1982 | 59.2 | 100.0 | 131.2 | 221.6 | 96.3 | 162.7 | 94.2 | 159.1 |
| 1983 | 70.9 | 116.0 | 125.5 | 205.4 | 87.8 | 143.7 | 82.6 | 135.2 |
| 1984 | 73.7 | 115.7 | 123.4 | 193.7 | 84.2 | 132.2 | 82.3 | 129.2 |
| 1985 | 71.7 | 108.7 | 120.1 | 182.0 | 79.6 | 120.6 | 78.9 | 119.6 |
| 1986 | 74.5 | 110.8 | 101.1 | 150.3 | 52.9 | 78.7 | 47.8 | 71.1 |
| 1987 | 70.1 | 100.6 | 90.7 | 130.1 | 54.3 | 77.9 | 55.1 | 79.0 |
| 1988 | 71.4 | 98.4 | 89.1 | 122.8 | 51.3 | 70.7 | 50.0 | 68.9 |
| 1989 | 61.5 | 80.9 | 99.5 | 130.9 | 59.2 | 77.9 | 58.5 | 76.9 |
| 1990 | 74.5 | 92.9 | 112.0 | 139.7 | 76.6 | 95.6 | 72.5 | 90.4 |
| 1991 | 73.0 | 87.4 | 104.7 | 125.3 | 65.2 | 78.0 | 64.8 | 77.6 |
| 1992 | 64.3 | 74.7 | 102.7 | 119.3 | 61.0 | 70.9 | 61.9 | 71.9 |
| 1993 | 67.3 | 75.9 | 99.0 | 111.7 | 58.0 | 65.5 | 60.2 | 67.9 |
| 1994 | 53.0 | 58.3 | 95.7 | 105.2 | 53.4 | 58.7 | 55.4 | 60.9 |
| 1995 | 49.2 | 52.6 | 100.5 | 107.5 | 54.0 | 57.7 | 56.0 | 59.9 |
| 1996 | 60.5 | 62.9 | 111.6 | 116.0 | 65.1 | 67.6 | 68.1 | 70.8 |
| 1997 | 55.2 | 56.1 | 112.8 | 114.6 | 61.3 | 62.3 | 64.2 | 65.2 |
| 1998 | 40.5 | 40.5 | 97.5 | 97.5 | 45.2 | 45.2 | 49.4 | 49.4 |
| 1999 | 45.7 | 44.7 | 105.9 | 103.6 | 53.8 | 52.6 | 57.9 | 56.7 |
| Average annual percentage change | | | | | | | | |
| 1978–99 | 1.5% | -2.9% | 3.5% | -1.0% | 1.6% | -2.9% | 2.1% | -2.4% |
| 1989–99 | -2.9% | -5.8% | 0.6% | -2.3% | -1.0% | -3.9% | -0.1% | -3.0% |

Source:

U.S. Department of Energy, Energy Information Administration, *Monthly Energy Review*, March 2000, Washington, DC, Table 9.7.

(Additional resources: www.eia.doe.gov)

^aConsumer grade.

^bAdjusted by the Consumer Price Inflation Index.

Table 5.6
State Taxes on Motor Fuels, 1999
(dollars per gallon or gasoline equivalent gallon)
 (Footnotes for this table appear on next page)

| State | Gasoline | Diesel fuel | Gasohol | CNG | Propane | Methanol | Ethanol |
|--------------------------------|-------------------|-------------------|-------------------|-----------------------|-------------------|--------------------|--------------------|
| Alabama | 0.16 | 0.17 | 0.16 | ^a | ^a | 0.16 ^b | 0.16 ^b |
| Alaska | 0.08 | 0.08 | 0.08 ^c | 0.08 | 0.00 | 0.08 ^b | 0.08 ^b |
| Arizona | 0.18 | 0.18 | 0.00 | 0.10 ^d | 0.18 | 0.18 | 0.00 |
| Arkansas | 0.185 | 0.185 | 0.185 | 0.05 ^e | 0.165 | 0.185 | 0.185 |
| California | 0.18 | 0.18 | 0.18 | 0.07 ^e | 0.06 | 0.09 | 0.09 |
| Colorado | 0.22 | 0.205 | 0.22 | 0.205 | 0.205 | 0.205 | 0.205 |
| Connecticut | 0.39 | 0.18 | 0.38 | 0.18 ^f | 0.18 ^f | 0.37 ^b | 0.37 ^b |
| Delaware | 0.23 | 0.22 | 0.23 | 0.22 | 0.22 | 0.22 | 0.23 |
| District of Columbia | 0.20 | 0.20 | 0.20 | 0.20 | 0.20 | 0.20 | 0.20 |
| Florida | 0.04 | 0.04 | 0.04 | ^a | ^a | 0.04 ^b | 0.04 ^b |
| Georgia | 0.075 | 0.075 | 0.075 | 0.075 | 0.075 | 0.075 | 0.075 |
| Hawaii (Honolulu) ^g | 0.325 | 0.325 | 0.325 | 0.325 | 0.22 | 0.325 | 0.325 |
| Idaho | 0.25 | 0.25 | 0.25 | 0.197 ^h | 0.181 | 0.25 ^b | 0.25 ^b |
| Illinois | 0.19 | 0.215 | 0.19 | 0.19 | 0.19 | 0.19 ^b | 0.19 ^b |
| Indiana | 0.15 | 0.16 | 0.15 | ^a | ^a | 0.15 | 0.15 |
| Iowa | 0.20 | 0.225 | 0.19 | 0.16 ^e | 0.20 | 0.19 ^b | 0.19 ^b |
| Kansas | 0.18 | 0.20 | 0.18 | 0.17 | 0.17 | 0.20 | 0.20 |
| Kentucky | 0.15 | 0.12 | 0.15 | 0.12 | 0.15 | 0.15 | 0.15 |
| Louisiana | 0.20 | 0.20 | 0.20 | 0.16 ⁱ | 0.16 ⁱ | 0.20 ^b | 0.20 ^b |
| Maine | 0.19 | 0.20 | 0.19 | 0.18 | 0.18 | 0.18 | 0.18 |
| Maryland | 0.235 | 0.2425 | 0.235 | 0.235 | 0.235 | 0.235 | 0.235 |
| Massachusetts | 0.21 | 0.21 | 0.21 | 0.0 | 0.097 | 0.21 | 0.21 |
| Michigan | 0.15 | 0.15 | 0.18 | 0.0 | 0.15 | 0.15 ^b | 0.025 ^b |
| Minnesota | 0.20 | 0.20 | 0.20 | 0.001739 ^j | 0.15 | NA | 0.20 ^b |
| Mississippi | 0.18 | 0.18 | 0.18 | 0.18 ^e | 0.17 | 0.18 ^b | 0.18 ^b |
| Missouri | 0.17 | 0.17 | 0.17 | ^a | ^a | 0.17 ^b | 0.17 ^b |
| Montana | 0.27 | 0.2775 | 0.27 | 0.07 ^k | ^a | 0.27 | 0.27 |
| Nebraska | 0.253 | 0.253 | 0.253 | 0.253 | 0.253 | 0.253 | 0.253 ^b |
| Nevada | 0.23 | 0.27 | 0.23 | 0.23 ^e | 0.23 ^e | 0.23 | 0.23 |
| New Hampshire | 0.18 | 0.18 | 0.18 | 0.18 | 0.18 | 0.18 ^b | 0.18 ^b |
| New Jersey | 0.105 | 0.135 | 0.105 | 0.0525 | 0.0525 | 0.105 ^b | 0.105 ^b |
| New Mexico | 0.22 | 0.18 | 0.22 | 0.06 ⁱ | 0.06 ⁱ | 0.22 ^b | 0.22 ^b |
| New York | 0.08 ^l | 0.10 ^l | 0.08 ^l | 0.08 ^l | 0.08 ^l | 0.08 ^l | 0.08 ^l |
| North Carolina | 0.217 | 0.217 | 0.217 | 0.217 | 0.217 | 0.217 | 0.217 |
| North Dakota | 0.20 | 0.20 | 0.20 | 0.20 | 0.20 | 0.20 ^b | 0.20 ^b |
| Ohio | 0.22 | 0.22 | 0.22 | 0.22 | 0.22 | 0.22 ^b | 0.22 ^b |

Table 5.6 (continued)
State Taxes on Motor Fuels, 1999
(dollars per gallon or gasoline equivalent gallon)

| State | Gasoline | Diesel fuel | Gasohol | CNG | Propane | Methanol | Ethanol |
|----------------|-------------------|-------------------|-------------------|-------------------|-------------------|--------------------|--------------------|
| Oklahoma | 0.16 | 0.13 | 0.16 | ^a | 0.16 | 0.16 ^b | 0.16 ^b |
| Oregon | 0.24 | 0.24 | 0.24 | 0.24 | 0.24 | 0.24 | 0.24 |
| Pennsylvania | 0.12 ^m | 0.12 ^m | 0.12 ^m | 0.12 ^m | 0.12 ^m | 0.12 ^m | 0.12 ^m |
| Rhode Island | 0.28 | 0.28 | 0.28 | 0.0 | 0.28 | 0.28 | 0.28 |
| South Carolina | 0.16 | 0.16 | 0.16 | 0.16 | 0.16 | 0.16 | 0.16 |
| South Dakota | 0.18 | 0.18 | 0.16 | 0.06 | 0.16 | 0.06 | 0.06 |
| Tennessee | 0.20 | 0.17 | 0.17 | 0.13 | 0.17 | 0.17 | 0.17 |
| Texas | 0.20 | 0.20 | 0.20 | 0.15 | 0.15 | 0.20 ^b | 0.20 ^b |
| Utah | 0.19 | 0.19 | 0.19 | 0.19 ^m | 0.19 ^m | 0.19 | 0.19 |
| Vermont | 0.16 | 0.17 | 0.16 | 0.16 | ^a | 0.16 | 0.16 |
| Virginia | 0.175 | 0.16 | 0.175 | 0.10 | 0.10 | 0.175 ^b | 0.175 ^b |
| Washington | 0.23 | 0.23 | 0.23 | ^a | ^a | 0.23 | 0.23 |
| West Virginia | 0.205 | 0.205 | 0.205 | 0.205 | 0.205 | 0.205 | 0.205 |
| Wisconsin | 0.254 | 0.254 | 0.254 | 0.203 | 0.186 | 0.254 | 0.254 |
| Wyoming | 0.08 | 0.08 | 0.00 | 0.00 | 0.00 | 0.08 ^b | 0.08 ^b |

Source:

Energy Futures, Inc., *The Clean Fuels and Electric Vehicles Report*, Boulder, CO, February 1999, pp. 150–151.

^aAnnual flat fee.

^bBlends with gasoline only.

^cNovember-February tax rate is \$0.02.

^dPer 1.25 therm.

^ePer 100 ft³.

^fCNG, LNG, and LPG are exempt from motor fuel taxes when used as vehicle fuel until July 1, 2001.

^gFor County of Honolulu; for County of Maui LPG tax is \$0.20/gal. and all other fuels are taxed at \$0.18/gal.; other counties have all fuels taxed at \$0.26/gal.

^hPer therm.

ⁱOptional: flat fee may be paid instead.

^jPer cubic foot; LNG is taxed at \$0.12/gal.

^kPer 120 ft³.

^lPlus a petroleum business tax; the amount varies but is usually in the ballpark of \$0.12–\$0.14.

^mPlus 0.1035 oil franchise tax.

As of January 2000, only five states offered tax exemptions to encourage the use of gasohol for transportation purposes. This list is quite short compared to the 30 states which offered gasohol tax exemptions fifteen years ago. Still, the Federal Government encourages gasohol use via a difference in the Federal tax rates of gasoline and gasohol.

Table 5.7
State Tax Exemptions for Gasohol, January 1, 2000

| State | Exemption (Cents/gallon of gasohol) |
|--------------|---|
| Alaska | 8.0 |
| Connecticut | 1.0 |
| Idaho | 2.5 |
| Iowa | 1.0 |
| South Dakota | 2.0 |

Source:

U.S. Department of Transportation, Federal Highway Administration, "Monthly Motor Fuel Reported by the States, October 1999," February 2000, Washington, DC, Table MF-121T. (Additional resources: www.fhwa.dat.gov)

Table 5.8
Federal Excise Taxes on Motor Fuels

| Fuel | Cents per gallon |
|---------------------|-------------------------------|
| Gasoline | 18.40 |
| Diesel ^a | 24.40 |
| Gasohol | 10% Ethanol |
| | 7.7% Ethanol |
| | 5.7% Ethanol |
| Gasohol | 10% Methanol |
| | 7.7% Methanol |
| | 5.7% Methanol |
| Methanol | Qualified ^b |
| | Partially exempt ^c |
| Ethanol | Qualified ^b |
| | Partially exempt ^c |
| CNG | 48.54/mcf ^d |
| LNG | 11.90 |
| LPG | 13.60 |

Source:

Energy Futures, Inc., *The Clean Fuels and Electric Vehicles Report*, Boulder, CO, February 1999, pp. 150–151.

^a Reduced diesel rates are specified for marine fleets, trains and certain intercity buses. Diesel rates are also reduced for diesel/alcohol blends. Diesel used exclusively in state and local government fleets, non-profit organization vehicles, school buses and qualified local buses is exempt from Federal taxes.

^bQualified - contains at least 85 percent methanol or ethanol or other alcohol produced from a substance other than petroleum or natural gas.

^cPartially exempt - > 85 percent alcohol and produced from natural gas.

^dThousand cubic feet.

Table 5.9
States With Ethanol Tax Incentives

| State | Ethanol tax incentives |
|-------|--|
| AK | \$0.08/ethanol gallon (blender) |
| CA | E85 and M85 excise tax is half of the gasoline tax. Neat alcohol fuels are exempt from fuel taxes. |
| FL | County governments receive waste reduction credits for using yard trash, wood, or paper waste as feed stocks for fuel. |
| HI | 4% ethanol sales tax exemption |
| ID | \$0.21 excise tax exemption for ethanol or biodiesel |
| IN | 10% gross income tax deduction for improvements to ethanol producing facilities. |
| IL | 2% sales tax exemption for 10% volume ethanol blends |
| IA | \$0.01 (blender) |
| MN | \$0.25 (producer), \$0.005 (blender) until Oct. 1, 1997 |
| MO | \$0.20 (producer) |
| MT | \$0.30 (producer) |
| NE | \$0.20 (producer), \$0.50 ETBE (producer) |
| NC | Individual income and corporate tax credit of 20% for the construction of an ethanol plant using agricultural or forestry products; an additional 10% if the distillery is powered with alternative fuels. |
| ND | \$0.40 (producer) |
| OH | \$0.01 (blender), income tax credit |
| SD | \$0.20 (blender), \$0.20 (producer) Alternative fuels are taxed at \$0.06/gal |
| WY | \$0.40 (producer) |

Source:

U.S. Department of Energy, *Clean Cities Guide to Alternative Fuel Vehicle Incentives and Laws*, 2nd edition, Washington, DC, November 1996.
(Additional resources: www.ccities.doe.gov)

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

Table 5.10
Average Price of a New Car, 1970–99

| Year | Domestic ^a | | Import | | Total | |
|---|-----------------------|------------------------------------|-----------------|------------------------------------|-----------------|------------------------------------|
| | Current dollars | Constant 1998 dollars ^b | Current dollars | Constant 1998 dollars ^b | Current dollars | Constant 1998 dollars ^b |
| 1970 | 3,708 | 15,568 | 2,648 | 11,118 | 3,542 | 14,872 |
| 1971 | 3,919 | 15,776 | 2,769 | 11,147 | 3,742 | 15,064 |
| 1972 | 4,034 | 15,721 | 2,994 | 11,668 | 3,879 | 15,117 |
| 1973 | 4,181 | 15,339 | 3,344 | 12,268 | 4,052 | 14,865 |
| 1974 | 4,524 | 14,956 | 4,206 | 13,310 | 4,440 | 14,679 |
| 1975 | 5,084 | 15,400 | 4,384 | 13,280 | 4,950 | 14,994 |
| 1976 | 5,506 | 15,769 | 4,923 | 14,099 | 5,418 | 15,517 |
| 1977 | 5,985 | 16,102 | 5,072 | 13,645 | 5,814 | 15,642 |
| 1978 | 6,478 | 16,188 | 5,934 | 14,829 | 6,379 | 15,941 |
| 1979 | 6,889 | 15,473 | 6,704 | 15,058 | 6,847 | 15,379 |
| 1980 | 7,609 | 15,055 | 7,482 | 14,803 | 7,574 | 14,985 |
| 1981 | 8,912 | 15,976 | 8,896 | 15,947 | 8,910 | 15,972 |
| 1982 | 9,865 | 16,662 | 9,957 | 16,818 | 9,890 | 16,727 |
| 1983 | 10,516 | 17,208 | 10,868 | 17,784 | 10,606 | 17,356 |
| 1984 | 11,079 | 17,390 | 12,336 | 19,362 | 11,375 | 17,854 |
| 1985 | 11,589 | 17,563 | 12,853 | 19,479 | 11,838 | 17,941 |
| 1986 | 12,319 | 18,317 | 13,670 | 20,326 | 12,652 | 18,812 |
| 1987 | 12,922 | 18,536 | 14,470 | 20,757 | 13,386 | 19,202 |
| 1988 | 13,418 | 18,493 | 15,221 | 20,978 | 13,932 | 19,201 |
| 1989 | 13,936 | 18,327 | 15,510 | 20,397 | 14,371 | 18,899 |
| 1990 | 14,489 | 18,076 | 16,640 | 20,760 | 15,042 | 18,766 |
| 1991 | 15,192 | 18,182 | 16,327 | 19,540 | 15,475 | 18,521 |
| 1992 | 15,644 | 18,175 | 18,593 | 21,601 | 16,336 | 18,979 |
| 1993 | 15,976 | 18,029 | 20,261 | 22,864 | 16,871 | 19,039 |
| 1994 | 16,930 | 18,619 | 21,989 | 24,183 | 17,903 | 19,689 |
| 1995 | 16,864 | 18,035 | 23,202 | 24,813 | 17,959 | 19,206 |
| 1996 | 17,468 | 18,152 | 26,205 | 27,231 | 18,777 | 19,512 |
| 1997 | 17,838 | 18,116 | 28,193 | 28,633 | 19,551 | 19,856 |
| 1998 | 18,579 | 18,579 | 31,986 | 31,986 | 20,849 | 20,849 |
| 1999 | 18,725 | 18,323 | 30,350 | 29,699 | 21,022 | 20,571 |
| <i>Average annual percentage change</i> | | | | | | |
| 1970–99 | 5.7% | 0.6% | 8.8% | 3.4% | 6.3% | 1.1% |
| 1989–99 | 3.0% | 0.0% | 6.9% | 3.6% | 3.9% | 0.9% |

Source:

U.S. Department of Commerce, Bureau of Economic Analysis, *National Income and Product Accounts*, underlying detail estimates for Motor Vehicle Output, Washington, DC, 2000.

(Additional resources: www.stat-usa.gov)

^aIncludes transplants.

^bAdjusted by the Consumer Price Inflation Index.

Table 5.11
Average Price of a New Car by Sector, 1970–99

| Year | Consumer | | Business | | Government | |
|---|-----------------|------------------------------------|-----------------|------------------------------------|-----------------|------------------------------------|
| | Current dollars | Constant 1998 dollars ^a | Current dollars | Constant 1998 dollars ^a | Current dollars | Constant 1998 dollars ^a |
| 1970 | 3,507 | 14,725 | 3,676 | 15,434 | 2,976 | 12,495 |
| 1971 | 3,705 | 14,915 | 3,878 | 15,611 | 3,150 | 12,681 |
| 1972 | 3,840 | 14,965 | 4,036 | 15,728 | 3,249 | 12,662 |
| 1973 | 4,035 | 14,803 | 4,137 | 15,177 | 3,231 | 11,853 |
| 1974 | 4,459 | 14,742 | 4,448 | 14,705 | 3,351 | 11,078 |
| 1975 | 4,960 | 15,025 | 4,994 | 15,128 | 3,604 | 10,917 |
| 1976 | 5,424 | 15,534 | 5,482 | 15,700 | 3,739 | 10,708 |
| 1977 | 5,801 | 15,607 | 5,887 | 15,838 | 4,813 | 12,949 |
| 1978 | 6,433 | 16,076 | 6,319 | 15,791 | 5,180 | 12,945 |
| 1979 | 6,871 | 15,433 | 6,858 | 15,404 | 5,518 | 12,394 |
| 1980 | 7,619 | 15,074 | 7,537 | 14,912 | 6,164 | 12,196 |
| 1981 | 9,028 | 16,183 | 8,743 | 15,673 | 7,217 | 12,937 |
| 1982 | 10,070 | 17,009 | 9,598 | 16,211 | 7,932 | 13,397 |
| 1983 | 10,901 | 17,838 | 10,108 | 16,541 | 8,152 | 13,340 |
| 1984 | 11,705 | 18,372 | 10,867 | 17,057 | 9,034 | 14,180 |
| 1985 | 12,163 | 18,433 | 11,493 | 17,418 | 9,546 | 14,467 |
| 1986 | 13,047 | 19,400 | 12,078 | 17,959 | 10,188 | 15,149 |
| 1987 | 13,777 | 19,763 | 12,723 | 18,251 | 10,946 | 15,702 |
| 1988 | 14,337 | 19,759 | 13,238 | 18,245 | 12,585 | 17,345 |
| 1989 | 14,783 | 19,441 | 13,599 | 17,884 | 14,497 | 19,065 |
| 1990 | 15,820 | 19,737 | 13,816 | 17,236 | 14,279 | 17,814 |
| 1991 | 16,337 | 19,552 | 14,413 | 17,250 | 16,103 | 19,272 |
| 1992 | 17,089 | 19,854 | 15,321 | 17,800 | 17,551 | 20,391 |
| 1993 | 17,608 | 19,871 | 15,918 | 17,963 | 18,171 | 20,506 |
| 1994 | 18,806 | 20,682 | 16,917 | 18,605 | 18,398 | 20,234 |
| 1995 | 18,895 | 20,207 | 17,020 | 18,202 | 17,048 | 18,232 |
| 1996 | 20,098 | 20,885 | 17,718 | 18,412 | 14,099 | 14,651 |
| 1997 | 21,177 | 21,507 | 18,201 | 18,485 | 15,027 | 15,261 |
| 1998 | 22,715 | 22,715 | 19,218 | 19,218 | 15,105 | 15,105 |
| 1999 | 23,040 | 22,546 | 19,166 | 18,755 | 14,984 | 14,663 |
| <i>Average annual percentage change</i> | | | | | | |
| 1970–99 | 6.7% | 1.5% | 5.9% | 0.7% | 5.7% | 0.6% |
| 1989–99 | 4.5% | 1.5% | 3.5% | 0.5% | 0.3% | -2.6% |

Source:

U.S. Department of Commerce, Bureau of Economic Analysis, *National Income and Product Accounts*, underlying detail estimates for Motor Vehicle Output, Washington, DC, 2000.
 (Additional resources: www.stat-usa.gov)

^aAdjusted by the Consumer Price Inflation Index.

The total cost of operating an automobile is the sum of the fixed cost (depreciation, insurance, finance charge, and license fee) and the variable cost, which is related to the amount of travel. The cost of operating a car in 1999 (constant 1998 cents) was approximately 57 cents per mile. Gas and oil accounted for only 9.7% of total cost per mile in 1999, which is the lowest in the series history.

Table 5.12
Automobile Operating Cost per Mile, 1975–99

| Model year ^c | Variable costs (constant 1998 cents per mile ^a) | | | | Constant 1998 dollars per 10,000 miles ^a | | | Total cost per mile ^b (constant 1998 cents ^a) |
|---|---|---|-------------|-------|---|------------|------------|--|
| | Gas and oil | Percentage gas and oil of total cost | Maintenance | Tires | Variable cost | Fixed cost | Total cost | |
| 1975 | 14.60 | 26.3% | 2.94 | 2.00 | 1,954 | 3,593 | 5,546 | 55.46 |
| 1977 | 11.06 | 20.4% | 2.77 | 1.78 | 1,560 | 3,871 | 5,432 | 54.32 |
| 1979 | 9.23 | 17.1% | 2.47 | 1.46 | 1,316 | 4,068 | 5,384 | 53.84 |
| 1980 | 11.59 | 21.0% | 2.22 | 1.27 | 1,508 | 4,022 | 5,530 | 55.30 |
| 1981 | 11.24 | 19.6% | 2.12 | 1.29 | 1,465 | 4,257 | 5,722 | 57.22 |
| 1982 | 11.38 | 20.8% | 1.69 | 1.06 | 1,414 | 4,050 | 5,464 | 54.64 |
| 1983 | 10.87 | 19.9% | 1.70 | 1.11 | 1,368 | 4,101 | 5,469 | 54.69 |
| 1984 | 9.72 | 19.8% | 1.63 | 0.99 | 1,234 | 3,682 | 4,916 | 49.16 |
| 1985 ^d | 9.34 | 22.6% | 1.86 | 0.99 | 1,218 | 2,904 | 4,122 | 41.22 |
| 1986 | 6.66 | 15.1% | 2.04 | 1.00 | 969 | 3,430 | 4,400 | 44.00 |
| 1987 | 6.89 | 14.7% | 2.30 | 1.15 | 1,033 | 3,649 | 4,682 | 46.82 |
| 1988 | 7.17 | 13.6% | 2.21 | 1.10 | 1,089 | 4,176 | 5,265 | 52.65 |
| 1989 | 6.84 | 13.6% | 2.50 | 1.05 | 1,039 | 3,985 | 5,024 | 50.24 |
| 1990 | 6.74 | 13.2% | 2.62 | 1.12 | 1,048 | 4,062 | 5,110 | 51.10 |
| 1991 | 8.02 | 15.4% | 2.63 | 1.08 | 1,173 | 4,050 | 5,223 | 52.23 |
| 1992 | 6.97 | 13.1% | 2.56 | 1.05 | 1,057 | 4,260 | 5,318 | 53.18 |
| 1993 | 6.77 | 13.3% | 2.71 | 1.02 | 1,050 | 4,045 | 5,094 | 50.94 |
| 1994 | 6.16 | 12.0% | 2.75 | 1.21 | 1,012 | 4,119 | 5,130 | 51.30 |
| 1995 | 6.42 | 12.3% | 2.78 | 1.50 | 1,069 | 4,161 | 5,231 | 52.31 |
| 1996 | 6.13 | 11.5% | 2.91 | 1.45 | 1,050 | 4,295 | 5,344 | 53.44 |
| 1997 | 6.70 | 12.4% | 2.84 | 1.42 | 1,097 | 4,294 | 5,391 | 53.91 |
| 1998 | 6.30 | 11.5% | 3.10 | 1.40 | 1,080 | 4,403 | 5,483 | 54.83 |
| 1999 | 5.49 ^e | 9.7% | 3.23 | 1.67 | 1,039 | 4,635 | 5,674 | 56.74 |
| <i>Average annual percentage change</i> | | | | | | | | |
| 1975–84 | -4.4% | | -6.3% | -7.5% | -4.9% | 0.3% | -1.3% | -1.3% |
| 1985–99 | -3.5% | | 4.0% | 3.8% | -1.1% | 3.4% | 2.3% | 2.3% |

Source:

American Automobile Association, *Your Driving Costs*, 1999 Edition, Heathrow, FL, and annual. (Additional resources: www.aaa.com, www.runzheimer.com)

^a Adjusted by the Consumer Price Inflation Index.

^b Based on 10,000 miles per year.

^c Data for 1976 and 1978 are not available.

^d Fixed and total operating costs preceding 1985 are not comparable with 1985 and later data. Fixed cost depreciation from 1975–84 was based on four years or 60,000 miles. After 1984, the depreciation was based on six years or 60,000 miles.

^e Fuel cost data used in this calculation was 1.098/gallon, which is much lower than most 1999 averages. This calculation was done early in 1999 when prices were much lower.

Table 5.13
Fixed Automobile Operating Costs per Year, 1975–99
(constant 1998 dollars)^a

| Model year | Fire & theft ^b | Collision ^c | Property damage & liability ^d | License, registration & taxes | Depreciation | Finance charge | Total | Average fixed cost per day |
|---|---------------------------|------------------------|--|-------------------------------|--------------|----------------|-------|----------------------------|
| 1975 | 161 | 427 | 573 | 91 | 2,342 | ^e | 3,593 | 9.84 |
| 1977 | 215 | 506 | 673 | 199 | 2,279 | ^e | 3,871 | 10.60 |
| 1978 | 142 | 345 | 572 | 185 | 2,234 | ^e | 3,479 | 9.52 |
| 1979 | 166 | 377 | 541 | 202 | 2,116 | 665 | 4,068 | 11.14 |
| 1980 | 138 | 340 | 491 | 162 | 2,054 | 837 | 4,022 | 11.02 |
| 1981 | 136 | 323 | 455 | 158 | 2,307 | 878 | 4,257 | 11.67 |
| 1982 | 90 | 258 | 410 | 91 | 2,290 | 910 | 4,050 | 11.10 |
| 1983 | 131 | 329 | 363 | 167 | 2,198 | 913 | 4,101 | 11.24 |
| 1984 | 126 | 314 | 353 | 166 | 1,894 | 829 | 3,682 | 10.09 |
| 1985 | 139 | 300 | 323 | 174 | 1,899 | 864 | 3,699 | 10.14 |
| 1986 | 128 | 284 | 345 | 193 | 1,963 | 947 | 3,860 | 10.57 |
| 1987 | 125 | 281 | 361 | 201 | 2,160 | 862 | 3,991 | 10.93 |
| 1988 | 119 | 280 | 391 | 192 | 2,459 | 779 | 4,219 | 11.56 |
| 1989 | 143 | 322 | 406 | 199 | 2,754 | 823 | 4,648 | 12.73 |
| 1990 | 137 | 308 | 397 | 206 | 2,941 | 848 | 4,837 | 13.25 |
| 1991 | 138 | 309 | 422 | 202 | 3,043 | 932 | 5,047 | 13.82 |
| 1992 | 131 | 303 | 433 | 208 | 3,230 | 967 | 5,272 | 14.44 |
| 1993 | 121 | 262 | 434 | 207 | 3,253 | 785 | 5,062 | 13.87 |
| 1994 | 100 | 227 | 440 | 224 | 3,286 | 764 | 5,041 | 13.81 |
| 1995 | 102 | 226 | 438 | 226 | 3,314 | 780 | 5,085 | 13.93 |
| 1996 | 113 | 257 | 443 | 238 | 3,334 | 808 | 5,193 | 14.23 |
| 1997 | 108 | 307 | 407 | 223 | 3,319 | 805 | 5,169 | 14.17 |
| 1998 | 115 | 262 | 479 | 223 | 3,294 | 802 | 5,175 | 14.18 |
| 1999 | 159 | 318 | 474 | 221 | 3,367 | 811 | 5,351 | 14.66 |
| <i>Average annual percentage change</i> | | | | | | | | |
| 1975–99 | -0.1% | -1.2% | -0.8% | 3.8% | 1.5% | ^e | 1.7% | 1.7% |
| 1989–99 | 1.1% | -0.1% | 1.6% | 1.1% | 2.0% | -0.1% | 1.4% | 1.4% |

Source:

American Automobile Association, "Your Driving Costs," 1999 Edition, Heathrow, FL, and annual. (Additional resources: www.aaa.com, www.runzheimer.com)

Note:

The data in this table are costs *per year*, while the data on the previous table are costs *per mile*.

^a Adjusted by the Consumer Price Inflation Index.

^b \$50 deductible 1975 through 1977; \$100 deductible 1978 through 1992; \$250 deductible for 1993 – on.

^c \$100 deductible through 1977; \$250 deductible 1978 through 1992; \$500 deductible for 1993 – on.

^d Coverage: \$100,000/\$300,000.

^e Data are not available.

Table 5.14
Economic Indicators, 1970–99
(billion dollars)

| Year | Gross National Product | | Total transportation outlays | | Transportation as a percent of GNP |
|------|-----------------------------------|----------------------------|---|----------------------------|--|
| | Current | Constant 1998 ^a | Current | Constant 1998 ^a | |
| 1970 | 1,015.5 | 4,194.0 | 192.8 | 809.5 | 19.0% |
| 1980 | 2,732.0 | 5,327.4 | 533.0 | 1,054.6 | 19.5% |
| 1990 | 5,567.8 | 6,848.4 | 951.0 | 1,186.4 | 17.1% |
| 1997 | 8,102.9 | 8,102.9 | 1,317.2 | 1,337.7 | 16.3% |
| 1998 | 8,750.0 | 8,750.0 | 1,378.1 | 1,378.1 | 15.7% |
| Year | Personal Consumption Expenditures | | Transportation Personal Consumption Expenditures ^b | | Transportation PCE as a percent of total PCE |
| | Current | Constant 1998 ^a | Current | Constant 1998 ^a | |
| 1970 | 640.0 | 2,687.1 | 81.5 | 342.2 | 12.7% |
| 1980 | 1,732.6 | 3,428.0 | 238.5 | 471.9 | 13.8% |
| 1990 | 3,761.2 | 4,692.4 | 453.9 | 566.3 | 12.1% |
| 1999 | 6,257.3 | 6,123.1 | 694.6 | 679.7 | 11.1% |

Sources:

GNP - U.S. Department of Commerce, Bureau of Economic Analysis, *Survey of Current Business*, April 2000, Table 1.9, p. D-4, and annual. (Additional resources: www.bea.doc.gov)

Transportation outlays - Eno Transportation Foundation, *Transportation in America 1999*, Seventeenth Edition, Lansdowne, VA, 2000, p. 38.

PCE - U.S. Department of Commerce, Bureau of Economic Analysis, *Survey of Current Business*, March 2000, Table 2.2 and annual. (Additional resources: www.bea.doc.gov/bea/scbinfo.html)

Table 5.15
Consumer Price Indices, 1970–99
(1970 = 1.000)

| Year | Consumer Price Index | Transportation Consumer Price Index ^c | New car Consumer Price Index | Used car Consumer Price Index | Gross National Product |
|------|----------------------|--|------------------------------|-------------------------------|------------------------|
| 1970 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 |
| 1980 | 2.122 | 2.216 | 1.667 | 1.995 | 2.690 |
| 1990 | 3.365 | 3.213 | 2.283 | 3.769 | 5.483 |
| 1999 | 4.291 | 3.581 | 2.696 | 4.872 | 9.217 |

Source:

Bureau of Labor Statistics, Consumer Price Index Table 1A for 1999, and annual. [GNP—see above.]
 (Additional resources: stats.bls.gov/cpihome.htm)

^a Adjusted by the implicit GNP price deflator.

^c Transportation Personal Consumption Expenditures include user operating expenses (new and used auto purchases, gas and oil, repair, greasing, washing, parking, storage, rental, other motor vehicles, insurance premiums, tires, tubes and other parts); purchased intercity transportation; and purchased local transportation.

^d Transportation Consumer Price Index includes new and used cars, gasoline, auto insurance rates, intracity mass transit, intracity bus fare, and airline fares.

Table 5.16
Motor Vehicle Manufacturing Employment Statistics, 1972–98

| Year | Motor vehicle manufacturing employees (thousands) | Sales of domestic automobiles ^a (thousands) | Sales of domestic light trucks ^b (thousands) | Employees per hundred vehicles sold | Expenditure per new domestic car | Total domestic vehicle expenditures ^c (millions) | Employees per million dollar expenditure (current) | Employees per million dollar expenditure (constant 1998 ^d) |
|---|--|---|--|---|--|--|---|---|
| 1972 | 415 | 9,327 | 2,096 | 3.6 | \$4,034 | \$46,080 | 9.0 | 29.9 |
| 1973 | 462 | 9,676 | 2,512 | 3.8 | \$4,181 | \$50,958 | 9.1 | 28.5 |
| 1974 | 416 | 7,454 | 2,163 | 4.3 | \$4,524 | \$43,507 | 9.6 | 27.6 |
| 1975 | 375 | 7,053 | 2,053 | 4.1 | \$5,084 | \$46,295 | 8.1 | 21.4 |
| 1976 | 416 | 8,611 | 2,720 | 3.7 | \$5,506 | \$62,388 | 6.7 | 16.7 |
| 1977 | 442 | 9,109 | 3,108 | 3.6 | \$5,985 | \$73,119 | 6.0 | 14.3 |
| 1978 | 470 | 9,312 | 3,473 | 3.7 | \$6,478 | \$82,821 | 5.7 | 12.5 |
| 1979 | 463 | 8,341 | 2,844 | 4.1 | \$6,889 | \$77,053 | 6.0 | 12.2 |
| 1980 | 368 | 6,581 | 1,959 | 4.3 | \$7,609 | \$64,981 | 5.7 | 10.5 |
| 1981 | 359 | 6,209 | 1,745 | 4.5 | \$8,912 | \$70,886 | 5.1 | 8.6 |
| 1982 | 318 | 5,759 | 2,062 | 4.1 | \$9,865 | \$77,154 | 4.1 | 6.6 |
| 1983 | 349 | 6,795 | 2,518 | 3.7 | \$10,516 | \$97,936 | 3.6 | 5.5 |
| 1984 | 392 | 7,952 | 3,257 | 3.5 | \$11,079 | \$124,185 | 3.2 | 4.7 |
| 1985 | 409 | 8,205 | 3,691 | 3.4 | \$11,589 | \$137,863 | 3.0 | 4.3 |
| 1986 | 400 | 8,215 | 3,671 | 3.4 | \$12,319 | \$146,424 | 2.7 | 3.8 |
| 1987 | 381 | 7,081 | 3,785 | 3.5 | \$12,922 | \$140,410 | 2.7 | 3.7 |
| 1988 | 357 | 7,526 | 4,195 | 3.0 | \$13,418 | \$157,272 | 2.3 | 3.0 |
| 1989 | 350 | 7,073 | 4,108 | 3.1 | \$13,936 | \$155,818 | 2.2 | 2.8 |
| 1990 | 329 | 6,897 | 3,948 | 3.0 | \$14,489 | \$157,133 | 2.1 | 2.6 |
| 1991 | 316 | 6,137 | 3,595 | 3.2 | \$15,192 | \$147,849 | 2.1 | 2.5 |
| 1992 | 314 | 6,277 | 4,233 | 3.0 | \$15,644 | \$164,418 | 1.9 | 2.2 |
| 1993 | 319 | 6,742 | 4,987 | 2.7 | \$15,976 | \$187,383 | 1.7 | 1.9 |
| 1994 | 340 | 7,255 | 5,638 | 2.6 | \$16,930 | \$218,278 | 1.6 | 1.7 |
| 1995 | 355 | 7,129 | 5,663 | 2.8 | \$16,864 | \$215,724 | 1.6 | 1.7 |
| 1996 | 342 | 7,254 | 6,088 | 2.6 | \$17,468 | \$233,058 | 1.5 | 1.5 |
| 1997 | 352 | 6,917 | 6,226 | 2.7 | \$17,838 | \$234,440 | 1.5 | 1.5 |
| 1998 | 344 | 6,761 | 6,683 | 2.6 | \$18,579 | \$249,776 | 1.4 | 1.4 |
| <i>Average annual percentage change</i> | | | | | | | | |
| 1972–98 | -0.7% | -1.2% | 4.6% | -1.2% | 6.1% | 6.7% | -6.9% | -11.1% |
| 1988–98 | -0.4% | -1.1% | 4.8% | -1.4% | 3.3% | 4.7% | -4.8% | -7.3% |

Source:

Employees - U.S. Department of Labor, Bureau of Labor Statistics, Covered Employment and Wages, SIC 3711, www.bls.gov, April 2000.

Sales - See Table 6.4. Expenditures - See Table 5.10.

^a Vehicles produced in North America.

^b Less than 10,000 pounds gross vehicle weight.

^c Estimated as domestic auto and light truck vehicle sales multiplied by average expenditure.

^d Adjusted by the implicit Gross National Product price deflator.

Employees of motor vehicle and related industries comprise 7.6% of the labor force. For employment in the entire transportation industry, see the next table.

Table 5.17
Employees of Motor Vehicle and Related Industries, 1990 and 1997

| Industry | 1990 | | | 1997 | | | Percent change 1990–95 |
|---|------------|--------------------------------------|---|-------------|--------------------------------------|---|---------------------------|
| | Employees | Percent of total motor vehicle | Percent of total U.S. employment ^a | Employees | Percent of total motor vehicle | Percent of total U.S. employment ^a | |
| Motor vehicle and equipment manufacturing | 1,055,595 | 15.0% | 1.1% | 1,192,105 | 14.8% | 1.1% | 12.9% |
| <i>Motor vehicles and equipment</i> | 707,160 | 10.0% | 0.8% | 815,513 | 10.1% | 0.8% | 15.3% |
| <i>Travel trailers and campers</i> | 14,301 | 0.2% | 0.0% | b | b | b | b |
| <i>Transportation equipment not elsewhere classified</i> | 17,263 | 0.2% | 0.0% | 60,739 | 0.8% | 0.1% | 251.8% |
| <i>Automotive stampings</i> | 111,548 | 1.6% | 0.1% | 126,712 | 1.6% | 0.1% | 13.6% |
| <i>Carburetors, pistons, piston rings, and valves</i> | 19,674 | 0.3% | 0.0% | 18,290 | 0.2% | 0.0% | -7.0% |
| <i>Vehicular lighting equipment</i> | 15,586 | 0.2% | 0.0% | 16,689 | 0.2% | 0.0% | 7.1% |
| <i>Storage batteries</i> | 23,518 | 0.3% | 0.0% | 23,131 | 0.3% | 0.0% | -1.6% |
| <i>Electrical equipment for internal combustion engines</i> | 61,675 | 0.9% | 0.1% | 52,885 | 0.7% | 0.1% | -14.3% |
| <i>Tires and inner tubes</i> | 68,505 | 1.0% | 0.1% | 63,699 | 0.8% | 0.1% | -7.0% |
| <i>Cold-rolled steel sheet, strip, and bars</i> | 16,365 | 0.2% | 0.0% | 14,447 | 0.2% | 0.0% | -11.7% |
| Road construction and maintenance | 261,461 | 3.7% | 0.3% | b | b | b | b |
| Motor freight transportation and related services | 1,662,836 | 23.6% | 1.8% | 2,056,223 | 25.5% | 2.0% | 23.7% |
| <i>Trucking and courier services, except by air or by the U.S. Postal Service</i> | 1,458,847 | 20.7% | 1.6% | 1,811,597 | 22.5% | 1.7% | 24.2% |
| Petroleum refining and wholesale distribution | 264,820 | 3.8% | 0.3% | 238,298 | 3.0% | 0.2% | -10.0% |
| Passenger transportation | 672,271 | 9.5% | 0.7% | 907,395 | 11.3% | 0.9% | 35.0% |
| Automotive sales and servicing | 3,135,783 | 44.5% | 3.4% | 3,656,899 | 45.4% | 3.5% | 16.6% |
| Total of motor vehicle and related industries | 7,052,766 | 100.0% | 7.5% | 8,050,920 | 100.0% | 7.6% | 14.2% |
| U.S. Total ^b | 93,476,087 | | 100.0% | 105,299,123 | | 100.0% | 12.6% |

Source:

U.S. Department of Commerce, Bureau of the Census, County Business Patterns web site: tier2.census.gov/cbp/, February 2000.
(Additional resources: www.census.gov)

^aData for employees of establishments totally exempt from FICA are excluded, as are self-employed persons, domestic service workers, railroad employees, agricultural production workers and most government employees.

^bData are not available.

Table 5.18
Employment in Transportation and Related Industries, 1960–98
(persons in thousands)

| | 1960 | 1965 | 1970 | 1975 | 1980 | 1985 | 1990 | 1995 | 1998 |
|---|---------------|---------------|---------------|---------------|---------------|----------------|----------------|----------------|----------------|
| <u>Transportation Service</u> | | | | | | | | | |
| Air transport | 191 | 229 | 351 | 362 | 453 | 537 | 789 | 920 | 1,008 |
| Bus, intercity | 41 | 42 | 43 | 39 | 38 | 36 | 20 | 24 | 26 |
| Local transport | 101 | 83 | 77 | 69 | 79 | 90 | 136 | 203 | 235 |
| Railroads | 885 | 735 | 627 | 538 | 532 | 346 | 285 | 238 | 231 |
| Oil pipeline | 23 | 20 | 18 | 17 | 21 | 19 | 20 | 15 | 14 |
| Taxi | 121 | 110 | 107 | 83 | 53 | 38 | 33 | 31 | 31 |
| Trucking & truck materials | 770 | 882 | 998 | 996 | 1,189 | 1,285 | 1,534 | 1,587 | 1,745 |
| Water | 232 | 230 | 215 | 190 | 213 | 214 | 173 | 175 | 180 |
| Total | 2,364 | 2,331 | 2,436 | 2,294 | 2,578 | 2,565 | 2,990 | 3,192 | 3,470 |
| <u>Transportation Equipment Manufacturing</u> | | | | | | | | | |
| Aircraft & parts | 646 | 624 | 669 | 514 | 652 | 647 | 709 | 451 | 524 |
| Motor vehicles, equipment, tires | 829 | 945 | 914 | 892 | 904 | 964 | 886 | 1,112 | 1,130 |
| Railroad equipment | 43 | 56 | 51 | 52 | 71 | 34 | 34 | 38 | 37 |
| Ship & boat building & repair | 141 | 160 | 170 | 194 | 221 | 193 | 189 | 160 | 164 |
| Other transportation equipment | 33 | 57 | 111 | 115 | 149 | 130 | 46 | 53 | 55 |
| Total | 1,692 | 1,842 | 1,915 | 1,767 | 1,997 | 1,968 | 1,864 | 1,812 | 1,910 |
| <u>Transportation Related Industries</u> | | | | | | | | | |
| Automotive/accessory retail dealers | 807 | 902 | 996 | 1,076 | 1,048 | 1,185 | 1,292 | 1,388 | 1,356 |
| Automotive wholesalers | 215 | 255 | 320 | 367 | 418 | 433 | 451 | 492 | 518 |
| Automotive service & garages | 251 | 324 | 384 | 400 | 571 | 730 | 926 | 981 | 1,249 |
| Gasoline service stations | 461 | 522 | 614 | 616 | 561 | 611 | 641 | 649 | 689 |
| Highway & street construction | 294 | 324 | 331 | 297 | 268 | 264 | 245 | 228 | 253 |
| Petroleum ^f | 311 | 292 | 333 | 390 | 533 | 568 | 521 | 429 | 442 |
| Other industries | | | | | | | | | |
| Truck drivers & deliverymen | 1,477 | 1,521 | 1,565 | 1,796 | 1,931 | 2,050 | 2,148 | 2,861 | 2,601 |
| Freight handlers | 365 | 411 | 456 | 613 | 622 | 574 | 504 | 536 | 628 |
| Total | 4,181 | 4,551 | 4,999 | 5,545 | 5,952 | 6,415 | 6,728 | 7,564 | 7,737 |
| <u>Government Transportation Employees</u> | | | | | | | | | |
| U.S. Department of Transportation | 38 | 45 | 66 | 75 | 72 | 61 | 65 | 64 | 65 |
| Highways, state & local | 499 | 550 | 568 | 569 | 532 | 549 | 569 | 543 | 530 |
| U.S. Postal Service ^b | 83 | 83 | 103 | 98 | 92 | 104 | 115 | 118 | 122 |
| Other ^c | 18 | 16 | 12 | 13 | 13 | 11 | 11 | 11 | 12 |
| Total | 638 | 694 | 749 | 755 | 709 | 725 | 760 | 736 | 729 |
| Total transportation employment | 8,875 | 9,418 | 10,099 | 10,361 | 11,236 | 11,673 | 12,342 | 13,304 | 13,845 |
| Total employed civilians | 65,778 | 71,088 | 78,627 | 85,783 | 99,303 | 107,150 | 117,914 | 125,136 | 131,463 |
| Transportation percent of total | 13.5% | 13.2% | 12.8% | 12.1% | 11.3% | 10.9% | 10.5% | 10.6% | 10.5% |

Source:

Eno Transportation Foundation, *Transportation in America 1999*, Seventeenth Edition, Lansdowne, VA, 2000, p. 61.

^a Estimated by assuming transport share of total petroleum industry employment is same as transport share of petroleum domestic demand.

^b Estimated share (approximately 14%) of total employees engaged in transportation work.

^c Agencies include Civil Aeronautics Board (sunset in 1985), Federal Maritime Commission, Federal Energy Regulatory Commission, Interstate Commerce Commission, Railroad Retirement Board, and Panama Canal Commission.

Chapter 6

Highway Vehicles and Characteristics

Summary Statistics from Tables in this Chapter

| Source | | |
|------------|---|-----------------|
| Table 6.1 | U.S. share of world automobile registrations, 1996 | 26.7% |
| Table 6.2 | U.S. share of world truck & bus registrations, 1996 | 41.3% |
| Table 6.3 | Number of automobiles, 1998 (Polk - in thousands) | 125,966 |
| Table 6.3 | Number of trucks, 1998 (Polk - in thousands) | 79,077 |
| Table 6.5 | Vehicle miles traveled, 1997 | (million miles) |
| | <i>Automobiles</i> | 1,545,830 |
| | <i>Motorcycles</i> | 10,260 |
| | <i>Two-axle, four-tire trucks</i> | 866,228 |
| | <i>Other single-unit trucks</i> | 67,894 |
| | <i>Combination trucks</i> | 128,159 |
| | <i>Buses</i> | 6,996 |
| Table 6.8 | Average age of vehicles, 1998 | (years) |
| | <i>Automobiles</i> | 8.8 |
| | <i>Trucks</i> | 8.3 |
| | Median lifetime of vehicles | (years) |
| Table 6.9 | <i>Automobiles</i> | 14.0 |
| Table 6.10 | <i>Light trucks</i> | 15.2 |

Table 6.1
Automobile Registrations for Selected Countries, 1950–96
(thousands)

| Year | China | India | Japan | France | United Kingdom | Germany ^a | Canada ^b | United States ^c | U.S. percentage of world ^c | World total ^d |
|---|--------------|--------------|--------|--------------|----------------|----------------------|---------------------|----------------------------|---------------------------------------|--------------------------|
| 1950 | ^e | ^e | 43 | ^e | 2,307 | ^e | 1,913 | 40,339 | 76.0% | 53,051 |
| 1955 | ^e | ^e | 153 | ^e | 360 | ^e | 2,961 | 52,145 | 71.4% | 73,036 |
| 1960 | ^e | ^e | 457 | 4,950 | 5,650 | 4,856 | 4,104 | 61,671 | 62.7% | 98,305 |
| 1965 | ^e | ^e | 2,181 | 8,320 | 9,131 | 9,719 | 5,279 | 75,258 | 53.8% | 139,776 |
| 1970 | ^e | ^e | 8,779 | 11,860 | 11,802 | 14,376 | 6,602 | 89,244 | 46.1% | 193,479 |
| 1975 | ^e | ^e | 17,236 | 15,180 | 14,061 | 18,161 | 8,870 | 106,706 | 41.0% | 260,201 |
| 1980 | 351 | ^e | 23,660 | 18,440 | 15,438 | 23,236 | 10,256 | 121,601 | 38.0% | 320,390 |
| 1985 | 795 | 1,607 | 27,845 | 20,800 | 18,953 | 26,099 | 11,118 | 127,885 | 34.5% | 370,504 |
| 1986 | 966 | 1,780 | 28,654 | 21,090 | 19,415 | 27,224 | 11,586 | 130,004 | 34.1% | 380,923 |
| 1987 | 1,112 | 2,007 | 29,478 | 21,500 | 20,108 | 28,304 | 11,686 | 131,482 | 33.9% | 388,188 |
| 1988 | 1,304 | 2,295 | 30,776 | 21,970 | 20,977 | 29,190 | 12,086 | 133,836 | 33.0% | 405,491 |
| 1989 | 1,464 | 2,486 | 32,621 | 22,520 | 21,919 | 30,152 | 12,380 | 134,559 | 32.4% | 415,844 |
| 1990 | 1,622 | 2,694 | 34,924 | 23,010 | 22,528 | 30,695 | 12,622 | 133,700 | 30.7% | 435,050 |
| 1991 | 1,852 | 2,954 | 37,076 | 23,550 | 22,744 | 31,309 | 12,578 | 128,300 | 29.1% | 441,377 |
| 1992 | 2,262 | 3,205 | 38,963 | 24,020 | 23,008 | 37,579 | 12,781 | 126,581 | 28.0% | 452,311 |
| 1993 | 2,860 | 3,361 | 40,772 | 24,385 | 23,402 | 39,202 | 12,927 | 127,327 | 28.3% | 450,473 |
| 1994 | 3,497 | 3,569 | 42,678 | 24,900 | 23,832 | 39,918 | 13,122 | 127,883 | 27.0% | 473,487 |
| 1995 | 4,179 | 3,837 | 44,680 | 25,100 | 24,307 | 40,499 | 13,183 | 128,387 | 26.9% | 477,010 |
| 1996 | 4,700 | 4,246 | 46,868 | 25,500 | 24,864 | 41,045 | 13,300 | 129,728 | 26.7% | 485,954 |
| <i>Average annual percentage change</i> | | | | | | | | | | |
| 1950–9 | ^e | ^e | 16.4% | ^e | 5.3% | ^e | ^e | ^e | | 4.9% |
| 1970–9 | ^e | ^e | 6.7% | 3.0% | 2.9% | ^e | ^e | ^e | | 3.6% |
| 1986–9 | 17.1% | 9.1% | 5.0% | 1.9% | 2.5% | ^e | ^e | 0.0% | | 2.5% |

Source:

Motor Vehicle Manufacturers Association, *World Motor Vehicle Data*, 1998 Edition, Detroit, MI, 1998, pp. 8, 23, 28, 42, 85, 98, 169, 206, 230 and annual.
 (Additional resources: www.aama.com)

^a Data for 1991 and prior include West Germany only. Kraftwagen are included with automobiles.

^b Data from 1991 and later are not comparable to prior data.

^c Data from 1985 and later are not comparable to prior data.

^d World totals were recalculated from 1985–94 based on change in U.S. data.

^e Data are not available.

Table 6.2
Truck and Bus Registrations for Selected Countries, 1950–96
(thousands)

| Year | China | India | Japan | France | United Kingdom | Germany ^a | Canada ^b | United States ^c | U.S. percentage of world ^c | World total ^d |
|---|--------------|--------------|--------|--------------|----------------|----------------------|---------------------|----------------------------|---------------------------------------|--------------------------|
| 1950 | ^e | ^e | 183 | ^e | 1,060 | ^e | 643 | 8,823 | 50.9% | 17,349 |
| 1955 | ^e | ^e | 318 | ^e | 1,244 | ^e | 952 | 10,544 | 46.1% | 22,860 |
| 1960 | ^e | ^e | 896 | 1,540 | 1,534 | 786 | 1,056 | 12,186 | 42.6% | 28,583 |
| 1965 | ^e | ^e | 4,119 | 1,770 | 1,748 | 1,021 | 1,232 | 15,100 | 39.6% | 38,118 |
| 1970 | ^e | ^e | 8,803 | 1,850 | 1,769 | 1,228 | 1,481 | 19,175 | 36.2% | 52,899 |
| 1975 | 811 | ^e | 10,854 | 2,210 | 1,934 | 1,337 | 2,158 | 26,243 | 38.8% | 67,698 |
| 1980 | 1,480 | ^e | 14,197 | 2,550 | 1,920 | 1,617 | 2,955 | 34,195 | 37.7% | 90,592 |
| 1985 | 2,402 | 1,045 | 18,313 | 3,310 | 3,278 | 1,723 | 3,149 | 43,804 | 37.4% | |
| 1986 | 2,884 | 1,090 | 19,319 | 3,980 | 3,336 | 1,760 | 3,213 | 45,697 | 38.6% | |
| 1987 | 3,247 | 1,229 | 20,424 | 4,200 | 3,452 | 1,801 | 3,576 | 47,428 | 37.4% | |
| 1988 | 3,716 | 1,383 | 21,674 | 4,370 | 3,621 | 1,846 | 3,766 | 50,557 | 37.6% | |
| 1989 | 4,118 | 1,457 | 22,472 | 4,570 | 3,754 | 1,914 | 3,889 | 52,797 | 37.4% | |
| 1990 | 4,496 | 1,536 | 22,773 | 4,748 | 3,774 | 1,989 | 3,931 | 55,097 | 37.2% | |
| 1991 | 4,721 | 1,687 | 22,839 | 4,910 | 3,685 | 2,114 | 3,402 | 59,837 | 38.9% | |
| 1992 | 5,177 | 1,872 | 22,694 | 5,040 | 3,643 | 2,672 | 3,413 | 63,781 | 39.6% | |
| 1993 | 5,316 | 1,967 | 22,490 | 5,065 | 3,604 | 2,842 | 3,409 | 66,736 | 40.1% | |
| 1994 | 5,922 | 2,083 | 22,333 | 5,140 | 3,605 | 2,960 | 3,466 | 70,162 | 45.1% | |
| 1995 | 6,221 | 2,221 | 22,173 | 5,195 | 3,635 | 3,062 | 3,485 | 73,143 | 43.1% | 169,749 |
| 1996 | 6,750 | 2,506 | 21,933 | 5,255 | 3,621 | 3,122 | 3,515 | 76,637 | 41.3% | 185,404 |
| <i>Average annual percentage change</i> | | | | | | | | | | |
| 1950–9 | ^e | ^e | 11.0% | ^e | 2.7% | ^e | ^e | ^e | | 5.3% |
| 1970–9 | ^e | ^e | 3.6% | 4.1% | 2.8% | ^e | ^e | ^e | | 4.9% |
| 1986–9 | 8.9% | 8.7% | 1.3% | 2.8% | 0.8% | ^e | ^e | 5.3% | | 4.6% |

Source:

Motor Vehicle Manufacturers Association, *World Motor Vehicle Data*, 1998 Edition, Detroit, MI, 1998, pp. 8, 23, 28, 42, 85, 98, 169, 206, 230 and annual.
 (Additional resources: www.aama.com)

^a Data for 1991 and prior include West Germany only. Kraftwagen are included with automobiles (Table 1.1).

^b Data from 1991 and later are not comparable to prior data.

^c Data from 1985 and later are not comparable to prior data.

^d World totals were recalculated from 1985–94 based on change in U.S. data.

^e Data are not available.

VEHICLES IN USE

Both the Federal Highway Administration (FHWA) and The Polk Company report figures on the automobile and truck population each year. The two estimates, however, differ by as much as 25.6% for trucks (1992). The differences can be attributed to several factors:

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

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

Table 6.3
Automobiles and Trucks in Use, 1970–98
 (thousands)

| Year | Automobiles | | | Trucks | | | Total | | |
|------|-------------|------------------|-----------------------|--------|------------------|-----------------------|---------|------------------|-----------------------|
| | FHWA | The Polk Company | Percentage difference | FHWA | The Polk Company | Percentage difference | FHWA | The Polk Company | Percentage difference |
| 1970 | 89,243 | 80,448 | 10.9% | 18,797 | 17,688 | 6.3% | 108,040 | 98,136 | 10.1% |
| 1971 | 92,718 | 83,138 | 11.5% | 19,871 | 18,462 | 7.6% | 112,589 | 101,600 | 10.8% |
| 1972 | 97,082 | 86,439 | 12.3% | 21,308 | 19,773 | 7.8% | 118,390 | 106,212 | 11.5% |
| 1973 | 101,985 | 89,805 | 13.6% | 23,244 | 21,412 | 8.6% | 125,229 | 111,217 | 12.6% |
| 1974 | 104,856 | 92,608 | 13.2% | 24,630 | 23,312 | 5.7% | 129,487 | 115,920 | 11.7% |
| 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% |

Source:

FHWA - U.S. Department of Transportation, Federal Highway Administration, *Highway Statistics 1998*, Washington, DC, 1999, Table VM-1, p. V-47, and annual. (Additional resources: www.fhwa.dot.gov)

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

The data on automobile stock by size class are estimations based on historical sales data. This method assumes a constant scrappage rate for all size classes. The data on trucks by weight class are based on estimates from the 1997 Vehicle Inventory and Use Survey (latest available survey).

Table 6.4
Vehicle Stock and New Sales in United States, 1998 Calendar Year

| | Vehicle stock ^a | | New sales | | |
|--|----------------------------|---------------|-------------------------|------------------------------------|-----------------------|
| | Thousands | Percentage | Domestic (thousands) | Import ^b (thousands) | Total (thousands) |
| Autos | 125,966 | 100.0% | 6,761 (83.1%) | 1,378 (16.9%) | 8,139 (100.0%) |
| Two seaters | 2,129 | 1.7% | 0 (0.0%) | 12 (100.0%) | 12 (100.0%) |
| Minicompact | 1,297 | 1.0% | 1,278 (85.0%) | 226 (15.0%) | 1,504 (100.0%) |
| Subcompact | 27,817 | 22.1% | 1,863 (80.0%) | 465 (20.0%) | 2,328 (100.0%) |
| Compact | 40,759 | 32.4% | 2,524 (80.6%) | 608 (19.4%) | 3,132 (100.0%) |
| Midsized | 36,499 | 29.0% | 1,043 (98.3%) | 19 (1.7%) | 1,062 (100.0%) |
| Large | 17,464 | 13.9% | 54 (52.8%) | 48 (47.2%) | 101 (100.0%) |
| Autos | 125,966 | 100.0% | c | c | c |
| Business fleet autos ^d | 9,550 | 7.6% | c | c | c |
| Personal autos | 116,416 | 92.4% | c | c | c |
| Motorcycles | 3,879^e | 100.0% | c | c | c |
| Recreational vehicles | c | c | 441 (100.0%) | 0 (0.0%) | 441 (100.0%) |
| Trucks | 79,077 | 100.0% | c | c | 7,826 (100.0%) |
| Light (0–10,000 lbs) | 73,971 | 93.5% | 6,683 (91.5%) | 616 (8.4%) | 7,300 (100.0%) |
| Medium (10,001–26,000 lbs) | 2,351 | 3.0% | c | c | 203 (100.0%) |
| Heavy-heavy (26,001 lbs and over) | 2,754 | 3.5% | c | c | 324 (100.0%) |
| Trucks | 79,077 | 100.0% | c | c | c |
| Business fleet trucks #19,500 lbs ^d | 7,329 | 9.3% | c | c | c |
| Personal trucks # 19,500 lbs | 68,202 | 86.2% | c | c | c |
| Trucks > 19,500 lbs. | 3,546 | 4.5% | c | c | c |

Source:

See Appendix A for Table 6.4. (Additional resources: www.polk.com)

^a Total auto and truck vehicle stock as of July 1 from The Polk Company (FURTHER REPRODUCTION PROHIBITED).

^b Includes domestic-sponsored imports.

^c Data are not available.

^d In fleets of four or more vehicles.

^e Includes mostly on-highway motorcycles. Many states do not require registration for off-highway vehicles.

Table 6.5
Highway Vehicle Miles Traveled by Vehicle Type, 1970–98
(million miles)

| Year | Automobiles | Motorcycles | Two-axle, four-tire trucks | Other single-unit trucks | Combination trucks | Buses ^a | Total |
|---|-------------|-------------|----------------------------------|--------------------------------|-----------------------|--------------------|-----------|
| 1970 | 916,700 | 2,979 | 123,286 | 27,081 | 35,134 | 4,544 | 1,109,724 |
| 1971 | 966,330 | 3,607 | 137,870 | 28,985 | 37,217 | 4,802 | 1,178,811 |
| 1972 | 1,021,365 | 4,331 | 156,622 | 31,414 | 40,706 | 5,348 | 1,259,786 |
| 1973 | 1,045,981 | 5,194 | 176,833 | 33,661 | 45,649 | 5,792 | 1,313,110 |
| 1974 | 1,007,251 | 5,445 | 182,757 | 33,441 | 45,966 | 5,684 | 1,280,544 |
| 1975 | 1,033,950 | 5,629 | 200,700 | 34,606 | 46,724 | 6,055 | 1,327,664 |
| 1976 | 1,078,215 | 6,003 | 225,834 | 36,390 | 49,680 | 6,258 | 1,402,380 |
| 1977 | 1,109,243 | 6,349 | 250,591 | 39,339 | 55,682 | 5,823 | 1,467,027 |
| 1978 | 1,146,508 | 7,158 | 279,414 | 42,747 | 62,992 | 5,885 | 1,544,704 |
| 1979 | 1,113,640 | 8,637 | 291,905 | 42,012 | 66,992 | 5,947 | 1,529,133 |
| 1980 | 1,111,596 | 10,214 | 290,935 | 39,813 | 68,678 | 6,059 | 1,527,295 |
| 1981 | 1,133,332 | 10,690 | 296,343 | 39,568 | 69,134 | 6,241 | 1,555,308 |
| 1982 | 1,161,713 | 9,910 | 306,141 | 40,658 | 70,765 | 5,823 | 1,595,010 |
| 1983 | 1,195,054 | 8,760 | 327,643 | 42,546 | 73,586 | 5,199 | 1,652,788 |
| 1984 | 1,227,043 | 8,784 | 358,006 | 44,419 | 77,377 | 4,640 | 1,720,269 |
| 1985 | 1,246,798 | 9,086 | 390,961 | 45,441 | 78,063 | 4,478 | 1,774,826 |
| 1986 | 1,270,167 | 9,397 | 423,915 | 45,637 | 81,038 | 4,717 | 1,834,872 |
| 1987 | 1,315,982 | 9,506 | 456,870 | 48,022 | 85,495 | 5,330 | 1,921,204 |
| 1988 | 1,370,271 | 10,024 | 502,207 | 49,434 | 88,551 | 5,475 | 2,025,962 |
| 1989 | 1,401,221 | 10,371 | 536,475 | 50,870 | 91,879 | 5,670 | 2,096,487 |
| 1990 | 1,408,266 | 9,557 | 574,571 | 51,901 | 94,341 | 5,726 | 2,144,362 |
| 1991 | 1,358,185 | 9,178 | 649,394 | 52,898 | 96,645 | 5,750 | 2,172,050 |
| 1992 | 1,371,569 | 9,557 | 706,863 | 53,874 | 99,510 | 5,778 | 2,247,151 |
| 1993 | 1,374,709 | 9,906 | 745,750 | 56,772 | 103,116 | 6,125 | 2,296,378 |
| 1994 | 1,406,089 | 10,240 | 764,634 | 61,284 | 108,932 | 6,409 | 2,357,588 |
| 1995 | 1,438,294 | 9,797 | 790,029 | 62,705 | 115,451 | 6,420 | 2,422,696 |
| 1996 | 1,469,854 | 9,920 | 816,540 | 64,072 | 118,899 | 6,563 | 2,485,848 |
| 1997 | 1,502,556 | 10,081 | 850,739 | 66,893 | 124,584 | 6,842 | 2,561,695 |
| 1998 | 1,545,830 | 10,260 | 866,228 | 67,894 | 128,159 | 6,996 | 2,625,367 |
| <i>Average annual percentage change</i> | | | | | | | |
| 1970–9 | 1.9% | 4.5% | 7.2% | 3.3% | 4.7% | 1.6% | 3.1% |
| 1988–9 | 1.2% | 0.2% | 5.6% | 3.2% | 3.8% | 2.5% | 2.6% |

Source:

U.S. Department of Transportation, Federal Highway Administration, *Highway Statistics 1998*, Washington, DC, 1999, Table VM-1, p. V-47, and annual.
 (Additional resources: www.fhwa.dot.gov)

^aThe data do not correspond with vehicle-miles of travel presented in the "Bus" section of this chapter due to differing data sources.

Table 6.6
Automobiles in Operation and Vehicle Travel by Age, 1970 and 1998

| Age (years) | 1970 | | | 1998 | | | 1998 Estimated vehicle travel | | Average annual miles per vehicle |
|----------------------|-------------------------|---------------|--------------------------|-------------------------|------------|--------------------------|----------------------------------|--------------------------|--|
| | Vehicles (thousands) | Percentage | Cumulative percentage | Vehicles (thousands) | Percentage | Cumulative percentage | Percentage | Cumulative percentage | |
| Under 1 ^a | 6,288 | 7.8% | 7.8% | 5,619 | 4.5% | 4.5% | 6.1% | 6.1% | 15,600 |
| 1 | 9,299 | 11.6% | 19.4% | 8,049 | 6.4% | 10.9% | 6.3% | 12.4% | 11,200 |
| 2 | 8,816 | 11.0% | 30.3% | 7,564 | 6.0% | 16.9% | 5.9% | 18.3% | 11,300 |
| 3 | 7,878 | 9.8% | 40.1% | 8,926 | 7.1% | 23.9% | 7.2% | 25.5% | 11,600 |
| 4 | 8,538 | 10.6% | 50.8% | 7,878 | 6.3% | 30.2% | 6.8% | 32.3% | 12,400 |
| 5 | 8,506 | 10.6% | 61.3% | 7,953 | 6.3% | 36.5% | 7.0% | 39.3% | 12,700 |
| 6 | 7,116 | 8.8% | 70.2% | 7,320 | 5.8% | 42.3% | 6.6% | 45.9% | 12,900 |
| 7 | 6,268 | 7.8% | 78.0% | 7,536 | 6.0% | 48.3% | 7.2% | 53.1% | 13,800 |
| 8 | 5,058 | 6.3% | 84.3% | 7,620 | 6.0% | 54.4% | 7.8% | 60.9% | 14,800 |
| 9 | 3,267 | 4.1% | 88.3% | 8,187 | 6.5% | 60.9% | 8.2% | 69.2% | 14,500 |
| 10 | 2,776 | 3.5% | 91.8% | 8,008 | 6.4% | 67.2% | 5.0% | 74.2% | 9,000 |
| 11 | 1,692 | 2.1% | 93.9% | 7,439 | 5.9% | 73.1% | 4.7% | 78.8% | 9,000 |
| 12 | 799 | 1.0% | 94.9% | 6,870 | 5.5% | 78.6% | 4.3% | 83.1% | 9,000 |
| 13 | 996 | 1.2% | 96.1% | 5,774 | 4.6% | 83.2% | 3.6% | 86.7% | 9,000 |
| 14 | 794 | 1.0% | 97.1% | 4,636 | 3.7% | 86.8% | 2.9% | 89.6% | 9,000 |
| 15 and older | 2,336 | 2.9% | 100.0% | 16,587 | 13.2% | 100.0% | 10.4% | 100.0% | 9,000 |
| Subtotal | 80,427 | 100.0% | | 125,966 | | | | | |
| Age not given | 22 | | | 0 | | | | | |
| Total | 80,449 | | | 125,966 | | | | | |
| Average age | | 5.6 | | | 8.8 | | | | |
| Median age | | 4.9 | | | 8.3 | | | | |

Source:

The Polk Company, Detroit, MI. FURTHER REPRODUCTION PROHIBITED.

Vehicle travel - Average annual miles per auto by age were multiplied by the number of vehicles in operation by age to estimate the vehicle travel.

Average annual miles per auto by age - generated by ORNL from the *Nationwide Personal Transportation Survey* web site: www-cta.ornl.gov/npts.

(Additional resources: www.polk.com, www-cta.ornl.gov/npts)

^aAutomobiles sold as of July 1 of each year.

Table 6.7
Trucks in Operation and Vehicle Travel by Age, 1970 and 1998

| Age (years) | 1970 | | | 1998 | | | 1998 Estimated vehicle travel | | Average annual miles per vehicle |
|----------------------|-------------------------|---------------|--------------------------|-------------------------|------------|--------------------------|----------------------------------|--------------------------|--|
| | Vehicles (thousands) | Percentage | Cumulative percentage | Vehicles (thousands) | Percentage | Cumulative percentage | Percentage | Cumulative percentage | |
| Under 1 ^a | 1,262 | 7.1% | 7.1% | 5,030 | 6.4% | 6.4% | 7.9% | 7.9% | 17,500 |
| 1 | 1,881 | 10.6% | 17.8% | 6,550 | 8.3% | 14.6% | 11.3% | 19.1% | 19,200 |
| 2 | 1,536 | 8.7% | 26.5% | 5,545 | 7.0% | 21.7% | 9.8% | 29.0% | 19,800 |
| 3 | 1,428 | 8.1% | 34.6% | 6,165 | 7.8% | 29.5% | 9.9% | 38.9% | 17,900 |
| 4 | 1,483 | 8.4% | 43.0% | 5,593 | 7.1% | 36.5% | 8.8% | 47.6% | 17,500 |
| 5 | 1,339 | 7.6% | 50.5% | 4,711 | 6.0% | 42.5% | 7.2% | 54.8% | 17,000 |
| 6 | 1,154 | 6.5% | 57.1% | 3,870 | 4.9% | 47.4% | 5.4% | 60.2% | 15,600 |
| 7 | 975 | 5.5% | 62.6% | 3,800 | 4.8% | 52.2% | 5.2% | 65.4% | 15,400 |
| 8 | 826 | 4.7% | 67.3% | 3,647 | 4.6% | 56.8% | 4.9% | 70.3% | 15,100 |
| 9 | 621 | 3.5% | 70.8% | 4,171 | 5.3% | 62.1% | 4.9% | 75.3% | 13,200 |
| 10 | 658 | 3.7% | 74.5% | 3,979 | 5.0% | 67.1% | 3.3% | 78.6% | 9,200 |
| 11 | 583 | 3.3% | 77.8% | 3,418 | 4.3% | 71.4% | 2.8% | 81.4% | 9,200 |
| 12 | 383 | 2.2% | 80.0% | 3,448 | 4.4% | 75.8% | 2.8% | 84.2% | 9,200 |
| 13 | 417 | 2.4% | 82.3% | 2,855 | 3.6% | 79.4% | 2.4% | 86.6% | 9,200 |
| 14 | 414 | 2.3% | 84.7% | 2,367 | 3.0% | 82.4% | 2.0% | 88.5% | 9,200 |
| 15 and older | 2,710 | 15.3% | 100.0% | 13,928 | 17.6% | 100.0% | 11.5% | 100.0% | 9,200 |
| Subtotal | 17,670 | 100.0% | | 79,077 | | | 100.0% | | |
| Age not given | 15 | | | 0 | | | | | |
| Total | 17,685 | | | 79,077 | | | | | |
| Average age | | 7.3 | | | 8.3 | | | | |
| Median age | | 5.9 | | | 7.6 | | | | |

Source:

The Polk Company, Detroit, MI. **FURTHER REPRODUCTION PROHIBITED.**

Vehicle travel—The average annual vehicle-miles per truck by age were multiplied by the number of trucks in operation by age to estimate the vehicle travel. Average annual miles per truck by age were generated by ORNL from the *1992 Truck Inventory and Use Survey* public use tape provided by U.S. Department of Commerce, Bureau of the Census, Washington, DC, 1995. (Additional resources: www.polk.com, www.census.gov)

^aTrucks sold as of July 1 of each year.

The average age of automobiles was lower than the average age of trucks until 1995. Since then, the average automobile age continues to grow, while the average truck age has held about the same. The increasing popularity of light trucks as personal passenger vehicles may have had an influence on the average age of trucks.

Table 6.8
Average Age of Automobiles and Trucks in Use, 1970–98
(years)

| Calendar year | Automobiles | | Trucks | |
|------------------|-------------------|---------------------|-------------------|---------------------|
| | Mean ^a | Median ^b | Mean ^a | Median ^b |
| 1970 | 5.6 | 4.9 | 7.3 | 5.9 |
| 1971 | 5.7 | 5.1 | 7.4 | 6.1 |
| 1972 | 5.7 | 5.1 | 7.2 | 6.0 |
| 1973 | 5.7 | 5.1 | 6.9 | 5.8 |
| 1974 | 5.7 | 5.2 | 7.0 | 5.6 |
| 1975 | 6.0 | 5.4 | 6.9 | 5.8 |
| 1976 | 6.2 | 5.5 | 7.0 | 5.8 |
| 1977 | 6.2 | 5.6 | 6.9 | 5.7 |
| 1978 | 6.3 | 5.7 | 6.9 | 5.8 |
| 1979 | 6.4 | 5.9 | 6.9 | 5.9 |
| 1980 | 6.6 | 6.0 | 7.1 | 6.3 |
| 1981 | 6.9 | 6.0 | 7.5 | 6.5 |
| 1982 | 7.2 | 6.2 | 7.8 | 6.8 |
| 1983 | 7.4 | 6.5 | 8.1 | 7.2 |
| 1984 | 7.5 | 6.7 | 8.2 | 7.4 |
| 1985 | 7.6 | 6.9 | 8.1 | 7.6 |
| 1986 | 7.6 | 7.0 | 8.0 | 7.7 |
| 1987 | 7.6 | 6.9 | 8.0 | 7.8 |
| 1988 | 7.6 | 6.8 | 7.9 | 7.1 |
| 1989 | 7.6 | 6.5 | 7.9 | 6.7 |
| 1990 | 7.8 | 6.5 | 8.0 | 6.5 |
| 1991 | 7.9 | 6.7 | 8.1 | 6.8 |
| 1992 | 8.1 | 7.0 | 8.4 | 7.2 |
| 1993 | 8.3 | 7.3 | 8.6 | 7.5 |
| 1994 | 8.4 | 7.5 | 8.4 | 7.5 |
| 1995 | 8.5 | 7.7 | 8.4 | 7.6 |
| 1996 | 8.6 | 7.9 | 8.3 | 7.7 |
| 1997 | 8.7 | 8.1 | 8.3 | 7.8 |
| 1998 | 8.8 | 8.3 | 8.3 | 7.6 |

Source:

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

^aMean is the sum of the products of units multiplied by age, divided by the total units.

^bMedian is a value in an ordered set of values below and above which there are an equal number of values.

Using current registration data and a scrappage model by Greenspan and Cohen, [1996 paper: <http://www.bog.frb.fed.us/pubs/feds/1996/199640/199640pap.pdf>], ORNL calculated new automobile scrappage rates. The expected median lifetime for a 1990 model year automobile is 14 years. These data are fitted model values which assume constant economic conditions.

Table 6.9
Automobile Scrappage and Survival Rates
1970, 1980 and 1990 Model Years

| Vehicle age ^a (years) | 1970 model year | | 1980 model year | | 1990 model year | |
|-------------------------------------|----------------------------|-----------------------------|----------------------------|-----------------------------|----------------------------|-----------------------------|
| | Survival rate ^b | Scrappage rate ^c | Survival rate ^b | Scrappage rate ^c | Survival rate ^b | Scrappage rate ^c |
| 4 | 98.5 | 3.5 | 100.0 | 2.8 | 100.0 | 1.8 |
| 5 | 94.0 | 4.5 | 96.4 | 3.7 | 99.9 | 2.4 |
| 6 | 88.7 | 5.6 | 92.0 | 4.6 | 96.8 | 3.1 |
| 7 | 82.7 | 6.8 | 86.9 | 5.5 | 93.2 | 3.8 |
| 8 | 76.1 | 7.9 | 81.2 | 6.5 | 89.0 | 4.5 |
| 9 | 69.1 | 9.1 | 75.1 | 7.5 | 84.3 | 5.3 |
| 10 | 62.0 | 10.4 | 68.6 | 8.6 | 79.1 | 6.1 |
| 11 | 54.8 | 11.6 | 62.0 | 9.7 | 73.6 | 7.0 |
| 12 | 47.7 | 12.9 | 55.3 | 10.8 | 67.8 | 7.8 |
| 13 | 41.0 | 14.2 | 48.7 | 12.0 | 61.9 | 8.8 |
| 14 | 34.6 | 15.5 | 42.3 | 13.1 | 55.9 | 9.7 |
| 15 | 28.8 | 16.8 | 36.2 | 14.3 | 49.9 | 10.7 |
| 16 | 23.6 | 18.2 | 30.6 | 15.5 | 44.0 | 11.7 |
| 17 | 19.0 | 19.5 | 25.5 | 16.8 | 38.4 | 12.8 |
| 18 | 15.0 | 20.9 | 20.9 | 18.0 | 33.1 | 13.9 |
| 19 | 11.6 | 22.3 | 16.8 | 19.3 | 28.1 | 15.0 |
| 20 | 8.9 | 23.7 | 13.4 | 20.6 | 23.6 | 16.1 |
| 21 | 6.6 | 25.1 | 10.4 | 21.9 | 19.5 | 17.3 |
| 22 | 4.9 | 26.6 | 8.0 | 23.3 | 15.9 | 18.4 |
| 23 | 3.5 | 28.0 | 6.0 | 24.6 | 12.8 | 19.6 |
| 24 | 2.5 | 29.4 | 4.5 | 26.0 | 10.1 | 20.9 |
| 25 | 1.7 | 30.9 | 3.2 | 27.3 | 7.9 | 22.1 |
| 26 | 1.2 | 32.3 | 2.3 | 28.7 | 6.1 | 23.3 |
| 27 | 0.8 | 33.8 | 1.6 | 30.1 | 4.6 | 24.6 |
| 28 | 0.5 | 35.2 | 1.1 | 31.5 | 3.4 | 25.9 |
| 29 | 0.3 | 36.7 | 0.7 | 32.9 | 2.5 | 27.2 |
| 30 | 0.2 | 38.1 | 0.5 | 34.3 | 1.8 | 28.5 |
| Median lifetime | 11.3 years | | 12.2 years | | 14.0 years | |

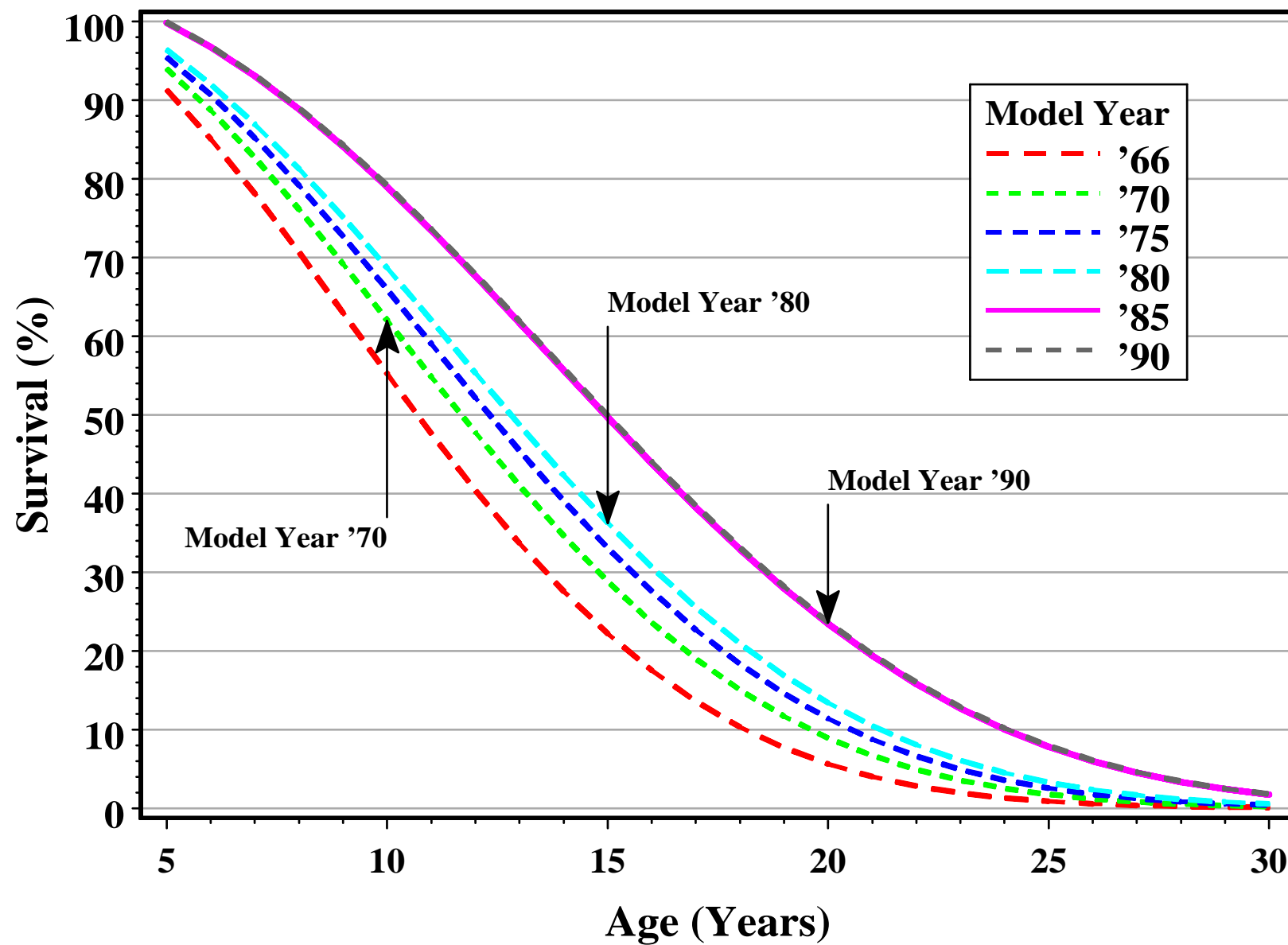
Source:

Schmoyer, Richard L., unpublished study on scrappage rates, Oak Ridge National Laboratory, Oak Ridge, TN, 2000.

^aIt was assumed that scrappage for vehicles less than 4 years old is 0.

^bThe percentage of 1970/80/90 model year automobiles which will be in use at the end of a given year.

^cThe percentage of 1970/80/90 model year automobiles which will be retired from use within a given year.



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Using current registration data and a scrappage model by Greenspan and Cohen [1996 paper: <http://www.bog.frb.fed.us/pubs/feds/1996/199640/199640pap.pdf>], ORNL calculated new light truck scrappage rates. The expected median lifetime for a 1990 model year light truck is 15.2 years. These data are fitted model values which assume constant economic conditions.

Table 6.10
Scrappage and Survival Rates for Light Trucks

| Vehicle age ^a (years) | 1970 model year | | 1980 model year | | 1990 model year | |
|-------------------------------------|----------------------------|-----------------------------|----------------------------|-----------------------------|----------------------------|-----------------------------|
| | Survival rate ^b | Scrappage rate ^c | Survival rate ^b | Scrappage rate ^c | Survival rate ^b | Scrappage rate ^c |
| 4 | 99.8 | 1.6 | 99.2 | 1.9 | 99.6 | 1.8 |
| 5 | 97.7 | 2.2 | 96.8 | 2.5 | 97.3 | 2.3 |
| 6 | 95.1 | 2.7 | 93.8 | 3.1 | 94.5 | 2.9 |
| 7 | 92.0 | 3.2 | 90.3 | 3.7 | 91.3 | 3.4 |
| 8 | 88.5 | 3.8 | 86.4 | 4.4 | 87.6 | 4.0 |
| 9 | 84.6 | 4.4 | 82.0 | 5.0 | 83.5 | 4.7 |
| 10 | 80.4 | 5.0 | 77.4 | 5.7 | 79.1 | 5.3 |
| 11 | 75.8 | 5.6 | 72.5 | 6.4 | 74.4 | 5.9 |
| 12 | 71.1 | 6.3 | 67.3 | 7.1 | 69.5 | 6.6 |
| 13 | 66.2 | 6.9 | 62.1 | 7.8 | 64.4 | 7.3 |
| 14 | 61.1 | 7.6 | 56.8 | 8.5 | 59.3 | 8.0 |
| 15 | 56.1 | 8.3 | 51.5 | 9.3 | 54.1 | 8.7 |
| 16 | 51.0 | 9.0 | 46.3 | 10.0 | 49.0 | 9.4 |
| 17 | 46.1 | 9.7 | 41.3 | 10.8 | 44.0 | 10.2 |
| 18 | 41.3 | 10.4 | 36.5 | 11.6 | 39.2 | 10.9 |
| 19 | 36.7 | 11.2 | 32.0 | 12.4 | 34.6 | 11.7 |
| 20 | 32.3 | 11.9 | 27.8 | 13.2 | 30.3 | 12.5 |
| 21 | 28.2 | 12.7 | 23.9 | 14.1 | 26.3 | 13.3 |
| 22 | 24.4 | 13.5 | 20.3 | 14.9 | 22.6 | 14.1 |
| 23 | 20.9 | 14.3 | 17.1 | 15.7 | 19.2 | 14.9 |
| 24 | 17.7 | 15.1 | 14.3 | 16.6 | 16.2 | 15.7 |
| 25 | 14.9 | 15.9 | 11.8 | 17.5 | 13.5 | 16.6 |
| 26 | 12.4 | 16.8 | 9.6 | 18.3 | 11.1 | 17.4 |
| 27 | 10.2 | 17.6 | 7.8 | 19.2 | 9.1 | 18.3 |
| 28 | 8.3 | 18.5 | 6.2 | 20.1 | 7.4 | 19.2 |
| 29 | 6.7 | 19.3 | 4.9 | 21.0 | 5.9 | 20.0 |
| 30 | 5.4 | 20.2 | 3.8 | 21.9 | 4.7 | 20.9 |
| Median lifetime | 16.8 years | | 15.7 years | | 15.2 years | |

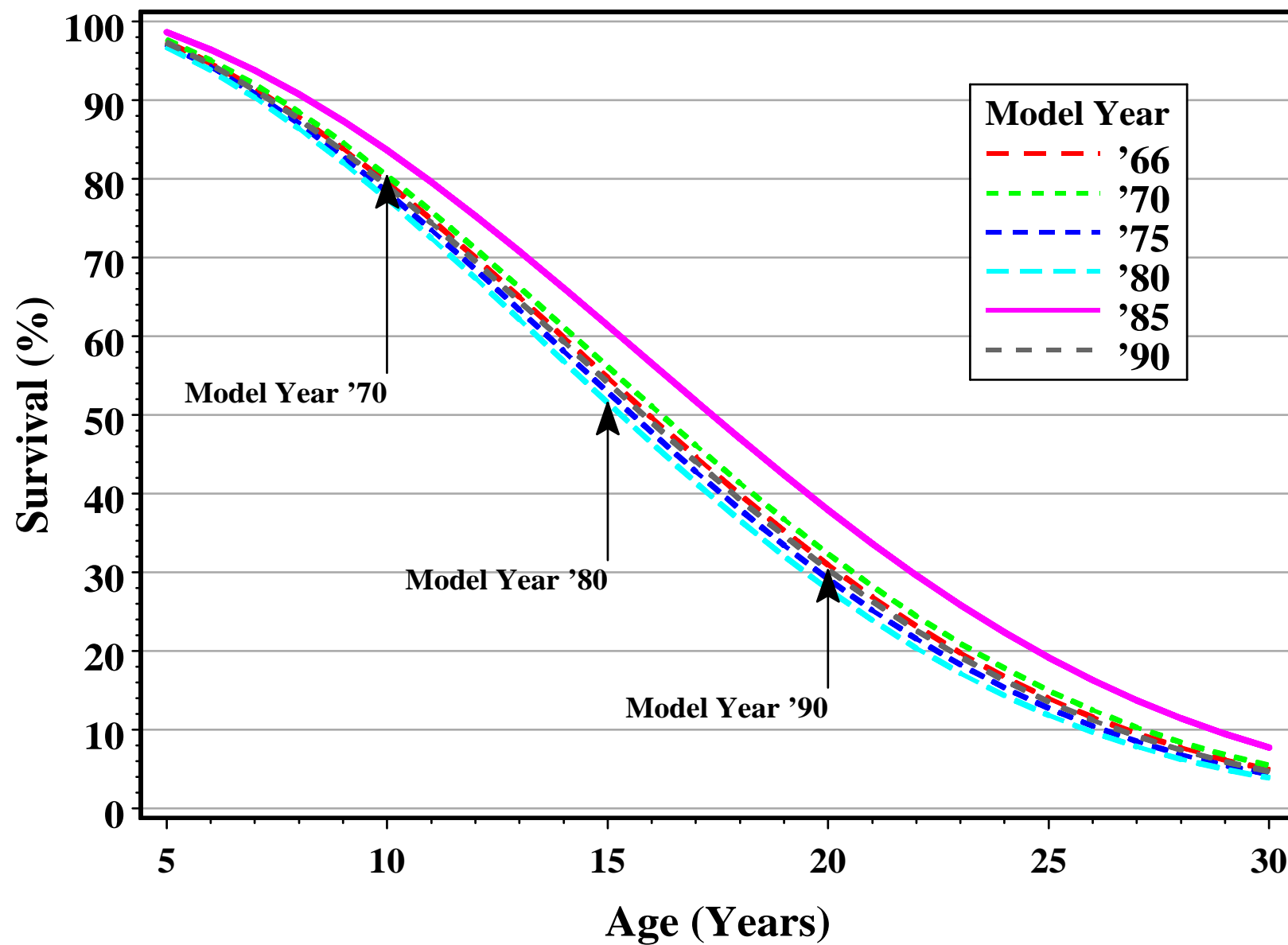
Source:

Schmoyer, Richard L., unpublished study on scrappage rates, Oak Ridge National Laboratory, Oak Ridge, TN, 2000.

^aIt was assumed that scrappage for vehicles less than 4 years old is 0.

^bThe percentage of 1970/80/90 model year light trucks which will be in use at the end of a given year.

^cThe percentage of 1970/80/90 model year light trucks which will be retired from use within a given year.



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Chapter 7

Light Vehicles and Characteristics

Summary Statistics from Tables in this Chapter

| Source | | |
|------------|--|-----------|
| Table 7.1 | Passenger cars, 1998 | |
| | <i>Registrations (thousands)</i> | 131,839 |
| | <i>Vehicle miles (million miles)</i> | 1,545,830 |
| | <i>Fuel economy (miles per gallon)</i> | 21.4 |
| Table 7.2 | Two-axle, four tire trucks, 1998 | |
| | <i>Registrations (thousands)</i> | 71,818 |
| | <i>Vehicle miles (million miles)</i> | 866,228 |
| | <i>Fuel economy (miles per gallon)</i> | 17.1 |
| Table 7.5 | Automobile sales, 1999 sales period | |
| | <i>Minicompact</i> | 12,903 |
| | <i>Subcompact</i> | 1,622,483 |
| | <i>Compact</i> | 2,367,048 |
| | <i>Midsized</i> | 3,359,492 |
| | <i>Large</i> | 1,180,739 |
| | <i>Two-seater</i> | 103,248 |
| Table 7.7 | Light truck share of total light vehicle sales | |
| | <i>1976</i> | 19.8% |
| | <i>1999</i> | 48.1% |
| Table 7.6 | Light truck sales, 1999 sales period | |
| | <i>Small pickup</i> | 302,426 |
| | <i>Large pickup</i> | 2,830,271 |
| | <i>Small van</i> | 1,319,398 |
| | <i>Large van</i> | 416,813 |
| | <i>Small utility</i> | 942,298 |
| | <i>Large utility</i> | 2,190,549 |
| Table 7.16 | Corporate average fuel economy | (mpg) |
| | <i>Automobile standard, MY 1999</i> | 27.5 |
| | <i>Automobile fuel economy, MY 1999</i> | 28.3 |
| | <i>Light truck standard, MY 1999</i> | 20.7 |
| | <i>Light truck fuel economy, MY 1999</i> | 20.7 |
| Table 7.21 | Average fuel economy loss from 55 to 70 mph | 17.1% |

*The Federal Highway Administration released revised historical data back to 1985 in their “Highway Statistics Summary to 1995” report. As a result, the data in this table have been revised. The data in this table from 1985–on **DO NOT** include minivans, pickups, or sport utility vehicles.*

Table 7.1
Summary Statistics for Passenger Cars, 1970–98

| Year | Registrations ^a (thousands) | Vehicle travel (million miles) | Fuel use (million gallons) | Fuel economy ^b (miles per gallon) |
|---|---|-----------------------------------|-------------------------------|---|
| 1970 | 89,244 | 916,700 | 67,820 | 13.5 |
| 1971 | 92,718 | 966,330 | 71,346 | 13.5 |
| 1972 | 97,082 | 1,021,365 | 75,937 | 13.5 |
| 1973 | 101,985 | 1,045,981 | 78,233 | 13.4 |
| 1974 | 104,856 | 1,007,251 | 74,229 | 13.6 |
| 1975 | 106,706 | 1,033,950 | 74,140 | 13.9 |
| 1976 | 110,189 | 1,078,215 | 78,297 | 13.8 |
| 1977 | 112,288 | 1,109,243 | 79,060 | 14.0 |
| 1978 | 116,573 | 1,146,508 | 80,652 | 14.2 |
| 1979 | 118,429 | 1,113,640 | 76,588 | 14.5 |
| 1980 | 121,601 | 1,111,596 | 69,981 | 15.9 |
| 1981 | 123,098 | 1,133,332 | 69,112 | 16.4 |
| 1982 | 123,702 | 1,161,713 | 69,116 | 16.8 |
| 1983 | 126,444 | 1,195,054 | 70,322 | 17.0 |
| 1984 | 128,158 | 1,227,043 | 70,663 | 17.4 |
| 1985 ^c | 127,885 | 1,246,798 | 71,518 | 17.4 |
| 1986 | 130,004 | 1,270,167 | 73,174 | 17.4 |
| 1987 | 131,482 | 1,315,982 | 73,308 | 18.0 |
| 1988 | 133,836 | 1,370,271 | 73,345 | 18.7 |
| 1989 | 134,559 | 1,401,221 | 73,913 | 19.0 |
| 1990 | 133,700 | 1,408,266 | 69,568 | 20.2 |
| 1991 | 128,300 | 1,358,185 | 64,318 | 21.1 |
| 1992 | 126,581 | 1,371,569 | 65,436 | 21.0 |
| 1993 | 127,327 | 1,374,709 | 67,047 | 20.5 |
| 1994 | 127,883 | 1,406,089 | 67,874 | 20.7 |
| 1995 | 128,387 | 1,438,294 | 68,072 | 21.1 |
| 1996 | 129,728 | 1,469,854 | 69,221 | 21.2 |
| 1997 | 129,749 | 1,502,556 | 69,892 | 21.5 |
| 1998 | 131,839 | 1,545,830 | 72,209 | 21.4 |
| <i>Average annual percentage change</i> | | | | |
| 1970–98 | 1.4% | 1.9% | 0.2% | 1.7% |
| 1988–98 | -0.2% | 1.2% | -0.2% | 1.4% |

Source:

U.S. Department of Transportation, Federal Highway Administration, *Highway Statistics 1998*, Washington, DC, 1999, Table VM-1, p. V-74, and annual.
(Additional resources: www.fhwa.dot.gov)

^a This number differs from R.L. Polk’s estimates of “number of automobiles in use.” See Table 6.3.

^b Fuel economy for automobile population.

^c Beginning in this year the data were revised to exclude minivans, pickups and sport utility vehicles which may have been previously included.

The Federal Highway Administration released revised historical data back to 1985 which better reflected two-axle, four-tire trucks. The definition of this category includes vans, pickup trucks, and sport utility vehicles.

Table 7.2
Summary Statistics for Two-Axle, Four-Tire Trucks, 1970–98

| Year | Registrations (thousands) | Vehicle travel (million miles) | Fuel use (million gallons) | Fuel economy (miles per gallon) |
|---|------------------------------|-----------------------------------|-------------------------------|------------------------------------|
| 1970 | 14,211 | 123,286 | 12,313 | 10.0 |
| 1971 | 15,181 | 137,870 | 13,484 | 10.2 |
| 1972 | 16,428 | 156,622 | 15,150 | 10.3 |
| 1973 | 18,083 | 176,833 | 16,828 | 10.5 |
| 1974 | 19,335 | 182,757 | 16,657 | 11.0 |
| 1975 | 20,418 | 200,700 | 19,081 | 10.5 |
| 1976 | 22,301 | 225,834 | 20,828 | 10.8 |
| 1977 | 23,624 | 250,591 | 22,383 | 11.2 |
| 1978 | 25,476 | 279,414 | 24,162 | 11.6 |
| 1979 | 27,022 | 291,905 | 24,445 | 11.9 |
| 1980 | 27,876 | 290,935 | 23,796 | 12.2 |
| 1981 | 28,928 | 296,343 | 23,697 | 12.5 |
| 1982 | 29,792 | 306,141 | 22,702 | 13.5 |
| 1983 | 31,214 | 327,643 | 23,945 | 13.7 |
| 1984 | 32,106 | 358,006 | 25,604 | 14.0 |
| 1985 ^a | 37,214 | 390,961 | 27,363 | 14.3 |
| 1986 | 39,382 | 423,915 | 29,074 | 14.6 |
| 1987 | 41,107 | 456,870 | 30,598 | 14.9 |
| 1988 | 43,805 | 502,207 | 32,653 | 15.4 |
| 1989 | 45,945 | 536,475 | 33,271 | 16.1 |
| 1990 | 48,275 | 574,571 | 35,611 | 16.1 |
| 1991 | 53,033 | 649,394 | 38,217 | 17.0 |
| 1992 | 57,091 | 706,863 | 40,929 | 17.3 |
| 1993 | 59,994 | 745,750 | 42,851 | 17.4 |
| 1994 | 62,904 | 764,634 | 44,112 | 17.3 |
| 1995 | 65,738 | 790,029 | 45,605 | 17.3 |
| 1996 | 69,134 | 816,540 | 47,354 | 17.2 |
| 1997 | 70,224 | 850,739 | 49,389 | 17.2 |
| 1998 | 71,818 | 866,228 | 50,579 | 17.1 |
| <i>Average annual percentage change</i> | | | | |
| 1970–98 | 6.0% | 7.2% | 5.2% | 1.9% |
| 1988–98 | 5.1% | 5.6% | 4.5% | 1.1% |

Source:

U.S. Department of Transportation, Federal Highway Administration, *Highway Statistics 1998*, Washington, DC, 1999, Table VM-1, p. V-74, and annual.
(Additional resources: www.fhwa.dot.gov)

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

Table 7.3
New Retail Automobile Sales in the United States, 1970–98

| Calendar year | Domestic ^a (thousands) | Import ^b | Total | Percentage imports | Percentage transplants ^c on model year basis | Percentage imports and transplants | Percentage diesel |
|---|--------------------------------------|---------------------|--------|--------------------|--|------------------------------------|-------------------|
| 1970 | 7,119 | 1,285 | 8,404 | 15.3% | d | d | d |
| 1971 | 8,681 | 1,568 | 10,249 | 15.3% | d | d | 0.06% |
| 1972 | 9,327 | 1,623 | 10,950 | 14.8% | d | d | 0.05% |
| 1973 | 9,676 | 1,763 | 11,439 | 15.4% | d | d | 0.06% |
| 1974 | 7,454 | 1,399 | 8,853 | 15.8% | d | d | 0.20% |
| 1975 | 7,053 | 1,571 | 8,624 | 18.2% | d | d | 0.31% |
| 1976 | 8,611 | 1,499 | 10,110 | 14.8% | 0.0% | 14.8% | 0.22% |
| 1977 | 9,109 | 2,074 | 11,183 | 18.5% | 0.0% | 18.5% | 0.34% |
| 1978 | 9,312 | 2,002 | 11,314 | 17.7% | 0.0% | 17.7% | 1.02% |
| 1979 | 8,341 | 2,332 | 10,673 | 21.8% | 1.3% | 23.1% | 2.54% |
| 1980 | 6,581 | 2,398 | 8,979 | 26.7% | 2.1% | 28.8% | 4.31% |
| 1981 | 6,209 | 2,327 | 8,536 | 27.3% | 1.8% | 29.1% | 6.10% |
| 1982 | 5,759 | 2,223 | 7,982 | 27.9% | 1.4% | 29.3% | 4.44% |
| 1983 | 6,795 | 2,387 | 9,182 | 26.0% | 1.3% | 27.3% | 2.09% |
| 1984 | 7,952 | 2,439 | 10,391 | 23.5% | 2.0% | 25.5% | 1.45% |
| 1985 | 8,205 | 2,838 | 11,043 | 25.7% | 2.2% | 27.9% | 0.82% |
| 1986 | 8,215 | 3,238 | 11,453 | 28.3% | 2.8% | 31.1% | 0.37% |
| 1987 | 7,081 | 3,197 | 10,278 | 31.1% | 5.2% | 36.3% | 0.16% |
| 1988 | 7,526 | 3,099 | 10,626 | 29.2% | 5.8% | 35.0% | 0.02% |
| 1989 | 7,073 | 2,825 | 9,898 | 28.5% | 7.3% | 35.8% | 0.13% |
| 1990 | 6,897 | 2,404 | 9,301 | 25.8% | 11.2% | 37.0% | 0.08% |
| 1991 | 6,137 | 2,038 | 8,175 | 24.9% | 13.7% | 38.6% | 0.10% |
| 1992 | 6,277 | 1,937 | 8,213 | 23.6% | 14.1% | 37.7% | 0.06% |
| 1993 | 6,742 | 1,776 | 8,518 | 20.9% | 14.9% | 35.8% | 0.03% |
| 1994 | 7,255 | 1,735 | 8,990 | 19.3% | 16.5% | 35.8% | 0.04% |
| 1995 | 7,129 | 1,506 | 8,635 | 17.4% | 18.9% | 36.3% | 0.04% |
| 1996 | 7,254 | 1,273 | 8,527 | 14.9% | d | d | 0.10% |
| 1997 | 6,917 | 1,355 | 8,272 | 16.4% | d | d | 0.09% |
| 1998 | 6,761 | 1,378 | 8,139 | 16.9% | d | d | 0.13% |
| <i>Average annual percentage change</i> | | | | | | | |
| 1970–98 | -0.2% | 0.2% | -0.1% | | | | |
| 1988–98 | -1.1% | -7.8% | -2.6% | | | | |

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: Ward's Communications, *Ward's Automotive Yearbook*, Detroit, MI, 1999, p. 243.

Diesel data - Ward's Communications, *Ward's Automotive Yearbook*, Detroit, MI, 1999, p. 64, and annual.

Transplant data - Oak Ridge National Laboratory, Light Vehicle MPG and Market Shares Data System, Oak Ridge, TN, 1996. (Additional resources: www.aama.com, www.wardsauto.com)

^a North American built.

^b Does not include import tourist deliveries.

^c A transplant is an automobile which was built in the U.S. by a foreign firm. Also included are joint ventures which are built in the U.S.

^d Data are not available.

Table 7.4
New Retail Sales of Trucks 10,000 Pounds GVW and Less in the United States, 1970–98

| Calendar year | Light truck sales ^a (thousands) | Percentages | | | | | |
|----------------------------------|---|---------------------|--------------------------|----------------------|--|---|-----------------------------------|
| | | Import ^b | Transplants ^c | Diesels ^d | Four-wheel drive of domestic light trucks ^d | Light trucks of light-duty vehicle sales ^e | Light trucks of total truck sales |
| 1970 | 1,463 | 4.5% | f | g | f | 14.8% | 80.4% |
| 1971 | 1,757 | 4.8% | f | g | f | 14.6% | 83.4% |
| 1972 | 2,239 | 6.4% | f | g | f | 17.0% | 83.3% |
| 1973 | 2,745 | 8.5% | f | g | f | 19.4% | 84.2% |
| 1974 | 2,338 | 7.5% | f | g | 18.0% | 20.9% | 84.2% |
| 1975 | 2,281 | 10.0% | f | g | 23.4% | 20.9% | 87.9% |
| 1976 | 2,956 | 8.0% | 0.0% | g | 23.8% | 22.6% | 89.8% |
| 1977 | 3,430 | 9.4% | 0.0% | g | 24.6% | 23.5% | 89.7% |
| 1978 | 3,808 | 8.8% | 0.0% | 1.0% | 28.5% | 25.2% | 89.2% |
| 1979 | 3,311 | 14.1% | 0.0% | 1.2% | 29.4% | 23.7% | 88.7% |
| 1980 | 2,440 | 19.7% | 0.9% | 3.6% | 20.7% | 21.4% | 88.9% |
| 1981 | 2,189 | 20.3% | 0.0% | 3.1% | 18.6% | 20.4% | 89.8% |
| 1982 | 2,470 | 16.5% | 0.0% | 8.5% | 16.8% | 23.6% | 92.8% |
| 1983 | 2,984 | 15.6% | 0.0% | 6.7% | 28.5% | 24.5% | 93.6% |
| 1984 | 3,863 | 15.7% | 2.0% | 4.8% | 27.0% | 27.1% | 93.0% |
| 1985 | 4,458 | 17.2% | 2.6% | 3.8% | 29.1% | 28.8% | 93.6% |
| 1986 | 4,594 | 20.1% | 2.3% | 3.7% | 27.0% | 28.6% | 94.3% |
| 1987 | 4,610 | 17.9% | 1.7% | 2.3% | 32.0% | 31.0% | 93.9% |
| 1988 | 4,800 | 12.6% | 2.4% | 2.3% | 32.1% | 31.1% | 93.2% |
| 1989 | 4,610 | 10.9% | 2.6% | 2.9% | 31.4% | 31.8% | 93.3% |
| 1990 | 4,548 | 13.2% | 3.4% | 3.1% | 31.6% | 32.8% | 93.9% |
| 1991 | 4,123 | 12.8% | 4.5% | 3.2% | 34.4% | 33.5% | 94.5% |
| 1992 | 4,629 | 8.6% | 5.5% | 3.3% | 31.6% | 36.0% | 94.4% |
| 1993 | 5,351 | 6.8% | 7.1% | 3.7% | 32.6% | 38.6% | 94.2% |
| 1994 | 6,033 | 6.5% | 8.1% | 3.9% | 34.4% | 40.2% | 94.0% |
| 1995 | 6,053 | 6.5% | 7.5% | 4.1% | 39.1% | 41.2% | 93.4% |
| 1996 | 6,519 | 6.6% | f | 3.7% | 35.7% | 43.3% | 94.1% |
| 1997 | 6,797 | 8.4% | f | 4.8% | 39.6% | 46.6% | 94.1% |
| 1998 | 7,299 | 8.9% | f | 1.7% | 43.8% | 47.3% | 93.3% |
| Average annual percentage change | | | | | | | |
| 1970–98 | 5.9% | | | | | | |
| 1988–98 | 4.3% | | | | | | |

Source:

Four-wheel drive - 1970–88: Ward's Communications, *Ward's Automotive Yearbook*, Detroit, MI, 1989, p. 168, and annual.

1989–97: Ward's Communications, *Ward's Automotive Yearbook*, Factory Installation Reports, Detroit, MI, 1998, p. 300, and annual.

Transplants - Oak Ridge National Laboratory, Light-Duty Vehicle MPG and Market Shares System, Oak Ridge, TN, 1996.

All other - 1970–97: American Automobile Manufacturers Association, *Motor Vehicle Facts and Figures 1998*, Detroit, MI, 1998, pp. 8, 15, 24, and annual. 1998: Ward's Communications, *Ward's Automotive Yearbook*, Detroit, MI (Additional resources: www.aama.com, www.wardsauto.com)

^a Includes all trucks of 10,000 pounds gross vehicle weight and less sold in the U.S.

^b Excluding transplants.

^c Based on model year data. A transplant is a light truck which was built in the U.S. by a foreign firm. Also included are joint ventures built in the U.S.

^d Based on model year factory installations. Column was revised.

^e Light-duty vehicles include automobiles and light trucks.

^f Data are not available.

^g Indicates less than 1 percent.

Table 7.5
Period Sales, Market Shares, and Sales-Weighted Fuel Economies
of New Domestic and Import Automobiles, Selected Sales Periods^a 1976–99

| Sales Period ^a | 1976 | 1980 | 1984 | 1988 | 1990 | 1993 | 1994 | 1995 | 1996 | 1997 | 1998 | 1999 |
|---------------------------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|
| MINICOMPACT | | | | | | | | | | | | |
| Total sales, units | — | 428,346 | 41,368 | 84,186 | 76,698 | 84,345 | 57,198 | 44,752 | 34,234 | 39,519 | 12,159 | 12,903 |
| Market share, % | — | 4.7 | 0.4 | 0.8 | 0.8 | 1.0 | 0.6 | 0.5 | 0.4 | 0.5 | 0.2 | 0.1 |
| Fuel economy, mpg | — | 29.4 | 29.0 | 37.8 | 26.4 | 29.9 | 27.8 | 27.0 | 27.2 | 26.3 | 23.9 | 24.8 |
| SUBCOMPACT | | | | | | | | | | | | |
| Total sales, units | 2,625,92 | 3,441,48 | 2,510,92 | 1,983,35 | 2,030,22 | 1,944,89 | 2,015,28 | 1,518,20 | 1,315,28 | 1,510,05 | 1,491,23 | 1,622,48 |
| Market share, % | 27.1 | 37.8 | 24.6 | 19.1 | 22.0 | 23.2 | 22.6 | 17.4 | 15.2 | 18.3 | 18.5 | 18.8 |
| Fuel economy, mpg | 23.5 | 27.3 | 30.5 | 31.7 | 31.3 | 31.9 | 31.3 | 31.7 | 32.1 | 32.6 | 31.3 | 31.0 |
| COMPACT | | | | | | | | | | | | |
| Total sales, units | 2,839,60 | 599,423 | 2,768,05 | 4,199,63 | 3,156,48 | 2,655,37 | 3,077,20 | 3,289,73 | 3,492,95 | 2,937,06 | 2,309,33 | 2,367,04 |
| Market share, % | 29.3 | 6.6 | 27.1 | 40.5 | 34.2 | 31.7 | 34.5 | 37.7 | 40.4 | 35.6 | 28.6 | 27.4 |
| Fuel economy, mpg | 17.1 | 22.3 | 30.6 | 29.8 | 28.9 | 29.3 | 29.8 | 30.2 | 30.4 | 30.0 | 30.8 | 30.2 |
| MIDSIZE | | | | | | | | | | | | |
| Total sales, units | 1,815,50 | 3,073,10 | 3,059,64 | 2,550,96 | 2,511,50 | 2,445,84 | 2,359,89 | 2,498,52 | 2,487,88 | 2,531,19 | 3,106,78 | 3,359,49 |
| Market share, % | 18.7 | 33.8 | 30.0 | 24.6 | 27.2 | 29.2 | 26.5 | 28.6 | 28.8 | 30.6 | 38.5 | 38.9 |
| Fuel economy, mpg | 15.3 | 21.3 | 24.1 | 26.9 | 25.9 | 25.7 | 25.6 | 25.9 | 26.4 | 26.3 | 26.9 | 26.9 |
| LARGE | | | | | | | | | | | | |
| Total sales, units | 2,206,10 | 1,336,19 | 1,502,09 | 1,368,71 | 1,279,09 | 1,186,99 | 1,339,86 | 1,320,60 | 1,259,26 | 1,162,29 | 1,050,40 | 1,180,73 |
| Market share, % | 22.8 | 14.7 | 14.7 | 13.2 | 13.9 | 14.2 | 15.0 | 15.1 | 14.6 | 14.1 | 13.0 | 13.7 |
| Fuel economy, mpg | 13.9 | 19.3 | 20.2 | 24.2 | 23.5 | 24.0 | 24.2 | 24.1 | 24.2 | 24.5 | 24.6 | 24.4 |
| TWO SEATER | | | | | | | | | | | | |
| Total sales, units | 199,716 | 215,964 | 328,968 | 186,127 | 170,465 | 70,480 | 67,020 | 53,045 | 62,231 | 80,921 | 101,023 | 103,248 |
| Market share, % | 2.1 | 2.4 | 3.2 | 1.8 | 1.8 | 0.8 | 0.8 | 0.6 | 0.7 | 1.0 | 1.3 | 1.2 |
| Fuel economy, mpg | 20.1 | 21.0 | 26.5 | 27.3 | 28.0 | 24.8 | 23.9 | 24.7 | 25.4 | 26.3 | 25.4 | 25.3 |
| TOTAL | | | | | | | | | | | | |
| Total sales, units | 9,686,85 | 9,094,50 | 10,211,0 | 10,372,9 | 9,224,46 | 8,387,92 | 8,916,46 | 8,724,87 | 8,651,84 | 8,261,04 | 8,070,93 | 8,645,91 |
| Market share, % | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 |
| Fuel economy, mpg | 17.2 | 23.2 | 26.3 | 28.5 | 27.6 | 27.8 | 27.8 | 28.0 | 28.3 | 28.3 | 28.3 | 28.0 |

Source:

Oak Ridge National Laboratory, Light Vehicle MPG and Market Shares System, Oak Ridge, TN, 2000. (Additional resources: www-cta.ornl.gov)

^a “Sales period” is October 1 of the current year through September 30 of the next year. These figures represent only those sales that could be matched to corresponding EPA fuel economy values.

Table 7.6
Period Sales, Market Shares, and Sales-Weighted Fuel Economies
of New Domestic and Import Light Trucks, Selected Sales Periods^a 1976–99

| Sales Period ^a | 1976 | 1980 | 1984 | 1988 | 1990 | 1993 | 1994 | 1995 | 1996 | 1997 | 1998 | 1999 |
|---------------------------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|----------------------|-----------|-----------|-----------|
| SMALL PICKUP | | | | | | | | | | | | |
| Total sales, units | 170,351 | 516,412 | 1,012,298 | 1,026,551 | 678,488 | 332,470 | 365,322 | 356,856 | 574,930 ^b | 520,834 | 460,097 | 302,426 |
| Market share, % | 7.1 | 23.3 | 28.0 | 21.6 | 15.0 | 6.6 | 6.4 | 6.0 | 9.2 | 8.0 | 6.4 | 3.8 |
| Fuel economy, mpg | 23.9 | 25.5 | 27.2 | 26.1 | 25.2 | 24.9 | 25.3 | 25.6 | 25.6 | 24.6 | 24.5 | 24.8 |
| LARGE PICKUP | | | | | | | | | | | | |
| Total sales, units | 1,586,020 | 1,115,248 | 1,218,972 | 1,453,255 | 1,573,729 | 1,877,806 | 2,199,224 | 2,183,793 | 2,042,179 | 2,051,144 | 2,377,916 | 2,830,271 |
| Market share, % | 66.4 | 50.3 | 33.7 | 30.6 | 34.9 | 37.1 | 38.4 | 36.8 | 32.7 | 31.4 | 33.3 | 35.4 |
| Fuel economy, mpg | 15.1 | 17 | 17.5 | 18.5 | 18.9 | 19.6 | 20.1 | 19.4 | 18.9 | 19.4 | 19.1 | 19.3 |
| SMALL VAN | | | | | | | | | | | | |
| Total sales, units | 18,651 | 13,649 | 222,798 | 851,384 | 932,693 | 1,129,459 | 1,263,933 | 1,257,116 | 1,229,650 | 1,215,776 | 1,223,670 | 1,319,398 |
| Market share, % | 0.8 | 0.6 | 6.2 | 18.0 | 20.7 | 22.3 | 22.1 | 21.2 | 19.7 | 18.6 | 17.1 | 16.5 |
| Fuel economy, mpg | 19.5 | 19.6 | 25.0 | 22.9 | 23.1 | 22.9 | 22.1 | 22.8 | 22.8 | 22.9 | 23.3 | 23.0 |
| LARGE VAN | | | | | | | | | | | | |
| Total sales, units | 574,745 | 328,065 | 545,595 | 486,981 | 398,877 | 388,435 | 407,737 | 401,056 | 370,126 | 386,563 | 380,829 | 416,813 |
| Market share, % | 24.1 | 14.8 | 15.1 | 10.3 | 8.8 | 7.7 | 7.1 | 6.8 | 5.9 | 5.9 | 5.3 | 5.2 |
| Fuel economy, mpg | 15.4 | 16.3 | 16.3 | 17.0 | 16.9 | 17.3 | 17.4 | 17.1 | 17.2 | 17.8 | 18.2 | 17.8 |
| SMALL SUV | | | | | | | | | | | | |
| Total sales, units | 16,632 | 85,286 | 442,062 | 671,497 | 553,286 | 733,253 | 816,409 | 902,921 | 637,287 | 782,104 | 762,490 | 942,298 |
| Market share, % | 0.7 | 3.8 | 12.2 | 14.2 | 12.3 | 14.5 | 14.3 | 15.2 | 10.2 | 12.0 | 10.7 | 11.8 |
| Fuel economy, mpg | 15.5 | 16.6 | 21.7 | 22.3 | 21.5 | 21.0 | 20.4 | 20.4 | 21.7 | 21.5 | 22.9 | 23.0 |
| LARGE SUV | | | | | | | | | | | | |
| Total sales, units | 20,511 | 157,877 | 168,727 | 253,332 | 377,552 | 594,254 | 671,776 | 832,124 | 1,382,689 | 1,570,295 | 1,932,648 | 2,190,549 |
| Market share, % | 0.9 | 7.1 | 4.7 | 5.3 | 8.4 | 11.8 | 11.7 | 14.0 | 22.2 | 24.1 | 27.1 | 27.4 |
| Fuel economy, mpg | 14.3 | 14.6 | 16.0 | 16.8 | 18.9 | 18.9 | 19.0 | 18.8 | 19.5 | 18.3 | 18.9 | 18.8 |
| TOTAL | | | | | | | | | | | | |
| Total sales, units | 2,386,910 | 2,216,537 | 3,612,934 | 4,743,000 | 4,514,625 | 5,055,677 | 5,724,401 | 5,933,866 | 6,236,861 | 6,526,716 | 7,137,650 | 8,001,755 |
| Market share, % | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 |
| Fuel economy, mpg | 15.6 | 18.1 | 20.0 | 20.7 | 20.5 | 20.5 | 20.4 | 20.2 | 20.4 | 20.1 | 20.3 | 20.1 |

Source:

Oak Ridge National Laboratory, Light Vehicle MPG and Market Shares System, Oak Ridge, TN, 2000. (Additional resources: www-cta.ornl.gov)

^a “Sales period” is October 1 of the current year through September 30 of the next year. These figures represent only those sales that could be matched to corresponding EPA fuel economy values.

^b Some four-wheel drive pickups previously classified as large pickups were correctly reclassified as small pickups.

Table 7.7
Light Vehicle Market Shares by Size Class, Sales Periods^a 1976–99

| Sales period ^a | 1976 | 1977 | 1978 | 1979 | 1980 | 1981 | 1982 | 1983 | 1984 | 1985 | 1986 | 1987 |
|---------------------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|
| Minicompact | 0.0% | 6.5% | 6.7% | 4.3% | 3.8% | 3.9% | 2.7% | 2.1% | 0.3% | 0.3% | 1.2% | 1.0% |
| Subcompact | 21.7% | 15.5% | 15.0% | 24.4% | 30.4% | 31.2% | 26.6% | 23.2% | 18.2% | 15.7% | 15.9% | 13.6% |
| Compact | 23.5% | 21.8% | 12.0% | 6.7% | 5.3% | 5.4% | 10.8% | 12.6% | 20.0% | 23.2% | 23.6% | 27.1% |
| Midsize | 15.0% | 15.6% | 26.1% | 26.9% | 27.2% | 27.9% | 28.3% | 24.5% | 22.1% | 20.5% | 19.1% | 16.9% |
| Large | 18.3% | 20.0% | 17.6% | 15.4% | 11.8% | 12.1% | 10.1% | 9.6% | 10.9% | 10.0% | 9.4% | 9.3% |
| Two seater | 1.7% | 1.7% | 1.5% | 1.7% | 1.9% | 2.0% | 2.2% | 2.0% | 2.4% | 2.5% | 1.8% | 1.6% |
| Small pickup | 1.4% | 2.1% | 2.2% | 3.3% | 4.6% | 4.3% | 5.3% | 8.6% | 7.3% | 7.5% | 7.8% | 7.7% |
| Large pickup | 13.1% | 13.2% | 13.4% | 12.0% | 9.9% | 8.8% | 9.1% | 9.3% | 8.8% | 9.3% | 8.5% | 8.8% |
| Small van | 0.2% | 0.2% | 0.2% | 0.1% | 0.1% | 0.1% | 0.1% | 0.1% | 1.6% | 2.9% | 4.1% | 4.9% |
| Large van | 4.8% | 3.2% | 4.8% | 4.3% | 2.9% | 3.0% | 3.4% | 4.7% | 3.9% | 3.5% | 3.3% | 3.2% |
| Small utility | 0.1% | 0.1% | 0.1% | 0.0% | 0.8% | 0.4% | 0.3% | 1.6% | 3.2% | 2.9% | 3.8% | 4.6% |
| Large utility | 0.2% | 0.2% | 0.3% | 0.8% | 1.4% | 1.1% | 1.2% | 1.6% | 1.2% | 1.8% | 1.5% | 1.4% |
| Total light vehicles sold | 12,073,765 | 13,045,310 | 14,037,378 | 13,589,420 | 11,311,043 | 11,029,922 | 11,012,704 | 10,345,470 | 13,823,999 | 15,203,880 | 15,633,934 | 15,014,173 |
| Cars | 80.2% | 81.0% | 79.0% | 79.4% | 80.4% | 82.5% | 80.6% | 74.0% | 73.9% | 72.1% | 71.0% | 69.5% |
| Light trucks | 19.8% | 19.0% | 21.0% | 20.6% | 19.6% | 17.5% | 19.4% | 26.0% | 26.1% | 27.9% | 29.0% | 30.5% |

| Sales period ^a | 1988 | 1989 | 1990 | 1991 | 1992 | 1993 | 1994 | 1995 | 1996 | 1997 | 1998 | 1999 |
|---------------------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|
| Minicompact | 0.6% | 0.1% | 0.6% | 0.6% | 0.9% | 0.6% | 0.4% | 0.3% | 0.2% | 0.3% | 0.1% | 0.1% |
| Subcompact | 13.1% | 13.1% | 14.8% | 17.5% | 16.6% | 14.5% | 13.8% | 10.4% | 8.8% | 10.2% | 9.8% | 9.7% |
| Compact | 27.8% | 24.7% | 23.0% | 19.8% | 19.6% | 19.8% | 21.0% | 22.4% | 23.5% | 19.9% | 15.2% | 14.2% |
| Midsize | 16.9% | 19.7% | 18.3% | 18.8% | 18.0% | 18.2% | 16.1% | 17.0% | 16.7% | 17.1% | 20.4% | 20.2% |
| Large | 9.1% | 9.4% | 9.3% | 9.4% | 9.1% | 8.8% | 9.2% | 9.0% | 8.5% | 7.9% | 6.9% | 7.1% |
| Two seater | 1.2% | 1.1% | 1.2% | 1.1% | 0.7% | 0.5% | 0.5% | 0.4% | 0.4% | 0.5% | 0.7% | 0.6% |
| Small pickup | 6.8% | 5.9% | 4.9% | 4.9% | 4.7% | 2.5% | 2.5% | 2.4% | 3.9% | 3.5% | 3.0% | 1.8% |
| Large pickup | 9.6% | 10.6% | 11.5% | 11.0% | 11.6% | 14.0% | 15.0% | 14.9% | 13.7% | 13.9% | 15.6% | 17.0% |
| Small van | 5.6% | 5.8% | 6.8% | 7.1% | 7.7% | 8.4% | 8.6% | 8.6% | 8.3% | 8.2% | 8.0% | 7.9% |
| Large van | 3.2% | 3.2% | 2.9% | 2.5% | 2.8% | 2.9% | 2.8% | 2.7% | 2.5% | 2.6% | 2.5% | 2.5% |
| Small utility | 4.4% | 3.5% | 4.0% | 5.1% | 5.5% | 5.5% | 5.6% | 6.2% | 4.3% | 5.3% | 5.0% | 5.7% |
| Large utility | 1.7% | 3.1% | 2.7% | 2.2% | 2.8% | 4.4% | 4.6% | 5.7% | 9.3% | 10.6% | 12.7% | 13.2% |
| Total light vehicles sold | 15,115,985 | 14,939,837 | 13,739,090 | 12,422,881 | 12,499,454 | 13,443,605 | 14,640,863 | 14,658,736 | 14,888,710 | 14,787,756 | 15,208,587 | 16,647,668 |
| Cars | 68.6% | 68.1% | 67.1% | 67.1% | 64.9% | 62.4% | 60.9% | 59.5% | 58.1% | 55.9% | 53.1% | 51.9% |
| Light trucks | 31.4% | 31.9% | 32.9% | 32.9% | 35.1% | 37.6% | 39.1% | 40.5% | 41.9% | 44.1% | 46.9% | 48.1% |

Source:

Oak Ridge National Laboratory, Light Vehicle MPG and Market Shares System, Oak Ridge, TN, 2000. (Additional resources: www-cta.ornl.gov)

^a “Sales period” is October 1 of the current year through September 30 of the next year.

Table 7.8
Sales-Weighted Engine Size of New Domestic and Import Automobiles by Size Class,
Sales Periods^a 1976–99
(liters^b)

| Sales period ^a | Minicompact | Subcompact | Compact | Midsize | Large | Two seater | Fleet |
|---|-------------------|------------|---------|---------|-------|------------|-------|
| 1976 | ^c | 2.67 | 5.00 | 5.85 | 6.79 | 2.89 | 4.89 |
| 1977 | 1.98 | 2.73 | 4.79 | 5.47 | 6.02 | 2.81 | 4.56 |
| 1978 | 2.06 | 2.67 | 3.95 | 4.89 | 6.17 | 3.01 | 4.33 |
| 1979 | 1.86 | 2.39 | 3.74 | 4.41 | 5.56 | 2.77 | 3.78 |
| 1980 | 1.90 | 2.10 | 3.03 | 3.90 | 5.12 | 2.79 | 3.22 |
| 1981 | 1.57 | 2.04 | 2.20 | 3.63 | 5.00 | 2.49 | 2.98 |
| 1982 | 1.53 | 2.08 | 2.12 | 3.47 | 4.73 | 2.41 | 2.89 |
| 1983 | 1.60 | 2.19 | 2.20 | 3.45 | 4.95 | 2.52 | 2.98 |
| 1984 | 2.17 | 2.22 | 2.21 | 3.40 | 4.87 | 2.50 | 2.97 |
| 1985 | 1.95 | 2.29 | 2.27 | 3.37 | 4.65 | 2.47 | 2.92 |
| 1986 | 1.45 | 2.19 | 2.21 | 3.19 | 4.38 | 2.83 | 2.76 |
| 1987 | 1.48 | 2.19 | 2.20 | 2.99 | 4.36 | 2.57 | 2.68 |
| 1988 | 1.52 | 2.05 | 2.21 | 3.00 | 4.32 | 2.75 | 2.66 |
| 1989 | 2.54 | 2.08 | 2.11 | 3.01 | 4.31 | 2.81 | 2.68 |
| 1990 | 2.42 | 1.96 | 2.25 | 3.13 | 4.33 | 2.57 | 2.72 |
| 1991 | 2.17 | 1.97 | 2.23 | 3.16 | 4.40 | 2.67 | 2.72 |
| 1992 | 1.89 | 2.01 | 2.33 | 3.16 | 4.34 | 3.01 | 2.76 |
| 1993 | 1.96 | 2.07 | 2.28 | 3.16 | 4.27 | 3.47 | 2.78 |
| 1994 | 2.21 | 2.27 | 2.23 | 3.15 | 4.17 | 3.82 | 2.79 |
| 1995 | 2.42 | 2.26 | 2.23 | 3.12 | 4.12 | 3.76 | 2.79 |
| 1996 | 2.49 | 2.23 | 2.19 | 2.98 | 4.09 | 3.67 | 2.71 |
| 1997 | 2.62 | 2.13 | 2.28 | 3.02 | 4.03 | 3.08 | 2.74 |
| 1998 | 3.15 | 2.29 | 2.17 | 2.94 | 3.98 | 3.51 | 2.75 |
| 1999 | 2.86 | 2.31 | 2.25 | 2.91 | 3.91 | 3.62 | 2.76 |
| <i>Average annual percentage change</i> | | | | | | | |
| 1976–99 | 1.7% ^d | -0.6% | -3.4% | -3.0% | -2.4% | 1.0% | -2.5% |
| 1989–99 | 1.2% | 1.1% | 0.6% | -0.3% | -1.0% | 2.6% | 0.3% |

Source:

Oak Ridge National Laboratory, Light Vehicle MPG and Market Shares System, Oak Ridge, TN, 2000.

(Additional resources: www-cta.ornl.gov)

^a “Sales period” is October 1 of the current year through September 30 of the next year.

^a 1 liter = 61.02. cubic inches.

^b There were no minicompact automobiles sold in 1976.

^d Average annual percentage change begins with 1977.

Table 7.9
Sales-Weighted Engine Size of New Domestic and Import Light Trucks by Size Class
Sales Periods^a 1976–99
(liters^b)

| Sales period ^a | Small pickup | Large pickup | Small van | Large van | Small utility | Large utility | Fleet |
|---|--------------|--------------|-----------|-----------|---------------|---------------|-------|
| 1976 | 1.91 | 5.57 | 1.97 | 5.39 | 5.39 | 4.97 | 5.23 |
| 1977 | 2.01 | 5.48 | 1.97 | 5.32 | 5.46 | 4.95 | 5.03 |
| 1978 | 2.03 | 5.45 | 1.97 | 5.29 | 5.09 | 5.40 | 5.02 |
| 1979 | 2.05 | 5.15 | 1.97 | 5.13 | 4.52 | 5.30 | 4.62 |
| 1980 | 2.05 | 5.05 | 1.97 | 5.03 | 4.29 | 5.39 | 4.33 |
| 1981 | 2.14 | 4.82 | 1.97 | 4.84 | 3.94 | 5.15 | 4.15 |
| 1982 | 2.34 | 4.99 | 1.79 | 4.92 | 3.88 | 5.27 | 4.24 |
| 1983 | 2.35 | 4.97 | 1.87 | 5.06 | 3.05 | 5.34 | 4.00 |
| 1984 | 2.38 | 4.95 | 2.23 | 5.06 | 2.81 | 5.39 | 3.87 |
| 1985 | 2.38 | 4.77 | 2.65 | 5.12 | 2.83 | 5.37 | 3.77 |
| 1986 | 2.43 | 4.68 | 2.78 | 5.13 | 2.78 | 5.55 | 3.65 |
| 1987 | 2.44 | 4.69 | 2.96 | 5.21 | 2.80 | 5.42 | 3.65 |
| 1988 | 2.56 | 4.68 | 3.15 | 5.21 | 3.14 | 5.51 | 3.82 |
| 1989 | 2.64 | 4.70 | 3.11 | 5.22 | 3.50 | 5.45 | 3.93 |
| 1990 | 2.90 | 4.49 | 3.29 | 5.21 | 3.38 | 5.48 | 3.93 |
| 1991 | 2.91 | 4.57 | 3.29 | 5.23 | 3.62 | 5.40 | 3.94 |
| 1992 | 3.07 | 4.57 | 3.32 | 5.28 | 3.69 | 5.47 | 4.00 |
| 1993 | 3.25 | 4.32 | 3.30 | 5.21 | 3.80 | 5.58 | 4.02 |
| 1994 | 3.10 | 4.45 | 3.48 | 5.31 | 3.77 | 5.54 | 4.10 |
| 1995 | 2.95 | 4.44 | 3.40 | 5.15 | 3.75 | 5.49 | 4.06 |
| 1996 | 2.83 | 4.72 | 3.41 | 5.21 | 3.68 | 5.11 | 4.12 |
| 1997 | 2.90 | 4.62 | 3.36 | 5.04 | 3.98 | 4.97 | 4.14 |
| 1998 | 2.84 | 4.64 | 3.37 | 5.02 | 2.83 | 4.74 | 4.16 |
| 1999 | 2.92 | 4.94 | 3.44 | 4.99 | 2.84 | 4.73 | 4.15 |
| <i>Average annual percentage change</i> | | | | | | | |
| 1976–9 | 1.9% | -0.5% | 2.5% | -0.3% | -2.7% | -0.2% | -1.0% |
| 1989–9 | 1.0% | 0.5% | 1.0% | -0.4% | -2.1% | -1.4% | 0.5% |

Source:

Oak Ridge National Laboratory, Light Vehicle MPG and Market Shares System, Oak Ridge, TN, 2000.
 (Additional resources: www-cta.ornl.gov)

^a “Sales period” is October 1 of the current year through September 30 of the next year.

^a 1 liter = 61.02 cubic inches.

Table 7.10
Sales-Weighted Curb Weight of New Domestic and Import Automobiles by Size Class,
Sales Periods^a 1976–99
(pounds)

| Sales period ^a | Minicompact | Subcompact | Compact | Midsize | Large | Two seater | Fleet |
|---|-------------------|------------|---------|---------|-------|------------|-------|
| 1976 | ^b | 2,577 | 3,609 | 4,046 | 4,562 | 2,624 | 3,608 |
| 1977 | 2,228 | 2,586 | 3,550 | 3,900 | 4,026 | 2,608 | 3,424 |
| 1978 | 2,200 | 2,444 | 3,138 | 3,427 | 3,956 | 2,763 | 3,197 |
| 1979 | 2,120 | 2,367 | 3,048 | 3,287 | 3,763 | 2,699 | 3,000 |
| 1980 | 2,154 | 2,270 | 2,813 | 3,081 | 3,667 | 2,790 | 2,790 |
| 1981 | 1,920 | 2,370 | 2,382 | 2,996 | 3,672 | 2,744 | 2,744 |
| 1982 | 2,002 | 2,302 | 2,422 | 2,992 | 3,703 | 2,525 | 2,730 |
| 1983 | 2,072 | 2,334 | 2,441 | 3,027 | 3,779 | 2,663 | 2,788 |
| 1984 | 2,376 | 2,380 | 2,454 | 2,990 | 3,734 | 2,559 | 2,788 |
| 1985 | 2,211 | 2,392 | 2,464 | 2,954 | 3,575 | 2,539 | 2,743 |
| 1986 | 2,120 | 2,415 | 2,432 | 2,857 | 3,451 | 2,575 | 2,675 |
| 1987 | 1,960 | 2,423 | 2,474 | 2,857 | 3,483 | 2,602 | 2,689 |
| 1988 | 1,933 | 2,346 | 2,558 | 2,880 | 3,487 | 2,693 | 2,717 |
| 1989 | 2,576 | 2,357 | 2,517 | 2,985 | 3,496 | 2,735 | 2,760 |
| 1990 | 2,651 | 2,368 | 2,637 | 3,065 | 3,594 | 2,656 | 2,828 |
| 1991 | 2,584 | 2,406 | 2,652 | 3,085 | 3,650 | 2,707 | 2,848 |
| 1992 | 2,395 | 2,444 | 2,674 | 3,131 | 3,670 | 2,770 | 2,879 |
| 1993 | 2,449 | 2,478 | 2,659 | 3,142 | 3,615 | 2,967 | 2,894 |
| 1994 | 2,719 | 2,571 | 2,639 | 3,171 | 3,657 | 3,035 | 2,921 |
| 1995 | 2,831 | 2,552 | 2,647 | 3,179 | 3,648 | 2,947 | 2,937 |
| 1996 | 2,847 | 2,533 | 2,667 | 3,203 | 3,671 | 2,985 | 2,950 |
| 1997 | 2,997 | 2,489 | 2,737 | 3,241 | 3,653 | 2,863 | 2,977 |
| 1998 | 3,004 | 2,584 | 2,703 | 3,198 | 3,675 | 2,956 | 3,002 |
| 1999 | 2,835 | 2,626 | 2,755 | 3,198 | 3,689 | 3,007 | 3,034 |
| <i>Average annual percentage change</i> | | | | | | | |
| 1976–99 | 1.1% ^c | 0.1% | -1.2% | -1.0% | -0.9% | 0.6% | -0.8% |
| 1989–99 | 1.0% | 1.1% | 0.9% | 0.7% | 0.5% | 1.0% | 1.0% |

Source:

Oak Ridge National Laboratory, Light Vehicle MPG and Market Shares System, Oak Ridge, TN, 2000.

(Additional resources: www-cta.ornl.gov)

^a “Sales period” is October 1 of the current year through September 30 of the next year.

^b There were no minicompact automobiles sold in 1976.

^c Average annual percentage change begins with 1977.

Table 7.11
Sales-Weighted Interior Space of New Domestic and Import Automobiles by Size Class,
Sales Periods^a 1976–99
(cubic feet)

| Sales period ^a | Minicompact (< 85) | Subcompact (85–99) | Compact (100–109) | Midsize (110–119) | Large (> 120) | Fleet ^b |
|---|------------------------|-----------------------|----------------------|----------------------|-------------------|--------------------|
| 1977 | 78.8 | 89.8 | 107.1 | 113.0 | 128.0 | 107.9 |
| 1978 | 79.4 | 89.8 | 105.3 | 112.9 | 128.5 | 107.9 |
| 1979 | 80.0 | 90.2 | 105.8 | 113.4 | 130.1 | 106.9 |
| 1980 | 82.4 | 89.9 | 105.4 | 113.5 | 130.8 | 104.9 |
| 1981 | 83.3 | 90.2 | 103.6 | 113.7 | 130.6 | 105.5 |
| 1982 | 83.1 | 91.3 | 102.9 | 113.9 | 130.4 | 106.0 |
| 1983 | 82.7 | 93.3 | 103.0 | 113.1 | 131.3 | 107.3 |
| 1984 | 77.0 | 93.8 | 103.0 | 113.3 | 130.4 | 108.0 |
| 1985 | 77.8 | 94.1 | 103.1 | 113.5 | 129.7 | 107.9 |
| 1986 | 80.1 | 94.5 | 102.8 | 113.8 | 127.6 | 107.0 |
| 1987 | 81.6 | 93.1 | 103.0 | 113.9 | 127.5 | 106.9 |
| 1988 | 81.0 | 93.5 | 103.3 | 113.6 | 127.2 | 107.0 |
| 1989 | 75.0 | 93.3 | 102.7 | 113.8 | 127.4 | 107.5 |
| 1990 | 79.9 | 93.9 | 103.2 | 113.8 | 127.8 | 107.3 |
| 1991 | 79.6 | 94.4 | 103.2 | 113.8 | 128.3 | 107.1 |
| 1992 | 79.1 | 94.0 | 104.2 | 114.0 | 129.2 | 107.5 |
| 1993 | 79.2 | 94.5 | 104.0 | 114.0 | 128.9 | 108.0 |
| 1994 | 79.4 | 94.4 | 103.8 | 113.8 | 128.8 | 108.0 |
| 1995 | 78.5 | 93.8 | 103.9 | 114.3 | 128.1 | 108.7 |
| 1996 | 76.7 | 94.9 | 103.4 | 114.2 | 128.0 | 108.8 |
| 1997 | 77.2 | 95.6 | 103.2 | 114.6 | 128.0 | 108.7 |
| 1998 | 66.9 | 97.0 | 102.2 | 114.4 | 127.7 | 109.2 |
| 1999 | 76.3 | 96.7 | 103.3 | 114.1 | 127.1 | 109.5 |
| <i>Average annual percentage change</i> | | | | | | |
| 1977–99 | -0.1% | 0.3% | -0.2% | 0.0% | 0.0% | 0.1% |
| 1989–99 | 0.2% | 0.4% | 0.1% | 0.0% | 0.0% | 0.2% |

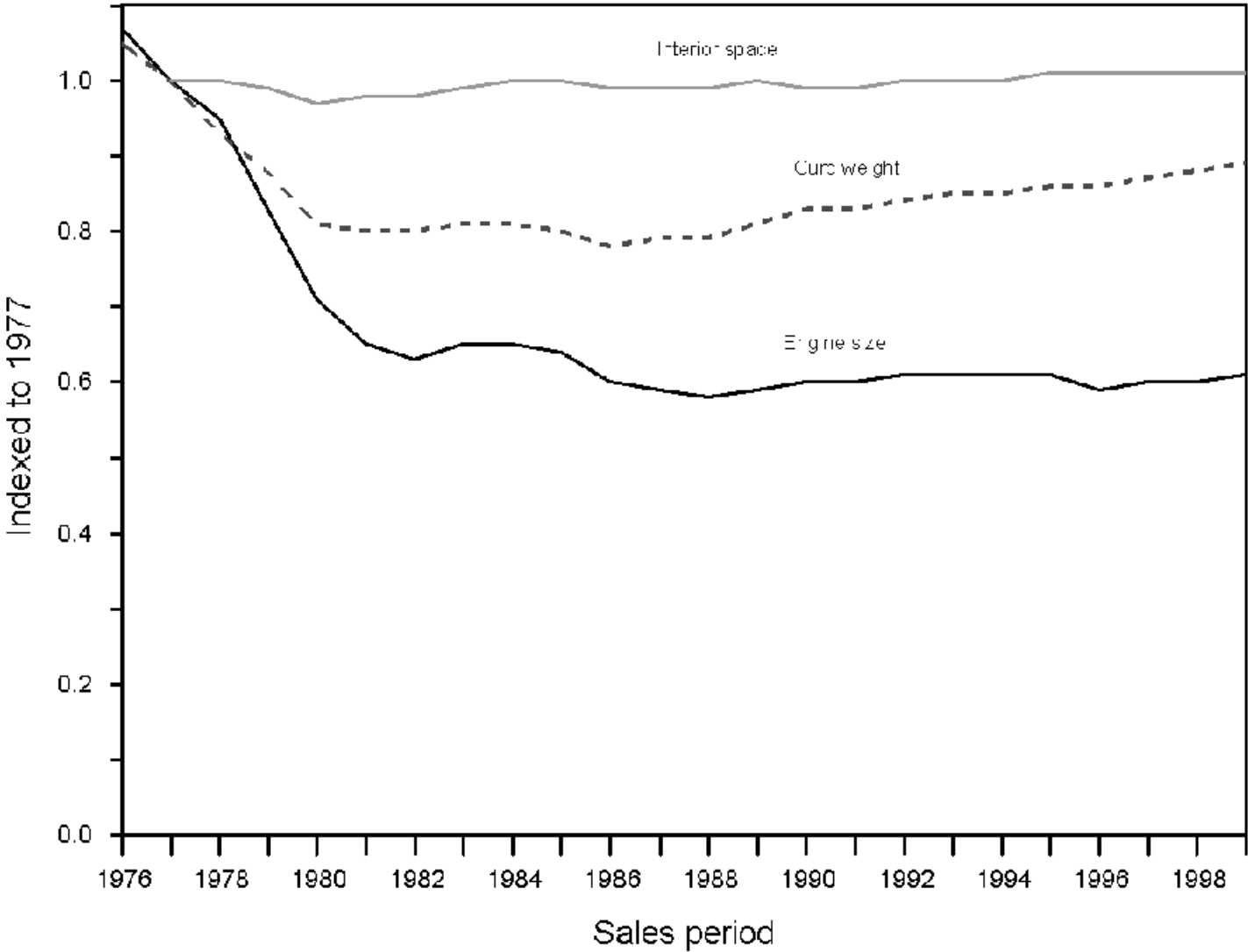
Source:

Oak Ridge National Laboratory, Light Vehicle MPG and Market Shares System, Oak Ridge, TN, 2000.
 (Additional resources: www-cta.ornl.gov)

^a “Sales period” is October 1 of the current year through September 30 of the next year.

^b Interior volumes of two-seaters are not reported to EPA.

Figure 7.1. Engine Size, Curb Weight, and Interior Space of New Domestic and Import Automobiles, 1976–99



Source: See Tables 7.8, 7.10, and 7.11.

Table 7.12
Sales-Weighted Wheelbase of New
Automobiles and Light Trucks, Sales Periods^a 1976–99
(inches)

| Sales period ^a | Automobiles | Light trucks | Automobiles and light trucks combined |
|---|-------------|-----------------|---|
| 1976 | 110.78 | 118.87 | 112.03 |
| 1977 | 109.75 | 117.79 | 111.05 |
| 1978 | 107.67 | 116.23 | 108.65 |
| 1979 | 105.77 | 116.27 | 107.93 |
| 1980 | 103.61 | 114.54 | 105.76 |
| 1981 | 102.97 | 114.86 | 105.10 |
| 1982 | 103.01 | 114.87 | 105.60 |
| 1983 | 103.76 | 113.73 | 106.10 |
| 1984 | 103.50 | 113.87 | 106.21 |
| 1985 | 102.96 | 113.98 | 106.02 |
| 1986 | 102.27 | 113.40 | 105.48 |
| 1987 | 102.11 | 113.27 | 105.52 |
| 1988 | 102.21 | 111.79 | 105.21 |
| 1989 | 102.66 | 112.23 | 105.71 |
| 1990 | 103.13 | 111.41 | 105.85 |
| 1991 | 103.27 | 111.09 | 105.82 |
| 1992 | 103.60 | 112.68 | 106.78 |
| 1993 | 104.03 | 112.57 | 107.21 |
| 1994 | 104.31 | 113.23 | 107.75 |
| 1995 | 104.95 | 113.37 | 108.31 |
| 1996 | 105.04 | 113.36 | 108.53 |
| 1997 | 105.36 | 113.36 | 108.89 |
| 1998 | 105.55 | 114.53 | 109.76 |
| 1999 | 105.77 | 114.70 | 110.06 |
| <i>Average annual percentage change</i> | | | |
| 1976–99 | -0.2% | -0.2% | -0.1% |
| 1989–99 | 0.3% | 0.2% | 0.4% |

Source:

Oak Ridge National Laboratory, Light Vehicle MPG and
Market Shares System, Oak Ridge, TN, 2000.
(Additional resources: www-cta.ornl.gov)

^a “Sales period” is October 1 of the current year through September 30 of the next year.

The average auto lost over 300 pounds from 1978 to 1985, but gained a few pounds back since then. Much of the weight reduction was due to the declining use of conventional steel and iron and the increasing use of aluminum and plastics. Conventional steel, however, remained the predominant component of automobiles in 1999 with a 43% share of total materials. As conventional steel use has been decreasing, use of high-strength steel has increased.

Table 7.13
Average Material Consumption for a Domestic Automobile,
1978, 1985, and 1999

| Material | 1978 | | 1985 | | 1999 | |
|---------------------------------|---------|------------|---------|------------|---------|------------|
| | Pounds | Percentage | Pounds | Percentage | Pounds | Percentage |
| Conventional steel ^a | 1,880.0 | 53.8% | 1,481.5 | 46.5% | 1,399.0 | 42.7% |
| High-strength steel | 127.5 | 3.6% | 217.5 | 6.8% | 328.0 | 10.0% |
| Stainless steel | 25.0 | 0.7% | 29.0 | 0.9% | 50.5 | 1.5% |
| Other steels | 56.0 | 1.6% | 54.5 | 1.7% | 25.0 | 0.8% |
| Iron | 503.0 | 14.4% | 468.0 | 14.7% | 355.0 | 10.8% |
| Aluminum | 112.0 | 3.2% | 138.0 | 4.3% | 236.0 | 7.2% |
| Rubber | 141.5 | 4.1% | 136.0 | 4.3% | 142.0 | 4.3% |
| Plastics/composites | 176.0 | 5.0% | 211.5 | 6.6% | 245.0 | 7.5% |
| Glass | 88.0 | 2.5% | 85.0 | 2.7% | 97.0 | 3.0% |
| Copper | 39.5 | 1.1% | 44.0 | 1.4% | 45.5 | 1.4% |
| Zinc die castings | 28.0 | 0.8% | 18.0 | 0.5% | 12.0 | 0.4% |
| Powder metal parts | 16.0 | 0.5% | 19.0 | 0.6% | 35.0 | 1.1% |
| Fluids & lubricants | 189.0 | 5.4% | 184.0 | 5.8% | 194.0 | 5.9% |
| Other materials | 112.5 | 3.2% | 101.5 | 3.2% | 110.0 | 3.4% |
| Total | 3,494.0 | 100.0% | 3,187.5 | 100.0% | 3,274.0 | 100.0% |

Source:

American Metal Market, www.amm.com/ref/carmat98.htm, New York, NY, 2000.

(Additional resources: www.amm.com)

^a Includes cold-rolled and pre-coated steel.

The number of franchised dealerships which sell new light-duty vehicles (cars and light trucks) has declined 27% since 1970, though new vehicle sales have increased. The average number of vehicles sold per dealer in 1998 was 683 vehicles per dealer – more than double the 1970 number.

Table 7.14
New Light Vehicle Dealerships and Sales, 1970–98

| Calendar year | Number of franchised new light vehicle dealerships ^a | New light vehicle sales (thousands) | Light vehicle sales per dealer |
|---|---|-------------------------------------|--------------------------------|
| 1970 | 30,800 | 9,867 | 320 |
| 1971 | 30,300 | 12,006 | 396 |
| 1972 | 30,100 | 13,189 | 438 |
| 1973 | 30,100 | 14,184 | 471 |
| 1974 | 30,000 | 11,191 | 373 |
| 1975 | 29,600 | 10,905 | 368 |
| 1976 | 29,300 | 13,066 | 446 |
| 1977 | 29,100 | 14,613 | 502 |
| 1978 | 29,000 | 15,122 | 521 |
| 1979 | 28,500 | 13,984 | 491 |
| 1980 | 27,900 | 11,419 | 409 |
| 1981 | 26,350 | 10,725 | 407 |
| 1982 | 25,700 | 10,452 | 407 |
| 1983 | 24,725 | 12,166 | 492 |
| 1984 | 24,725 | 14,254 | 577 |
| 1985 | 24,725 | 15,501 | 627 |
| 1986 | 24,825 | 16,047 | 646 |
| 1987 | 25,150 | 14,888 | 592 |
| 1988 | 25,025 | 15,426 | 616 |
| 1989 | 25,000 | 14,508 | 580 |
| 1990 | 24,825 | 13,849 | 558 |
| 1991 | 24,200 | 12,298 | 508 |
| 1992 | 23,500 | 12,842 | 546 |
| 1993 | 22,950 | 13,869 | 604 |
| 1994 | 22,850 | 15,023 | 657 |
| 1995 | 22,800 | 14,688 | 644 |
| 1996 | 22,750 | 15,046 | 661 |
| 1997 | 22,700 | 15,069 | 664 |
| 1998 | 22,600 | 15,438 | 683 |
| <i>Average annual percentage change</i> | | | |
| 1970–98 | -1.1% | 1.6% | 2.7% |
| 1988–98 | -1.0% | 0.0% | 1.0% |

Source:

Number of dealers - National Automobile Dealers Association, *Automotive Executive Magazine*, 1999. (Additional resources: www.nada.org/)

Light-duty vehicle sales - See tables 7.3 and 7.4.

^aAs of the beginning of the year.

The number of conventional refueling stations has declined since 1970 while the number of vehicle fueling at those stations continues to rise. In 1996, there were less than 0.5 conventional fueling stations per thousand vehicles. Data for alternative fuel vehicles in 1999 indicate that there was an average of 15 stations per thousand vehicles.

Table 7.15
Conventional and Alternative Fuel Refueling Stations

| Calendar year | Refueling stations ^a | Vehicles in operation (thousands) | Stations per thousand vehicles |
|--------------------------------------|---------------------------------|-----------------------------------|--------------------------------|
| | | Conventional fuels | |
| 1970 | 146,616 | 98,136 | 1.49 |
| 1975 | 147,576 | 120,054 | 1.23 |
| 1980 | 116,900 | 139,832 | 0.84 |
| 1985 | 105,787 | 157,048 | 0.67 |
| 1988 | 108,107 | 171,741 | 0.63 |
| 1989 | 105,767 | 175,960 | 0.60 |
| 1990 | 104,801 | 179,299 | 0.58 |
| 1991 | 101,894 | 181,438 | 0.56 |
| 1992 | 100,078 | 181,519 | 0.55 |
| 1993 | 101,383 | 186,315 | 0.54 |
| 1994 | 99,250 | 188,714 | 0.53 |
| 1995 | 97,448 | 193,441 | 0.50 |
| 1996 | 96,236 | 198,294 | 0.49 |
| 1997 | 95,847 | 201,071 | 0.48 |
| Alternative fuels, 1999 ^b | | | |
| LPG | 4,153 | 268 | 1,549.63 |
| CNG | 1,267 | 90 | 14.08 |
| Electricity | 490 | 6 | 84.13 |
| M85/M10 | 51 | 20 | 2.55 |
| 0 | | | |
| LNG | 46 | 1 | 33.87 |
| E85/E95 | 49 | 22 | 2.23 |
| Total | 6,056 | 407 | 14.87 |

Source:

Refueling stations - Conventional: U.S. Department of Commerce, Bureau of the Census, County Business Patterns for the United States, www.census.gov/epcd/cbp/view/cbpview.html and electronic communication with the County Business Pattern Office, 1998. Alternative Fuel: Alternative Fuels Data Center, www.afdc.doe.gov.

Vehicles - Conventional: The Polk Company, Detroit, MI. FURTHER REPRODUCTION PROHIBITED. Alternative Fuel: Alternative Fuels Data Center, www.afdc.doe.gov.

^a Includes convenience stores/refueling stations and truck stops which have gasoline sales of at least 50% of total establishment sales.

^b Additional data on alternative fuel vehicles and refueling stations are in Chapter 9.

Table 7.16
Corporate Average Fuel Economy (CAFE)
Standards versus Sales-Weighted Fuel Economy Estimates
for Automobiles and Light Trucks, 1978–99^a
(miles per gallon)

| Model year ^b | Automobiles | | | | Light trucks ^c | | | | CAFE estimates |
|----------------------------|-------------------|-----------------------------|--------|----------|--------------------------------|-----------------------------|---------------------|-----------------------|------------------------------------|
| | CAFE standards | CAFE estimates ^d | | | CAFE standards ^e | CAFE estimates ^d | | | Autos and light trucks combined |
| | | Domestic | Import | Combined | | Domestic ^f | Import ^f | Combined ^f | |
| 1978 | 18.0 | 18.7 | 27.3 | 19.9 | ^e | ^f | ^f | ^f | 19.9 |
| 1979 | 19.0 | 19.3 | 26.1 | 20.3 | ^e | 17.7 | 20.8 | 18.2 | 20.1 |
| 1980 | 20.0 | 22.6 | 29.6 | 24.3 | ^e | 16.8 | 24.3 | 18.5 | 23.1 |
| 1981 | 22.0 | 24.2 | 31.5 | 25.9 | ^e | 18.3 | 27.4 | 20.1 | 24.6 |
| 1982 | 24.0 | 25.0 | 31.1 | 26.6 | 17.5 | 19.2 | 27.0 | 20.5 | 25.1 |
| 1983 | 26.0 | 24.4 | 32.4 | 26.4 | 19.0 | 19.6 | 27.1 | 20.7 | 24.8 |
| 1984 | 27.0 | 25.5 | 32.0 | 26.9 | 20.0 | 19.3 | 26.7 | 20.6 | 25.0 |
| 1985 | 27.5 | 26.3 | 31.5 | 27.6 | 19.5 | 19.6 | 26.5 | 20.7 | 25.4 |
| 1986 | 26.0 | 26.9 | 31.6 | 28.2 | 20.0 | 20.0 | 25.9 | 21.5 | 25.9 |
| 1987 | 26.0 | 27.0 | 31.2 | 28.4 | 20.5 | 20.5 | 25.2 | 21.7 | 26.2 |
| 1988 | 26.0 | 27.4 | 31.5 | 28.0 | 20.5 | 20.6 | 24.6 | 21.3 | 26.0 |
| 1989 | 26.5 | 27.2 | 30.8 | 28.4 | 20.5 | 20.4 | 23.5 | 21.0 | 25.6 |
| 1990 | 27.5 | 26.9 | 29.9 | 27.9 | 20.0 | 20.3 | 23.0 | 20.8 | 25.4 |
| 1991 | 27.5 | 27.3 | 30.1 | 28.4 | 20.2 | 20.9 | 23.0 | 21.3 | 25.6 |
| 1992 | 27.5 | 27.0 | 29.2 | 27.9 | 20.2 | 20.5 | 22.7 | 20.8 | 25.1 |
| 1993 | 27.5 | 27.8 | 29.6 | 28.4 | 20.4 | 20.7 | 22.8 | 21.0 | 25.2 |
| 1994 | 27.5 | 27.5 | 29.7 | 28.3 | 20.5 | 20.5 | 22.0 | 20.8 | 24.7 |
| 1995 | 27.5 | 27.7 | 30.3 | 28.6 | 20.6 | 20.3 | 21.5 | 20.5 | 24.9 |
| 1996 | 27.5 | 28.1 | 29.6 | 28.5 | 20.7 | 20.5 | 22.1 | 20.8 | 24.9 |
| 1997 | 27.5 | 27.8 | 30.1 | 28.7 | 20.7 | 20.1 | 22.1 | 20.6 | 24.6 |
| 1998 | 27.5 | 28.1 | 30.0 | 28.7 | 20.7 | 20.4 ^f | 23.0 ^f | 20.9 | 24.6 |
| 1999 | 27.5 | 28.2 | 28.4 | 28.3 | 20.7 | ^f | ^f | 20.7 | 24.5 |

Source:

U.S. Department of Transportation, NHTSA, "Summary of Fuel Economy Performance," Washington, DC, October 1999. (Additional resources: www.nhtsa.dot.gov)

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

^bModel year as determined by the manufacturer on a vehicle by vehicle basis.

^cRepresents 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.

^dAll CAFE calculations are sales-weighted.

^eStandards were set for two-wheel drive and four-wheel drive light trucks separately, but no combined standard was set in this year.

^fData are not available.

Table 7.17
Corporate Average Fuel Economy (CAFE) Fines Collected, 1983–98^a
(thousands)

| Model year | Current dollars | 1998 constant dollars ^b |
|------------|-----------------|------------------------------------|
| 1983 | 58 | 95 |
| 1984 | 5,958 | 9,352 |
| 1985 | 15,565 | 23,589 |
| 1986 | 29,872 | 44,417 |
| 1987 | 31,261 | 44,844 |
| 1988 | 44,519 | 61,357 |
| 1989 | 47,381 | 62,311 |
| 1990 | 48,449 | 60,444 |
| 1991 | 42,243 | 50,557 |
| 1992 | 38,287 | 44,481 |
| 1993 | 28,688 | 32,374 |
| 1994 | 31,478 | 34,619 |
| 1995 | 40,788 | 43,620 |
| 1996 | 19,302 | 20,058 |
| 1997 | 36,204 | 36,769 |
| 1998 | 17,677 | 17,677 |

Source:

U.S. Department of Transportation, National Highway Traffic Safety Administration, Office of Vehicle Safety Compliance, Washington, DC, March, 2000.
 (Additional resources: www.nhtsa.dot.gov)

Table 7.18
Tax Receipts from the Sale of Gas Guzzlers, 1980–98
(thousands)

| Fiscal year | Current dollars | 1998 constant dollars ^b |
|-------------|-----------------|------------------------------------|
| 1980 | 740 | 1,464 |
| 1981 | 780 | 1,398 |
| 1982 | 1,720 | 2,905 |
| 1983 | 4,020 | 6,578 |
| 1984 | 8,820 | 13,844 |
| 1985 | 39,790 | 60,302 |
| 1986 | 147,660 | 219,557 |
| 1987 | 145,900 | 209,292 |
| 1988 | 116,780 | 160,947 |
| 1989 | 109,640 | 144,189 |
| 1990 | 103,200 | 128,750 |
| 1991 | 118,400 | 141,703 |
| 1992 | 144,200 | 167,530 |
| 1993 | 111,600 | 125,940 |
| 1994 | 64,100 | 70,496 |
| 1995 | 73,500 | 78,603 |
| 1996 | 52,600 | 54,660 |
| 1997 | 48,200 | 48,952 |
| 1998 | 47,700 | 47,700 |

Source:

Internal Revenue Service, Statistics of Income Bulletin, Summer 1999, Washington, DC, 1999, p. 220. (Additional resources: www.irs.gov/tax_stats).

^a These are fines which are actually collected. Fines which are assessed in a 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 an automobile that has an Environmental Protection Agency (EPA) fuel economy rating 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.

Table 7.19
The Gas Guzzler Tax on New Cars
(dollars per vehicle)

| Vehicle fuel economy (mpg) | 1980 | 1981 | 1982 | 1983 | 1984 | 1985 | 1986–9 0 | 1991 + |
|----------------------------------|------|------|-------|-------|-------|------|-------------|-----------|
| 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 | 1,00 | 1,300 | 2,600 |
| 17.0–17.5 | 0 | 0 | 350 | 500 | 750 | 1,00 | 1,500 | 3,000 |
| 16.5–17.0 | 0 | 200 | 350 | 650 | 750 | 1,20 | 1,500 | 3,000 |
| 16.0–16.5 | 0 | 200 | 450 | 650 | 950 | 1,20 | 1,850 | 3,700 |
| 15.5–16.0 | 0 | 350 | 450 | 800 | 950 | 1,50 | 1,850 | 3,700 |
| 15.0–15.5 | 0 | 350 | 600 | 800 | 1,150 | 1,50 | 2,250 | 4,500 |
| 14.5–15.0 | 200 | 450 | 600 | 1,000 | 1,150 | 1,80 | 2,250 | 4,500 |
| 14.0–14.5 | 200 | 450 | 750 | 1,000 | 1,450 | 1,80 | 2,700 | 5,400 |
| 13.5–14.0 | 300 | 550 | 750 | 1,250 | 1,450 | 2,20 | 2,700 | 5,400 |
| 13.0–13.5 | 300 | 550 | 950 | 1,250 | 1,750 | 2,20 | 3,200 | 6,400 |
| 12.5–13.0 | 550 | 650 | 950 | 1,550 | 1,750 | 2,65 | 3,200 | 6,400 |
| Under 12.5 | 550 | 650 | 1,200 | 1,550 | 2,150 | 2,65 | 3,850 | 7,700 |

Source:

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

Fuel Economy by Vehicle Speed

ORNL has developed fuel consumption and emissions lookup tables for the Federal Highway Administration, for use in their TRAF series of traffic models (NETSIM, CORSIM, FRESIM), although more generic uses are also possible. To develop the data-based models, vehicles are tested both on-road and on a chassis dynamometer. Engine parameters are measured on-road under real-world driving conditions that cover the vehicle's entire operating envelope. Emissions and fuel consumption are then measured on the chassis dynamometer as functions of engine conditions. The two data sets are merged to produce the final three-dimensional maps as functions of vehicle speed and acceleration. Eight well-functioning, late-model vehicles, and one 1997 model vehicle, have been tested thus far in fully warmed-up conditions.

Similar continuing work is planned for the Department of Energy as well as FHWA, which will include more well-functioning, late-model vehicles, pre-control (1960's) vehicles, malfunctioning high-emitter vehicles, light-duty diesel vehicles (cars and pickup trucks), alternative fuel vehicles, and possibly heavy-duty diesel vehicles. ORNL will also be developing cold-start algorithms to enhance the existing models, since emissions and fuel economy generally improve as vehicles warm up to normal operating temperatures.

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Table 7.20
Vehicle Specifications for Tested Vehicles

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

Source:

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

^a PFI = port fuel injection. TBI = throttle-body fuel injection.

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

Table 7.21
Fuel Economy by Speed, 1973, 1984, and 1997
(miles per gallon)

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

Source:

1973- U.S. Department of Transportation, Federal Highway Administration, Office of Highway Planning, *The Effect of Speed on Automobile Gasoline Consumption Rates*, Washington, DC, October 1973.

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

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

(Additional resources: www.fhwa-tsis.com)

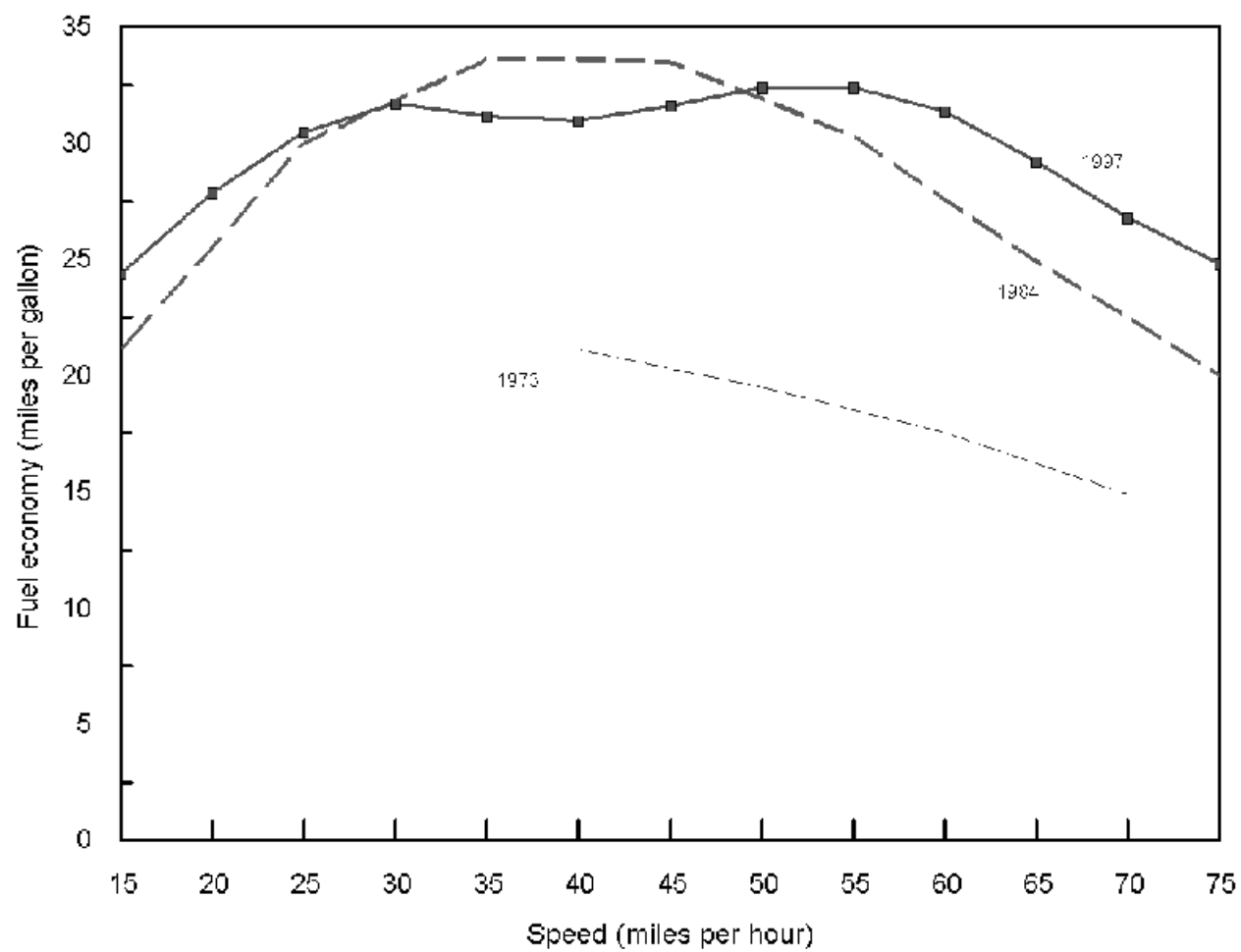
^aModel years 1970 and earlier automobiles.

^bModel years 1981–84 automobiles and light trucks.

^cModel years 1988–97 automobiles and light trucks.

^dData are not available.

Figure 7.2. Fuel Economy by Speed, 1973, 1984, and 1997



Source: See Table 7.21.

Table 7.22
Steady Speed Fuel Economy for Tested Vehicles
(miles per gallon)

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

Source:

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

Note:

For specifications of the tested vehicles, please see Table 7.20.

The Environmental Protection Agency (EPA) tests new vehicles to determine fuel economy ratings. The city and highway fuel economies that are posted on the windows of new vehicles are determined by testing the vehicle during these driving cycles. The driving cycles simulate the performance of an engine while driving in the city and on the highway. Once the urban cycle is completed, the engine is stopped, then started again for the 8.5 minute hot start cycle.

Figure 7.3. Urban Driving Cycle

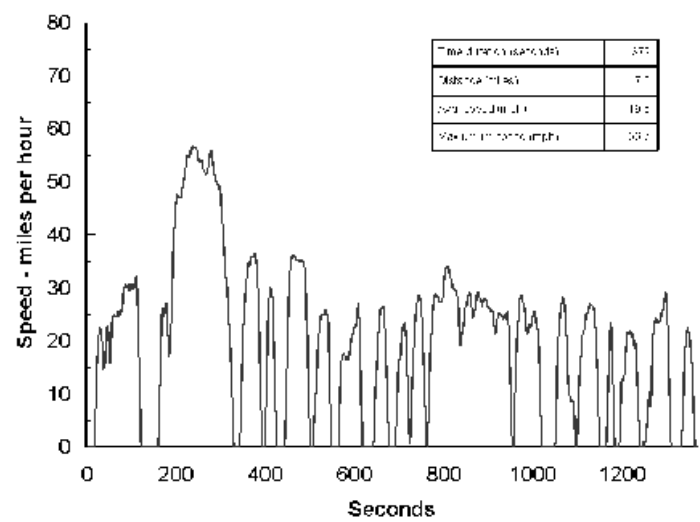
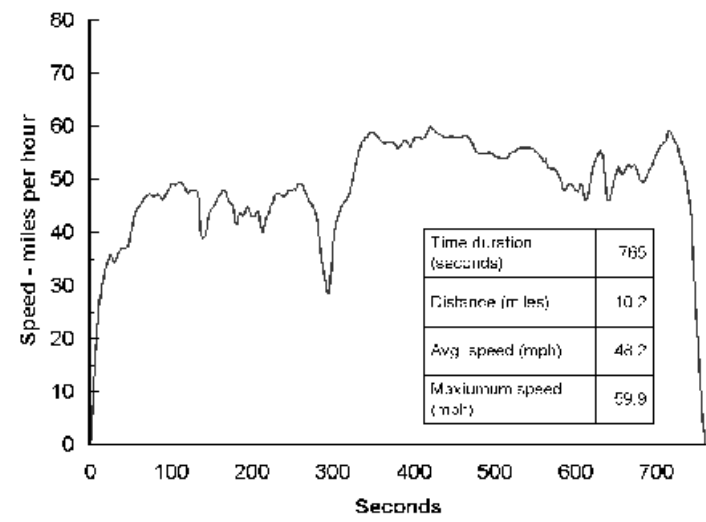


Figure 7.4. Highway Driving Cycle



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.

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 recently to better represent actual on-road driving by combining modern urban and freeway driving.

Figure 7.5. New York City Driving Cycle

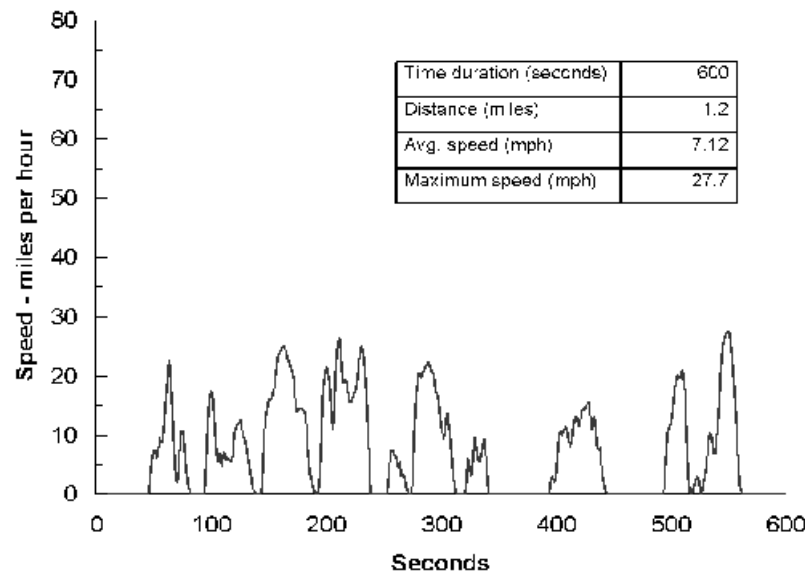
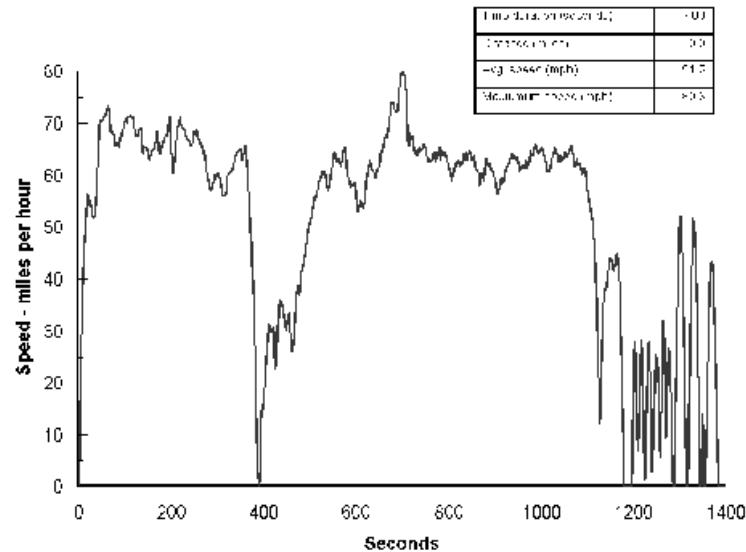


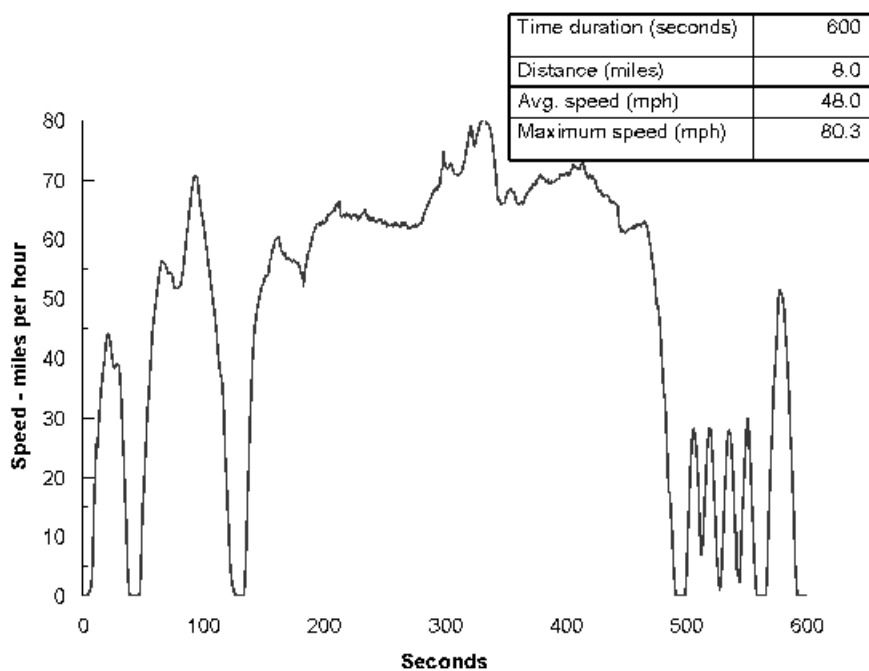
Figure 7.6. Representative Number Five Driving Cycle



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

The US06 driving cycle was developed as a supplement to the Federal Test Procedure. It is a short-duration cycle (600 seconds) which represents hard-acceleration driving.

Figure 7.7. US06 Driving Cycle



Source:

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

Table 7.23
Occupant Fatalities by Vehicle Type and Nonoccupant Fatalities, 1975–98

| | 1975 | 1980 | 1985 | 1990 | 1995 | 1996 | 1997 | 1998 |
|--|--------------------------|---------------|---------------|---------------|---------------|---------------------------|---------------|---------------|
| Vehicle occupant fatalities by vehicle type | | | | | | | | |
| Passenger car | | | | | | | | |
| Subcompact | 3,834 | 7,299 | 7,993 | 8,309 | 6,791 | 6,618 | 6,220 | ^a |
| Compact | 614 | 927 | 2,635 | 5,310 | 6,899 | 7,288 | 7,195 | ^a |
| Intermediate | 1,869 | 3,878 | 4,391 | 4,849 | 4,666 | 4,670 | 4,794 | ^a |
| Full | 10,800 | 11,580 | 6,586 | 4,635 | 3,413 | 3,417 | 3,481 | ^a |
| Unknown | 8,812 | 3,765 | 1,607 | 989 | 654 | 512 | 509 | ^a |
| Total | 25,929 | 27,449 | 23,212 | 24,092 | 22,423 | 22,505 | 22,199 | 21,164 |
| Truck | | | | | | | | |
| Light | 4,856 | 7,486 | 6,689 | 8,601 | 9,568 | 9,932 | 10,249 | 10,647 |
| Large | 961 | 1,262 | 977 | 705 | 648 | 621 | 723 | 728 |
| Total | 5,817 | 8,748 | 7,666 | 9,306 | 10,216 | 10,553 | 10,972 | 11,375 |
| Other Vehicles | | | | | | | | |
| Motorcycle | 3,189 | 5,144 | 4,564 | 3,244 | 2,227 | 2,161 | 2,116 | 2,284 |
| Bus | 53 | 46 | 57 | 32 | 33 | 21 | 18 | 36 |
| Other/unknown vehicle type | ^R 937 | 540 | 544 | 460 | 392 | 455 | 420 | 500 |
| Total | ^R4,179 | 5,730 | 5,165 | 3,736 | 2,652 | 2,637 | 2,554 | 2,820 |
| TOTAL vehicle occupant fatalities | 35,925 | 41,927 | 36,043 | 37,134 | 35,291 | 35,695 | 34,725 | 35,369 |
| Nonoccupant fatalities | | | | | | | | |
| Pedestrian | 7,516 | 8,070 | 6,808 | 6,482 | 5,584 | 5,449 | 5,321 | 5,220 |
| Pedalcyclist | 1,003 | 965 | 890 | 859 | 833 | 765 | 814 | 761 |
| Other | 81 | 129 | 84 | 124 | 109 | 154 | 153 | 131 |
| Total | 8,600 | 9,164 | 7,782 | 7,465 | 6,526 | 6,368 | 6,288 | 6,112 |
| TOTAL traffic fatalities | 44,525 | 51,091 | 43,825 | 44,599 | 41,817 | 42,065^b | 42,013 | 41,471 |

Source:

U.S. Department of Transportation, Bureau of Transportation Statistics, *National Transportation Statistics 1999*, Washington, DC 1999, p. 232. [Original source: U.S. DOT, National Highway Traffic Safety Administration, Fatal Accident Reporting System.] (Additional resources: www.nhtsa.dot.gov)

^aData are not available.

^bIncludes 2 fatalities that could not be assigned to a category above.

Table 7.24
Light Vehicle Occupant Safety Data, 1975–98

| | 1975 | 1980 | 1985 | 1990 | 1995 | 1996 | 1997 | 1998 |
|---------------------------------------|--------|--------|--------|-----------|-----------|-----------|------------------|-----------|
| Passenger cars | | | | | | | | |
| Fatalities | 25,929 | 27,449 | 23,212 | 24,092 | 22,423 | 22,505 | 22,199 | 21,164 |
| Injuries | a | a | a | 2,376,000 | 2,469,000 | 2,458,000 | 2,341,000 | 2,201,000 |
| Crashes | a | a | a | 5,560,000 | 5,523,000 | 5,599,000 | 5,537,000 | a |
| Vehicle-miles (billions) ^b | 1,030 | 1,107 | 1,249 | 1,427 | 1,478 | 1,499 | 1,528 | a |
| Rates per 100 million vehicle miles | | | | | | | | |
| Fatalities | 2.5 | 2.5 | 1.9 | 1.7 | 1.5 | 1.5 | 1.4 | a |
| Injuries | a | a | a | 167 | 167 | 164 | ^R 153 | a |
| Crashes | a | a | a | 390 | 374 | 374 | ^R 355 | a |
| Light trucks (10,000 lbs. or less) | | | | | | | | |
| Fatalities | 4,856 | 7,486 | 6,689 | 8,601 | 9,568 | 9,932 | 10,249 | 10,647 |
| Injuries | a | a | a | 505,000 | 722,000 | 761,000 | 755,000 | 763,000 |
| Crashes | a | a | a | 2,152,000 | 2,709,000 | 2,881,000 | 2,901,000 | a |
| Vehicle-miles (billions) ^b | 204 | 295 | 389 | 556 | 750 | 787 | 824 | a |
| Rates per 100 million vehicle-miles | | | | | | | | |
| Fatalities | 2.4 | 2.5 | 1.7 | 1.5 | 1.3 | 1.3 | 1.2 | a |
| Injuries | a | a | a | 91 | 96 | 98 | 93 | a |
| Crashes | a | a | a | 387 | 361 | 366 | 352 | a |

Source:

U.S. Department of Transportation, Bureau of Transportation Statistics, *National Transportation Statistics 1999*, Washington, DC 1999, pp. 233, 235. [Original source: U.S. DOT, National Highway Traffic Safety Administration, Fatal Accident Reporting System.] (Additional resources: www.nhtsa.dot.gov)

^aData are not available.

^bVehicle-miles are estimated by the National Highway Traffic Safety Administration and do not match Federal Highway data.

In 1998, nearly 40% of all passenger car and light truck fatal crashes were single-vehicle crashes. Because there are so many passenger cars on the roads compared to the other vehicle types, total passenger car crashes are nearly double all other vehicle types combined.

Table 7.25
Crashes by Crash Severity, Crash Type, and Vehicle Type, 1998

| Vehicle type | Fatal | | Injury | | Property damage only | | Total crashes |
|----------------|----------------------|------------------------|----------------------|------------------------|----------------------|------------------------|---------------|
| | Single-vehicle crash | Multiple-vehicle crash | Single-vehicle crash | Multiple-vehicle crash | Single-vehicle crash | Multiple-vehicle crash | |
| Passenger cars | 10,785 | 18,207 | 362,000 | 725,000 | 725,000 | 4,171,000 | 7,470,000 |
| Light trucks | 7,540 | 11,677 | 163,000 | 896,000 | 365,000 | 1,950,000 | 3,393,000 |
| Large trucks | 808 | 4,127 | 14,000 | 75,000 | 73,000 | 245,000 | 412,000 |
| Buses | 106 | 179 | 2,000 | 11,000 | 8,000 | 32,000 | 53,000 |
| Motorcycles | 1,045 | 1,279 | 22,000 | 23,000 | 2,000 | 6,000 | 55,000 |

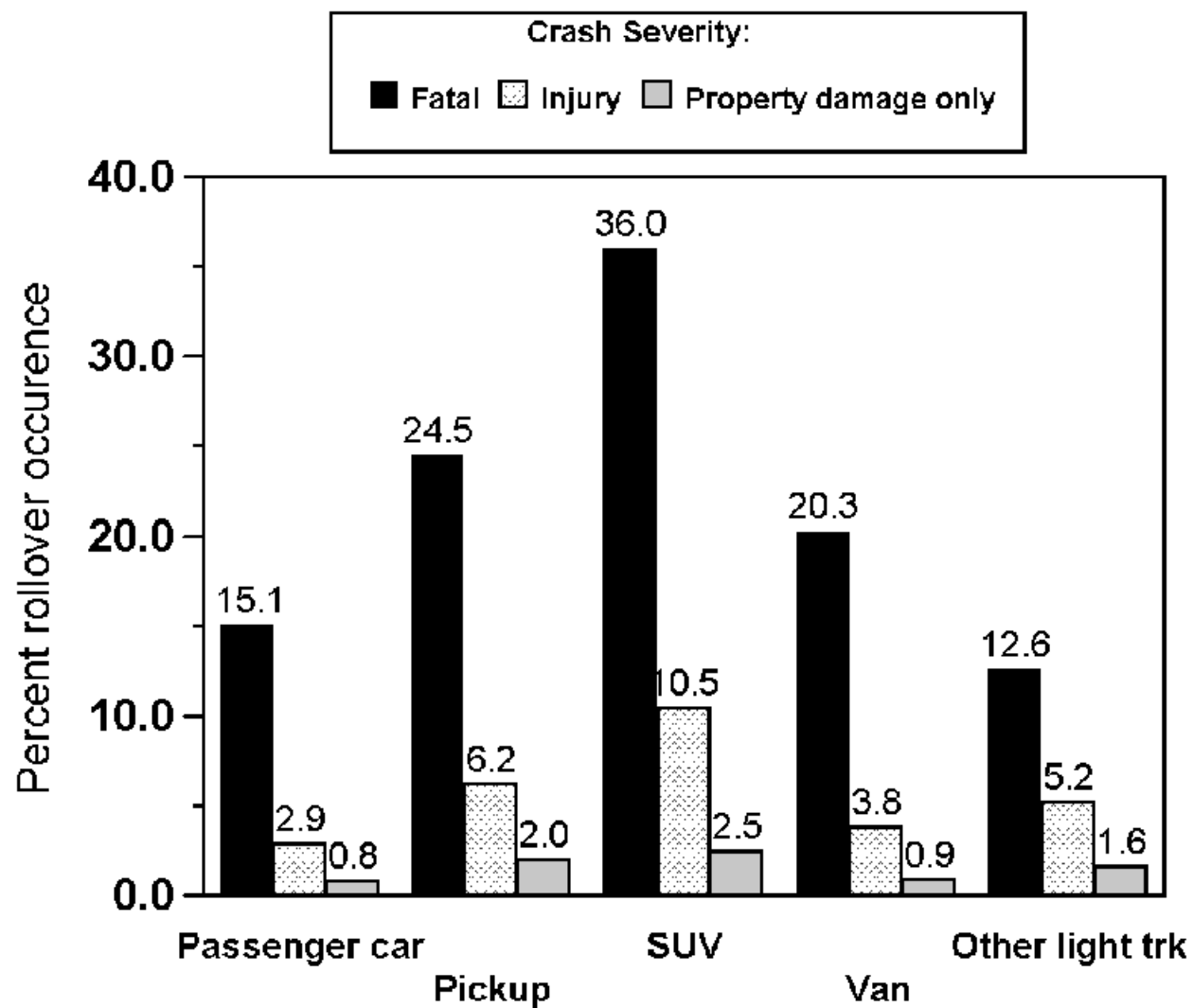
Source:

U.S. Department of Transportation, National Highway Traffic Safety Administration, *Traffic Safety Facts 1998*, Washington, DC, October 1999, pp. 72, 74, 76, 80, 82.

Note:

Multiple-vehicle crashes cannot be totaled over vehicle type due to duplication of accidents between vehicle types.

Figure 7.8. Percent Rollover Occurrence by Vehicle Type and Crash Severity

**Source:**

U.S. Department of Transportation, National Highway Traffic Safety Administration, *Traffic Safety Facts 1998*, Washington, DC, October 1999, p. 64.

Chapter 8

Heavy Vehicles and Characteristics

Summary Statistics from Tables in this Chapter

| Source | | |
|------------|---|------------|
| Table 8.1 | Heavy single-unit trucks, 1998 | |
| | <i>Registration (thousands)</i> | 5,414 |
| | <i>Vehicle miles (millions)</i> | 67,894 |
| | <i>Fuel economy (miles per gallon)</i> | 7.0 |
| Table 8.1 | Combination trucks, 1998 | |
| | <i>Registration (thousands)</i> | 1,831 |
| | <i>Vehicle miles (millions)</i> | 128,159 |
| | <i>Fuel economy (miles per gallon)</i> | 6.1 |
| Table 8.7 | Trucks by size, 1997 Truck Inventory & Use Survey | |
| | <i>Light (0–10,000 lbs)</i> | 93.5% |
| | <i>Medium (10,001–26,000 lbs)</i> | 3.0% |
| | <i>Heavy (26,001 lbs and over)</i> | 3.5% |
| Table 8.12 | Freight Shipments, 1997 Commodity Flow Survey | |
| | <i>Value (billion dollars)</i> | 8,567 |
| | <i>Tons (millions)</i> | 14,800 |
| | <i>Ton-miles (billions)</i> | 3,851 |
| Table 8.13 | Bus passenger miles, 1998 | (millions) |
| | <i>Transit</i> | 20,602 |
| | <i>Intercity</i> | 31,700 |

Table 8.1
Summary Statistics for Other Single-Unit and Combination Trucks, 1970–98^a

| Year | Other single-unit trucks ^b | | | | Combination trucks ^c | | | |
|---|---------------------------------------|-----------------------------------|-------------------------------|------------------------------------|---------------------------------|-----------------------------------|-------------------------------|------------------------------------|
| | Registrations (thousands) | Vehicle travel (million miles) | Fuel use (million gallons) | Fuel economy (miles per gallon) | Registrations (thousands) | Vehicle travel (million miles) | Fuel use (million gallons) | Fuel economy (miles per gallon) |
| 1970 | 3,681 | 27,081 | 3,968 | 6.8 | 905 | 35,134 | 7,348 | 4.8 |
| 1971 | 3,770 | 28,985 | 4,217 | 6.9 | 919 | 37,217 | 7,595 | 4.9 |
| 1972 | 3,918 | 31,414 | 4,844 | 6.5 | 961 | 40,706 | 8,120 | 5.0 |
| 1973 | 4,131 | 33,661 | 5,294 | 6.4 | 1,029 | 45,649 | 9,026 | 5.1 |
| 1974 | 4,211 | 33,441 | 5,261 | 6.4 | 1,085 | 45,966 | 9,080 | 5.1 |
| 1975 | 4,232 | 34,606 | 5,420 | 6.4 | 1,131 | 46,724 | 9,177 | 5.1 |
| 1976 | 4,350 | 36,390 | 5,706 | 6.4 | 1,225 | 49,680 | 9,703 | 5.1 |
| 1977 | 4,450 | 39,339 | 6,268 | 6.3 | 1,240 | 55,682 | 10,814 | 5.1 |
| 1978 | 4,518 | 42,747 | 6,955 | 6.1 | 1,342 | 62,992 | 12,165 | 5.2 |
| 1979 | 4,505 | 42,012 | 7,050 | 6.0 | 1,386 | 66,992 | 12,864 | 5.2 |
| 1980 | 4,374 | 39,813 | 6,923 | 5.8 | 1,417 | 68,678 | 13,037 | 5.3 |
| 1981 | 4,455 | 39,568 | 6,867 | 5.8 | 1,261 | 69,134 | 13,509 | 5.1 |
| 1982 | 4,325 | 40,658 | 6,803 | 6.0 | 1,265 | 70,765 | 13,583 | 5.2 |
| 1983 | 4,204 | 42,546 | 6,965 | 6.1 | 1,304 | 73,586 | 13,796 | 5.3 |
| 1984 | 4,061 | 44,419 | 7,240 | 6.1 | 1,340 | 77,377 | 14,188 | 5.5 |
| 1985 | 4,593 | 45,441 | 7,399 | 6.1 | 1,403 | 78,063 | 14,005 | 5.6 |
| 1986 | 4,313 | 45,637 | 7,386 | 6.2 | 1,408 | 81,038 | 14,475 | 5.6 |
| 1987 | 4,188 | 48,022 | 7,523 | 6.4 | 1,530 | 85,495 | 14,990 | 5.7 |
| 1988 | 4,470 | 49,434 | 7,701 | 6.4 | 1,667 | 88,551 | 15,224 | 5.8 |
| 1989 | 4,519 | 50,870 | 7,779 | 6.5 | 1,707 | 91,879 | 15,733 | 5.8 |
| 1990 | 4,487 | 51,901 | 8,357 | 6.2 | 1,709 | 94,341 | 16,133 | 5.8 |
| 1991 | 4,481 | 52,898 | 8,172 | 6.5 | 1,691 | 96,645 | 16,809 | 5.7 |
| 1992 | 4,370 | 53,874 | 8,237 | 6.5 | 1,675 | 99,510 | 17,216 | 5.8 |
| 1993 | 4,408 | 56,772 | 8,488 | 6.7 | 1,680 | 103,116 | 17,748 | 5.8 |
| 1994 | 4,906 | 61,284 | 9,032 | 6.8 | 1,681 | 108,932 | 18,653 | 5.8 |
| 1995 | 5,024 | 62,705 | 9,216 | 6.8 | 1,696 | 115,451 | 19,777 | 5.8 |
| 1996 | 5,266 | 64,072 | 9,409 | 6.8 | 1,747 | 118,899 | 20,192 | 5.9 |
| 1997 | 5,293 | 66,893 | 9,576 | 7.0 | 1,790 | 124,584 | 20,302 | 6.1 |
| 1998 | 5,414 | 67,894 | 9,741 | 7.0 | 1,831 | 128,159 | 21,100 | 6.1 |
| <i>Average annual percentage change</i> | | | | | | | | |
| 1970–98 | 1.4% | 3.3% | 3.3% | 0.1% | 2.5% | 4.7% | 3.8% | 0.9% |
| 1988–98 | 1.9% | 3.2% | 2.4% | 0.9% | 1.6% | 3.8% | 3.3% | 0.5% |

Source:

U. S. Department of Transportation, Federal Highway Administration, *Highway Statistics 1998*, Washington, DC, 1999, Table VM1 and annual.

(Additional resources: www.fhwa.dot.gov)

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

^b Other single-unit trucks are defined as all single-unit trucks with more than two axles or more than four tires.

^c The fuel economy for combination trucks is not the same as the fuel economy for Class 8 trucks. Fuel economy for Class 8 trucks is shown in Table 8.5.

Table 8.2
New Retail Truck Sales by Gross Vehicle Weight, 1970–98^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 |
| 1971 | 1,185 | 488 | 6 | 15 | 46 | 140 | 34 | 99 | 2,013 |
| 1972 | 1,498 | 599 | 55 | 11 | 29 | 182 | 35 | 126 | 2,535 |
| 1973 | 1,754 | 758 | 50 | 3 | 16 | 236 | 37 | 155 | 3,009 |
| 1974 | 1,467 | 696 | 21 | 3 | 14 | 207 | 31 | 148 | 2,587 |
| 1975 | 1,101 | 952 | 23 | 1 | 9 | 159 | 23 | 83 | 2,351 |
| 1976 | 1,318 | 1,401 | 43 | ^c | 9 | 153 | 22 | 97 | 3,043 |
| 1977 | 1,306 | 1,803 | 36 | 3 | 5 | 163 | 28 | 141 | 3,485 |
| 1978 | 1,334 | 2,140 | 73 | 6 | 3 | 156 | 41 | 162 | 3,915 |
| 1979 | 1,271 | 1,574 | 15 | 3 | 3 | 146 | 50 | 174 | 3,236 |
| 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 | 106 | 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 | 178 | 7,226 |
| 1998 | 5,263 | 2,036 | 102 | 43 | 25 | 32 | 115 | 209 | 7,825 |
| <i>Average annual percentage change</i> | | | | | | | | | |
| 1970–85 | 5.7% | 7.9% | 4.1% | - | -15.1% | -6.6% | 6.8% | 2.8% | 5.5% |
| 1986–98 | 3.8% | 4.4% | 19.5% | - | 12.6% | -2.8% | 1.1% | 5.3% | 4.0% |

Source:

1970–97: American Automobile Manufacturers Association, *Motor Vehicle Facts and Figures 1998*, Detroit, MI, 1998, p. 24, and annual. 1998: Ward's Communications, *Ward's Automotive Yearbook*, Southfield, MI, p. 260. (Additional resources: www.wardsauto.com)

^a Sales include domestic-sponsored imports.

^b Data for 1970 is based on new truck registrations.

^c Less than 500 trucks.

Vehicle Inventory and Use Survey

The Vehicle Inventory and Use Survey (VIUS), which was formerly the Truck Inventory and Use Survey, 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. The name of the 1997 survey was changed to the Vehicle Inventory and Use Survey due to future possibilities of including additional vehicle types. Data for 1997 have been released in a report, as well as on CD-ROM. Copies 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 is the location of the VIUS on-line.

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 1997 VIUS and registered in the U.S. as of July 1, 1997, was 72.8 million. These trucks were estimated to have been driven a total of 1,044 billion miles during 1997, an increase of 32.8% from 1992. The average annual miles traveled per truck was estimated at 14,300 miles.

In the 1997 VIUS, there are several ways to classify a truck by weight. The survey respondent was asked the average weight of the vehicle or vehicle-trailer combination when carrying a typical payload; the empty weight (truck minus cargo) of the vehicle as it was usually operated; and the maximum gross weight at which the vehicle or vehicle-trailer combination was operated. The Census Bureau also collected information on the Gross Vehicle Weight Class of the vehicles (decoded from the vehicle identification number) and the registered weight of the vehicles from the State registration files. Some of these weights are only provided in categories, while others are exact weights. Since all these weights could be quite different for a single truck, the tabulations by weight can be quite confusing. For illustration of this, see Tables 8.3 and 8.4. The first set of data are based on the Gross Vehicle Weight Class of the vehicle when it was manufactured; the data on Table 8.5 are based on the average weight as reported by the respondent. There is a 24% difference in the number of Class 1 trucks (6,000 lbs. and less). In most tables, the Gross Vehicle Weight Class was used. However, on the tables comparing different survey estimates, average weight must be used, as the older surveys did not include data on the Gross Vehicle Weight rating.

These tables illustrate the difference between two weight variables in the Vehicle Inventory and Use Survey. The manufacturer's gross vehicle weight class is likely to be more accurate than the average weight provided by the respondent.

Table 8.3
Truck Statistics by Gross Vehicle Weight Class, 1997

| Manufacturer's gross vehicle weight class | Number of trucks | Percentage of trucks | Average annual miles per truck | Average fuel economy | Gallons of fuel used (millions) | Percentage of fuel use |
|---|-------------------|----------------------|--------------------------------|----------------------|---------------------------------|------------------------|
| 6,000 lbs and less | 45,240,632 | 62.14% | 13,328 | 17.82 | 35,184 | 44.34% |
| 6,001 – 10,000 lbs | 22,373,167 | 30.73% | 12,952 | 14.11 | 21,226 | 26.75% |
| 10,001 – 14,000 lbs | 510,476 | 0.70% | 15,650 | 10.83 | 771 | 0.97% |
| 14,001 – 16,000 lbs | 194,951 | 0.27% | 16,390 | 10.11 | 320 | 0.40% |
| 16,001 – 19,500 lbs | 178,111 | 0.24% | 6,016 | 8.69 | 117 | 0.15% |
| 19,501 – 26,000 lbs | 1,884,246 | 2.59% | 13,637 | 8.21 | 3,202 | 4.04% |
| 26,001 – 33,000 lbs | 207,386 | 0.28% | 35,588 | 7.07 | 1,096 | 1.38% |
| 33,001 lbs and up | 2,211,283 | 3.04% | 48,095 | 6.69 | 17,427 | 21.96% |
| Total | 72,800,252 | 100.00% | 14,347 | 16.02 | 79,344 | 100.00% |

Source:

U.S. Department of Commerce, Bureau of the Census, *1997 Vehicle Inventory and Use Survey*, Microdata File on CD, 2000. (Additional resources: www.census.gov/svsd/www/tiusview.html)

Table 8.4
Percentage of Trucks by Size Class, 1977, 1982, 1987, 1992, and 1997
(percentage)

| Average weight as reported by respondent | 1977 TIUS | 1982 TIUS | 1987 TIUS | 1992 TIUS | 1997 VIUS |
|--|--------------|--------------|--------------|--------------|--------------|
| 6,000 lbs and less | 66.0% | 77.8% | 85.4% | 85.4% | 86.3% |
| 6,001–10,000 lbs | 17.9% | 11.6% | 6.5% | 7.9% | 7.3% |
| 10,000–14,000 lbs | 3.1% | 1.6% | 1.2% | 1.2% | 1.1% |
| 14,001–16,000 lbs | 1.3% | 0.9% | 0.5% | 0.5% | 0.4% |
| 16,001–19,500 lbs | 2.1% | 1.0% | 0.6% | 0.5% | 0.4% |
| 19,501–26,000 lbs | 3.4% | 2.4% | 1.7% | 1.2% | 1.0% |
| 26,001–33,000 lbs | 1.5% | 1.0% | 0.8% | 0.7% | 0.6% |
| 33,001 lbs and over | 4.6% | 3.8% | 3.3% | 2.8% | 2.9% |

Source:

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, *1977 Truck Inventory and Use Survey*, 1980; *1982 Truck Inventory and Use Survey*, 1985; *1987 Truck Inventory and Use Survey*, 1990; *1992 Truck Inventory and Use Survey*, 1995; *1997 Vehicle Inventory and Use Survey*, 2000.
(Additional resources: www.census.gov/svsd/www/tiusview.html)

*Though diesel engines are generally more efficient than gasoline engines, variations in patterns of use and weight distributions within a weight category can cause the fuel economies to be more similar. Data in the **Total** row give a good indication that the gasoline trucks are mainly lighter vehicles and diesels are used in heavier applications.*

Table 8.5
Truck Fuel Economy by Fuel Type and Size Class, 1997
(miles per gallon)

| Average weight as reported by the respondent | Gasoline trucks | Diesel trucks |
|--|-----------------|---------------|
| 6,000 lbs and less | 16.8 | 16.6 |
| 6,001–10,000 lbs | 13.7 | 13.7 |
| 10,001–14,000 lbs | 10.4 | 11.8 |
| 14,001–16,000 lbs | 8.9 | 10.3 |
| 16,001–19,500 lbs | 8.6 | 9.3 |
| 19,501–26,000 lbs | 7.5 | 8.3 |
| 26,001–33,000 lbs | 7.0 | 7.5 |
| 33,001 lbs and up | 6.5 | 5.9 |
| Weighted average | 16.4 | 10.3 |

Source:

U.S. Department of Commerce, Bureau of the Census, *1997 Vehicle Inventory and Use Survey*, Microdata File on CD, 2000. (Additional resources: www.census.gov/svsd/www/tiusview.html)

Table 8.6
Truck Fuel Economy by Size Class, 1977, 1982, 1987, 1992, and 1997
(miles per gallon)

| Average weight as reported by respondent | 1977 TIUS | 1982 TIUS | 1987 TIUS | 1992 TIUS | 1997 VIUS |
|--|--------------|--------------|--------------|--------------|--------------|
| 6,000 lbs and less | 13.2 | 14.2 | 15.0 | 16.1 | 16.8 |
| 6,001–10,000 lbs | 11.5 | 11.1 | 10.9 | 12.2 | 13.6 |
| 10,000–14,000 lbs | 9.4 | 8.1 | 8.1 | 9.2 | 10.8 |
| 14,001–16,000 lbs | 6.9 | 7.5 | 7.5 | 8.5 | 9.5 |
| 16,001–19,500 lbs | 7.6 | 7.2 | 7.1 | 8.1 | 8.9 |
| 19,501–26,000 lbs | 6.1 | 6.9 | 6.4 | 7.2 | 7.9 |
| 26,001–33,000 lbs | 5.3 | 6.2 | 6.1 | 6.8 | 7.4 |
| 33,001 lbs and over | 4.8 | 5.2 | 5.3 | 5.5 | 6.0 |

Source:

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, *1977 Truck Inventory and Use Survey*, 1980; *1982 Truck Inventory and Use Survey*, 1985; *1987 Truck Inventory and Use Survey*, 1990; *1992 Truck Inventory and Use Survey*, 1995; *1997 Vehicle Inventory and Use Survey*, 2000. (Additional resources: www.census.gov/svsd/www/tiusview.html)

Table 8.7
Truck Statistics by Size, 1997

| | Manufacturer's gross vehicle weight class | | | Total |
|--------------------------|---|-----------------------------------|-------------------------|------------|
| | Light (< 10,000 lbs) | Medium (10,001– 26,000 lbs) | Heavy (> 26,000 lbs) | |
| Trucks | 68,099,912 | 2,164,791 | 2,535,549 | 72,800,252 |
| Trucks (%) | 93.54% | 2.97% | 3.48% | 100% |
| Miles per truck | 13,165 | 13,837 | 46,513 | 14,347 |
| Total miles (%) | 85.84% | 2.87% | 11.29% | 100% |
| Fuel use (%) | 71.61% | 3.99% | 24.40% | 100% |
| Fuel economy (mpg) | 16.55 | 9.37 | 6.20 | 16.02 |
| | Range of operation | | | |
| | | | | |
| Under 50 miles | 75.15% | 62.50% | 39.55% | 73.53% |
| 51–100 miles | 12.84% | 16.60% | 16.73% | 13.09% |
| 101–200 miles | 3.85% | 5.60% | 10.82% | 4.15% |
| 201–500 miles | 2.05% | 5.74% | 12.18% | 2.52% |
| Over 500 miles | 2.28% | 20.04% | 16.00% | 2.75% |
| Off-road | 3.83% | 7.52% | 4.74% | 3.97% |
| Total | 100% | 100% | 100% | 100% |
| | Primary refueling facility | | | |
| | | | | |
| Central company-owned | 14.55% | 24.68% | 39.13% | 29.20% |
| Single off-site contract | 4.27% | 6.11% | 6.89% | 6.08% |
| Public station | 77.71% | 64.62% | 49.83% | 60.56% |
| Other | 3.47% | 4.59% | 4.16% | 4.16% |
| Total | 100% | 100% | 100% | 100% |

Source:

U.S. Department of Commerce, Bureau of the Census, *1997 Vehicle Inventory and Use Survey*,
Microdata
File on CD, 2000. (Additional resources: www.census.gov/svsd/www/tiusview.html)

Table 8.8
Percentage of Trucks by Size Ranked by Major Use, 1997

| Rank | Light (< 10,000 lbs) | Medium (10,001 – 26,000 lbs) | Heavy (> 26,000 lbs) |
|-------------|--------------------------------------|---|--------------------------------------|
| 1 | Personal 74.56% | Agriculture 19.54% | For Hire 31.48% |
| 2 | Construction 7.56% | Construction 20.19% | Construction 17.56% |
| 3 | Services^a 5.57% | Services^a 11.64% | Agriculture 14.01% |
| 4 | Agriculture 3.82% | Retail 9.28% | Wholesale 7.81% |
| 5 | Retail 2.79% | Utilities 4.40% | Retail 5.67% |
| 6 | Not in Use 1.61% | Wholesale 7.31% | Personal 0.31% |
| 7 | Wholesale 1.33% | For Hire 5.47% | Services^a 7.39% |
| 8 | Manufacturing 0.74% | Personal 7.00% | Manufacturing 5.61% |
| 9 | Utilities 0.75% | Manufacturing 3.72% | Not in Use 1.11% |
| 10 | Daily Rental 0.53% | Not in Use 3.21% | Utilities 2.18% |
| 11 | Forestry 0.26% | Daily Rental 4.21% | Forestry 2.56% |
| 12 | Mining 0.25% | Forestry 1.64% | Daily Rental 2.11% |
| 13 | For Hire 0.21% | Mining 1.14% | Mining 2.18% |
| 14 | One-Way Rental 0.01% | One-Way Rental 1.24% | One-Way Rental 0.01% |
| 15 | Other 0.00% | Other 0.00% | Other 0.00% |

Source:

U.S. Department of Commerce, Bureau of the Census, *1997 Vehicle Inventory and Use Survey*, Micro data File on CD, 2000. (Additional resources: www.census.gov/svsd/www/tiusview.html)

^a Business and personal services.

Nearly 60% of all truck fleets use public fueling stations as their primary refueling facility. As expected, larger fleets use central company-owned facilities more than smaller fleets. Mid-size fleets (10–500 vehicles) use off-site contract facilities more than the smaller or larger fleets.

Table 8.9
Percentage of Trucks by Fleet Size and Primary Refueling Facility, 1997

| Truck fleet size | Primary refueling facility | | | | Total |
|---------------------|--|---|----------------------------|--------------|-------------|
| | Central company-owned fueling facility | Single contract fueling facility located off-site | Public fueling stations | Other | |
| 1 | 5.94% | 2.70% | 87.26% | 4.09% | 100% |
| 2–5 | 13.80% | 4.56% | 76.12% | 5.52% | 100% |
| 6–9 | 25.77% | 7.32% | 62.02% | 4.88% | 100% |
| 10–24 | 37.08% | 10.43% | 49.70% | 2.79% | 100% |
| 25–99 | 48.48% | 9.65% | 39.29% | 2.59% | 100% |
| 100–499 | 48.76% | 10.62% | 38.40% | 2.22% | 100% |
| 500–999 | 46.39% | 7.46% | 44.38% | 1.77% | 100% |
| 1,000–4,999 | 45.24% | 4.93% | 45.94% | 3.89% | 100% |
| 5,000–9,999 | 35.77% | 6.01% | 53.36% | 4.87% | 100% |
| 10,000 & up | 71.72% | 2.56% | 19.27% | 6.45% | 100% |
| Total | 30.08% | 6.39% | 59.37% | 4.16% | 100% |

Source:

U.S. Department of Commerce, Bureau of the Census, *1997 Vehicle Inventory and Use Survey*, Microdata File on CD, 2000. (Additional resources: www.census.gov/svsd/www/tiusview.html)

Table 8.10
Percentage of Trucks by Major Use and Primary Refueling Facility, 1997

| Major Use | Primary refueling facility | | | | Total |
|--|--|---|-------------------------|--------|-------|
| | Central company-owned fueling facility | Single contract fueling facility located off-site | Public fueling stations | Other | |
| Agricultural services | 32.09% | 2.99% | 53.92% | 11.00% | 100% |
| Forestry or lumbering activities | 22.49% | 4.50% | 70.33% | 2.68% | 100% |
| Construction work | 33.40% | 5.39% | 58.79% | 2.42% | 100% |
| Contractor activities or special trades | 12.09% | 4.38% | 81.18% | 2.36% | 100% |
| Manufacturing, refining or processing activities | 35.47% | 9.48% | 53.69% | 1.36% | 100% |
| Wholesale trade | 32.56% | 11.90% | 53.62% | 1.92% | 100% |
| Retail trade | 28.21% | 10.25% | 59.41% | 2.12% | 100% |
| Business and personal services | 26.40% | 6.33% | 65.42% | 1.85% | 100% |
| Utilities | 40.56% | 5.09% | 52.25% | 2.09% | 100% |
| Mining or quarrying activities | 43.82% | 9.32% | 44.44% | 2.42% | 100% |
| Daily rental | 39.42% | 13.29% | 45.12% | 2.17% | 100% |
| Not in use | 10.56% | 2.37% | 53.12% | 33.94% | 100% |
| For-hire transportation | 32.87% | 4.90% | 59.53% | 2.70% | 100% |
| One-way rental | 48.47% | 3.10% | 48.43% | 0.00% | 100% |
| Personal transportation | 2.02% | 0.56% | 94.46% | 2.96% | 100% |
| Total | 29.20% | 6.08% | 60.56% | 4.16% | 100% |

Source:

U.S. Department of Commerce, Bureau of the Census, *1997 Vehicle Inventory and Use Survey*, Microdata File on CD, 2000.

(Additional resources: www.census.gov/svsd/www/tiusview.html)

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 and 1997 CFS are a continuation of statistics collected in the Commodity Transportation Survey from 1963 through 1977, and includes major improvements in methodology, sample size, and scope. In 1997, a sample of 100,000 domestic establishments randomly selected from a universe of about 800,000 establishments engaged in mining, manufacturing, wholesale, auxiliary establishments (warehouses) of multi-establishment companies, and some selected activities in retail and service was used. Each selected establishment reported a sample of approximately 25 outbound shipments for a one-week period in each of the four calendar quarters of 1997. This produced a total sample of over 5 million shipments. For each sampled shipment, zip codes of origin and destination, 5-digit Standard Classification of Transported Goods (SCTG) code, weight, value, and modes of transport, were provided. Establishments were also asked to indicate whether the shipment was containerized, a hazardous material, or an export.

The 1993 and 1997 CFS differ from previous surveys in their greatly expanded coverage of intermodalism. Earlier surveys reported only the principal mode. The 1993 and 1997 surveys report all modes used for the shipment (for-hire truck, private truck, rail, inland water, deep sea water, pipeline, air, parcel delivery or U.S. Postal Service, other mode, unknown). Route distance for each mode for each shipment as imputed from a mode-distance table developed by Oak Ridge National Laboratory. Distance, in turn, was used to compute ton-mileage by mode of transport.

For more information about the CFS, contact the Commodity Flow Survey Branch, Department of Commerce, Bureau of the Census, Services Division at (301) 457-2108, or visit the following Internet site: **www.bts.gov/cfs**.

Table 8.11
Growth of Freight Activity in the United States: Comparison of the 1997 and 1993 Commodity Flow Surveys
 (Detail may not add to total because of rounding)

| Mode of Transportation | Value | | | Tons | | | Ton-miles | | | Average miles per shipment | | |
|---|--------------------------------------|--------------------------------------|-------------------|--------------------|--------------------|-------------------|--------------------|--------------------|-------------------|----------------------------|-------|-------------------|
| | 1997 (billion 1997 dollars) | 1993 (billion 1997 dollars) | Percent change | 1997 (millions) | 1993 (millions) | Percent change | 1997 (billions) | 1993 (billions) | Percent change | 1997 | 1993 | Percent change |
| All modes | 6,944.0 | 6,360.8 | 9.2% | 11,089.7 | 9,688.5 | 14.5% | 2,661.4 | 2,420.9 | 9.9% | 472 | 424 | 11.4% |
| Single modes | 5,719.6 | 5,376.3 | 6.4% | 10,436.5 | 8,922.3 | 17.0% | 2,383.5 | 2,136.9 | 11.5% | 184 | 197 | -6.4% |
| Truck ^a | 4981.5 | 4791.0 | 4.0% | 7700.7 | 6385.9 | 20.6% | 1023.5 | 869.5 | 17.7% | 144 | 144 | -0.1% |
| For-hire truck | 2901.3 | 2856.1 | 1.6% | 3402.6 | 2808.3 | 21.2% | 741.1 | 629.0 | 17.8% | 485 | 472 | 2.9% |
| Private truck | 2036.5 | 1910.4 | 6.6% | 4137.3 | 3543.5 | 16.8% | 268.6 | 235.9 | 13.9% | 53 | 52 | 2.1% |
| Rail | 319.6 | 269.2 | 18.7% | 1,549.8 | 1,544.1 | 0.4% | 1,022.5 | 942.6 | 8.5% | 769 | 766 | 3.0% |
| Water | 75.8 | 67.1 | 13.1% | 563.4 | 505.4 | 11.5% | 261.7 | 272.0 | -3.8% | 482 | c | c |
| Shallow draft | 53.9 | 44.3 | 21.7% | 414.8 | 362.5 | 14.4% | 189.3 | 164.4 | 15.2% | 177 | c | c |
| Great Lakes | 1.5 | c | c | 38.4 | 33.0 | c | 13.4 | 12.4 | 8.2% | 204 | 534 | -61.8% |
| Deep draft | 20.4 | 21.5 | -4.9% | 110.2 | 109.9 | 0.2% | 59.0 | 95.2 | -38.0% | 1,024 | 1,861 | -45.0% |
| Air (includes truck and air) | 229.1 | 151.3 | 51.4% | 4.5 | 3.1 | 42.6% | 6.2 | 4.0 | 55.5% | 1,380 | 1,415 | -2.5% |
| Pipeline ^b | 113.5 | 97.8 | 16.1% | 618.2 | 483.6 | 27.8% | c | c | c | c | c | c |
| Multiple modes | 945.9 | 720.9 | 31.2% | 216.7 | 225.7 | -4.0% | 204.5 | 191.5 | 6.8% | 813 | 736 | 10.5% |
| Parcel, U.S. Postal Service or courier | 855.9 | 612.8 | 39.7% | 23.7 | 18.9 | 25.4% | 18.0 | 13.2 | 36.8% | 813 | 734 | 10.7% |
| Truck and rail | 75.7 | 90.4 | -16.3% | 54.2 | 40.6 | 33.5% | 55.6 | 37.7 | 47.5% | 1,347 | 1,403 | -3.9% |
| Truck and water | 8.2 | 10.2 | -19.4% | 33.2 | 68.0 | -51.2% | 34.8 | 40.6 | -14.4% | 1,265 | 1,417 | -10.7% |
| Rail and water | 1.8 | 4.0 | -55.2% | 79.3 | 79.2 | 0.1% | 77.6 | 70.2 | 10.5% | 1,092 | 627 | 74.1% |
| Other multiple modes | 4.3 | 3.5 | 22.0% | 26.2 | 18.9 | 38.6% | 18.6 | c | c | c | 1,082 | c |
| Other and unknown modes | 278.6 | 263.6 | 5.7% | 436.5 | 540.5 | -19.2% | 73.4 | 92.6 | -20.7% | 122 | 229 | -46.9% |

Source:

U.S. Department of Transportation, Bureau of Transportation Statistics, *Freight USA*, Washington, DC, 2000. (Additional resources: www.bts.gov/cfs)

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

^b CFS data for pipeline lack most shipments of crude oil.

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

Table 8.13
Summary Statistics on Buses by Type, 1970–98

| Year | Transit motor bus ^a | Intercity bus | School bus |
|-----------------------------------|--------------------------------|---------------|-------------------|
| Number in operation | | | |
| 1970 | 49,700 | 22,000 | 288,700 |
| 1975 | 50,811 | 20,500 | 368,300 |
| 1980 | 59,411 | 21,400 | 418,255 |
| 1985 | 64,258 | 20,200 | 480,400 |
| 1990 | 58,714 | 20,680 | 508,261 |
| 1995 | 67,107 | 20,138 | 560,447 |
| 1996 | 71,678 | 20,649 | 569,395 |
| 1997 | 72,770 | 20,910 | 568,113 |
| 1998 | 74,641 | 19,173 | 582,470 |
| Vehicle-miles (millions) | | | |
| 1970 | 1,409 | 1,209 | 2,100 |
| 1975 | 1,526 | 1,126 | 2,500 |
| 1980 | 1,677 | 1,162 | 2,900 |
| 1985 | 1,863 | 933 | 3,448 |
| 1990 | 2,123 | 991 | 3,800 |
| 1995 | 2,184 | 1,194 | 5,000 |
| 1996 | 2,221 | 1,220 | 5,000 |
| 1997 | 2,245 | 1,319 | 4,400 |
| 1998 | 2,291 | 1,366 | 4,300 |
| Passenger-miles (millions) | | | |
| 1970 | 18,210 | 25,300 | ^b |
| 1975 | 18,300 | 25,400 | ^b |
| 1980 | 21,790 | 27,400 | ^b |
| 1985 | 21,161 | 23,800 | ^b |
| 1990 | 20,981 | 23,000 | 74,200 |
| 1995 | 18,818 | 28,100 | 95,000 |
| 1996 | 19,096 | 28,800 | 99,000 |
| 1997 | 19,604 | 30,600 | 82,900 |
| 1998 | 20,602 | 31,700 | ^b |
| Energy use (trillion Btu) | | | |
| 1970 | 44.8 | 26.6 | 37.5 |
| 1975 | 51.5 | 24.8 | 42.6 |
| 1980 | 61.3 | 29.3 | 47.5 |
| 1985 | 72.4 | 31.5 | 57.0 |
| 1990 | 78.9 | 21.7 | 64.8 ^d |
| 1995 | 87.5 ^c | 22.6 | 83.9 |
| 1996 | 89.3 | 22.6 | 84.7 |
| 1997 | 93.0 | 22.2 | 83.9 |
| 1998 | 87.3 | 22.6 | 84.7 |

Source:

See Appendix A for Table 8.13.

(Additional resources: www.apta.com, www.fhwa.dot.gov, www.schoolbusfleet.com)

^a Data for transit buses after 1983 are not comparable with prior data. Data for prior years were provided voluntarily and statistically expanded; in 1984 reporting became mandatory.

^b Data are not available.

^c Beginning in 1992, data became available on alternative fuel use by transit buses.

^d Assumptions about fuel type changed in this year. See Appendix A for details.

Chapter 9

Alternative Fuel Vehicles and Characteristics

Summary Statistics from Tables in this Chapter

| Source | | |
|-----------|---|---------|
| Table 9.1 | Light alternative fuel vehicles, 1998 | 313,258 |
| | <i>LPG</i> | 212,000 |
| | <i>CNG</i> | 63,739 |
| | <i>LNG</i> | 118 |
| | <i>M85</i> | 19,627 |
| | <i>E85</i> | 12,778 |
| | <i>Electric</i> | 4,996 |
| Table 9.2 | Heavy alternative fuel vehicles, 1998 | 70,589 |
| | <i>LPG</i> | 54,000 |
| | <i>CNG</i> | 15,043 |
| | <i>LNG</i> | 1,054 |
| | <i>M85/M100</i> | 221 |
| | <i>E85/E95</i> | 24 |
| | <i>Electric</i> | 247 |
| Table 9.5 | Number of alternative fuel refuel sites, 1999 | 6,058 |
| | <i>LPG</i> | 4,153 |
| | <i>CNG</i> | 1,267 |
| | <i>LNG</i> | 490 |
| | <i>M85</i> | 51 |
| | <i>E85</i> | 49 |
| | <i>Electric</i> | 46 |

Fuel type abbreviations are used throughout this chapter.

| | | |
|--------------|---|-----------------------------------|
| <i>LPG</i> | = | <i>liquified petroleum gas</i> |
| <i>CNG</i> | = | <i>compressed natural gas</i> |
| <i>M-85</i> | = | <i>85% methanol, 15% gasoline</i> |
| <i>E-85</i> | = | <i>85% ethanol, 15% gasoline</i> |
| <i>M-100</i> | = | <i>100% methanol</i> |
| <i>E-95</i> | = | <i>95% ethanol, 5% gasoline</i> |
| <i>LNG</i> | = | <i>liquified natural gas</i> |

Alternative Fuels

The U.S. Department of Energy (DOE) defines alternative fuels as fuels which are substantially non-petroleum and yield energy security and environmental benefits. DOE currently recognizes the following as alternative fuels:

- methanol and denatured ethanol as alcohol fuels (alcohol mixtures that contain no less than 70% of the alcohol fuel),
- natural gas (compressed or liquefied),
- liquefied petroleum gas,
- hydrogen,
- coal-derived liquid fuels
- fuels derived from biological materials, and
- electricity (including solar energy).

DOE has established the Alternative Fuels Data Center (AFDC) in support of its work aimed at fulfilling the Alternative Motor Fuels Act (AMFA) directives. 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.

The data are collected for three specific vehicle types: (1) light vehicles, including automobiles, light trucks, and mini-vans; (2) heavy vehicles such as tractor-trailers and garbage trucks; and (3) urban transit buses. Much of the AFDC data can be obtained through their web site: **www.afdc.doe.gov**. Several tables and graphs in this chapter contain statistics which were generated by the AFDC.

DOE is sponsoring the **National Alternative Fuels Hotline** for Transportation Technologies in order to assist the general public and interested organizations in improving their understanding of alternative transportation fuels. The Hotline can be reached by dialing **1-800-423-1DOE**, or on the Internet at **www.afdc.doe.gov/hotline.html**.

There are more LPG vehicles in use than any other alternative fuel vehicle. The population of E85 vehicles, however, has grown the most since 1992. For details on alternative fuel use by fuel type, see Table 2.10

Table 9.1
Estimates of Alternative Fuel Vehicles in Use, 1992–2000

| Fuel type | 1992 | 1993 | 1994 | 1995 | 1996 | 1997 | 1998 | 1999 ^a | 2000 ^a | Average annual percentage change 1992–2000 |
|------------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|-------------------|-------------------|--|
| LPG | 221,000 | 269,000 | 264,000 | 259,000 | 263,000 | 263,000 | 266,000 | 268,000 | 270,000 | 2.5% |
| CNG | 23,191 | 32,714 | 41,227 | 50,218 | 60,144 | 68,571 | 78,782 | 89,633 | 101,991 | 20.3% |
| LNG | 90 | 299 | 484 | 603 | 663 | 813 | 1,172 | 1,422 | 1,682 | 44.2% |
| M85 | 4,850 | 10,263 | 15,484 | 18,319 | 20,265 | 21,040 | 19,648 | 19,497 | 18,725 | 18.4% |
| M100 | 404 | 414 | 415 | 386 | 172 | 172 | 200 | 200 | 200 | -8.4% |
| E85 ^b | 172 | 441 | 605 | 1,527 | 4,536 | 9,130 | 12,788 | 22,359 | 30,017 | 90.6% |
| E95 | 38 | 27 | 33 | 136 | 361 | 347 | 14 | 14 | 14 | -11.7% |
| Electricity | 1,607 | 1,690 | 2,224 | 2,860 | 3,280 | 4,453 | 5,243 | 6,417 | 7,590 | 21.4% |
| Total | 251,352 | 314,848 | 324,472 | 333,049 | 352,421 | 369,526 | 383,847 | 407,542 | 430,219 | 6.9% |

Source:

U. S. Department of Energy, Energy Information Administration, *Alternatives to Traditional Transportation Fuels, 1998*, Washington, DC, 1999, web site www.eia.doe.gov/cneaf/solar.renewables/alt_trans_fuel98/table1.html.
(Additional resources: www.eia.doe.gov)

^aBased on plans or projections.

^bDoes not include flex-fuel vehicles.

Table 9.2
Estimates of Light Alternative Fuel Vehicles, 1996, 1998, and 2000

| Fuel type | Private | | | State and local government | | | Federal Government | | |
|--------------|----------------|----------------|-------------------|----------------------------|---------------|-------------------|--------------------|---------------|-------------------|
| | 1996 | 1998 | 2000 ^a | 1996 | 1998 | 2000 ^a | 1996 | 1998 | 2000 ^a |
| LPG | 167,000 | 170,000 | 170,000 | 43,000 | 42,000 | 42,000 | 193 | 159 | 839 |
| CNG | 25,020 | 35,357 | 47,400 | 11,305 | 15,913 | 21,415 | 13,945 | 12,469 | 13,569 |
| LNG | 10 | 75 | 75 | 45 | 43 | 43 | 72 | 0 | 0 |
| M-85 | 6,633 | 10,773 | 10,111 | 5,958 | 8,313 | 8,252 | 7,668 | 541 | 341 |
| M-100 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| E-85 | 793 | 2,595 | 4,944 | 1,995 | 5,906 | 8,786 | 1,748 | 4,277 | 16,277 |
| E-95 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Electricity | 2,451 | 8,219 | 4,307 | 487 | 1,432 | 2,083 | 188 | 146 | 846 |
| Total | 201,907 | 222,218 | 236,837 | 62,790 | 73,607 | 82,579 | 23,814 | 17,592 | 31,872 |

Source:

U. S. Department of Energy, Energy Information Administration, *Alternatives to Traditional Transportation Fuels, 1998*, Washington, DC, 1999, web site www.eia.doe.gov/cneaf/solar.renewables/alt_trans_fuel98/atf1-13_99.html.

(Additional resources: www.eia.doe.gov)

Note: Light vehicles are less than or equal to 8,500 lbs. gross vehicle weight

^aBased on plans or projections.

Table 9.3
Estimates of Heavy Alternative Fuel Vehicles, 1996, 1998, and 2000

| Fuel type | Private | | | State and local government | | | Federal government | | |
|--------------|---------------|---------------|-------------------|----------------------------|---------------|-------------------|--------------------|------------|-------------------|
| | 1996 | 1998 | 2000 ^a | 1996 | 1998 | 2000 ^a | 1996 | 1998 | 2000 ^a |
| LPG | 43,000 | 43,000 | 45,000 | 10,000 | 11,000 | 12,000 | 2 | 16 | 16 |
| CNG | 5,485 | 7,972 | 10,396 | 4,389 | 6,378 | 8,318 | 0 | 693 | 893 |
| LNG | 77 | 204 | 280 | 453 | 836 | 1,144 | 6 | 14 | 140 |
| M85 | 0 | 0 | 0 | 6 | 19 | 19 | 0 | 2 | 2 |
| M100 | 0 | 0 | 0 | 172 | 200 | 200 | 0 | 0 | 0 |
| E85 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 10 | 10 |
| E95 | 4 | 0 | 0 | 357 | 14 | 14 | 0 | 0 | 0 |
| Electricity | 32 | 43 | 43 | 113 | 189 | 296 | 9 | 15 | 15 |
| Total | 48,598 | 51,219 | 55,719 | 15,490 | 18,636 | 21,991 | 17 | 734 | 1,076 |

Source:

U. S. Department of Energy, Energy Information Administration, *Alternatives to Traditional Transportation Fuels*, 1998, Washington, DC, 1999, web site www.eia.doe.gov/cneaf/solar.renewables/alt_trans_fuel98/atf1-13_99.html.

(Additional resources: www.eia.doe.gov)

Note: Heavy vehicles are above 8,500 lbs. gross vehicle weight.

^aBased on plans or projections.

Table 9.4
Alternative Fuel Vehicles Available by Manufacturer, Model Year 2000

| Model | Fuel | Type | Emission class |
|---|----------------------------------|------------------------|---------------------|
| Daimler Chrysler: 1-800-999-FLEET | | | |
| EPIC (CA, NY—lease only) | Electric-lead acid or NiMH | Minivan | ZEV |
| Minivan | E-85 | Minivan | N/A |
| Ram Wagon | CNG dedicated | Large van | ULEV/ILEV/SULEV |
| Ram Van | CNG dedicated | Large van | ULEV/ILEV/SULEV |
| Ford: 1-877-ALT-FUEL | | | |
| Ranger | Electric-lead acid | Standard pickup | ZEV |
| Ranger | E-85 flex-fuel | Standard pickup | TLEV |
| Contour (QVM) | CNG bi-fuel | Compact | TLEV |
| Crown Victoria | CNG dedicated | Large car | ULEV/ILEV |
| Econoline | CNG dedicated | Full-size van | ULEV/ILEV/SULEV |
| F-Series | CNG dedicated or CNG/LPG bi-fuel | Standard pickup | LEV/ULEV/ILEV/SULEV |
| Taurus | E-85 flex-fuel | Large car | TLEV |
| Th!nk (select markets) | Electric-NiCd | Two-seater | ZEV |
| General Motors: 1-800-25Electric, 313-556-7723 or 1-888-GM-AFT-4U (CNG) | | | |
| EV1 (CA and AZ only) | Electric-lead acid or NiMH | Two-seater | ZEV |
| Chevrolet S-10 | Electric-lead acid or NiMH | Small pickup | ILEV/ZEV |
| Chevrolet S-10 | E85 flex-fuel | Small pickup | LEV |
| Chevrolet Cavalier | CNG bi-fuel | Subcompact | LEV |
| Honda: 1-888-CCHonda | | | |
| Insight | Hybrid EV-NiMH | Two-seater | LEV/ULEV |
| Civic GX (CA, NY fleets only) | CNG dedicated | Subcompact | ILEV/ULEV |
| Mazda: 1-800-222-5500 | | | |
| B3000 | E85 flex fuel | Standard pickup | LEV/TLEV |
| Nissan: 1-310-771-3422 | | | |
| Altra EV (CA fleets only) | Electric lithium-ion | Mid-size wagon | ZEV |
| Solectria Corporation: 1-508-658-2231 | | | |
| Flash | Electric-lead acid | Small pickup truck | ZEV |
| Force | Electric-lead acid, NiMH, NiCd | Compact | ZEV |
| Toyota: 1-800-331-4331 (Press 3 for Alternative Fuel Information) (Fleet sales only) | | | |
| RAV4-EV (select markets) | Electric-lead acid, NiMH | Sports utility vehicle | ZEV |
| Camry | CNG dedicated | Compact | N/A |
| Prius (Summer 2000) | Hybrid EV | Compact | SULEV |

Source:

U.S. Department of Energy, National Alternative Fuels Data Center, web site, www.afdc.doe.gov/pdfs/my00.pdf, November 1999.
 (Additional resources: www.afdc.nrel.gov)

Note:

LEV=low emission vehicle. ILEV=inherently low emission vehicle. ULEV=ultra low emission vehicle. ZEV=zero emission vehicle.
 TLEV=transitional low emission vehicle.

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

Table 9.5
Number of Alternative Refuel Sites by State and Fuel Type, 1999

| State | M85 sites | CNG sites | E85 sites | LPG sites | LNG sites | Electric sites | Total |
|----------------------|-----------|--------------|-----------|--------------|-----------|----------------|--------------|
| Alabama | 0 | 16 | 0 | 151 | 2 | 0 | 169 |
| Alaska | 0 | 0 | 0 | 12 | 0 | 0 | 12 |
| Arizona | 1 | 28 | 0 | 81 | 3 | 46 | 159 |
| Arkansas | 0 | 6 | 0 | 133 | 0 | 0 | 139 |
| California | 36 | 208 | 0 | 517 | 9 | 336 | 1106 |
| Colorado | 0 | 44 | 1 | 93 | 2 | 0 | 140 |
| Connecticut | 0 | 27 | 0 | 48 | 0 | 1 | 76 |
| Delaware | 0 | 6 | 0 | 2 | 0 | 0 | 8 |
| District of Columbia | 0 | 4 | 0 | 0 | 0 | 1 | 5 |
| Florida | 1 | 43 | 0 | 109 | 1 | 5 | 159 |
| Georgia | 0 | 70 | 0 | 80 | 2 | 29 | 181 |
| Hawaii | 0 | 0 | 0 | 24 | 0 | 3 | 28 |
| Idaho | 0 | 7 | 1 | 29 | 0 | 1 | 38 |
| Illinois | 0 | 24 | 5 | 65 | 0 | 2 | 96 |
| Indiana | 0 | 38 | 1 | 46 | 3 | 1 | 89 |
| Iowa | 0 | 5 | 5 | 69 | 0 | 1 | 80 |
| Kansas | 0 | 6 | 1 | 123 | 1 | 0 | 131 |
| Kentucky | 0 | 9 | 2 | 24 | 0 | 0 | 35 |
| Louisiana | 0 | 15 | 0 | 25 | 0 | 0 | 40 |
| Maine | 0 | 1 | 0 | 57 | 0 | 0 | 58 |
| Maryland | 0 | 27 | 0 | 18 | 2 | 1 | 48 |
| Massachusetts | 0 | 17 | 0 | 69 | 0 | 4 | 90 |
| Michigan | 0 | 32 | 2 | 267 | 1 | 7 | 309 |
| Minnesota | 0 | 15 | 11 | 82 | 1 | 0 | 109 |
| Mississippi | 0 | 3 | 0 | 63 | 0 | 0 | 66 |
| Missouri | 0 | 10 | 4 | 295 | 0 | 0 | 309 |
| Montana | 0 | 11 | 1 | 56 | 1 | 0 | 69 |
| Nebraska | 0 | 6 | 6 | 44 | 0 | 0 | 57 |
| Nevada | 0 | 18 | 0 | 56 | 0 | 0 | 74 |
| New Hampshire | 0 | 2 | 0 | 68 | 0 | 1 | 71 |
| New Jersey | 0 | 22 | 0 | 25 | 0 | 0 | 47 |
| New Mexico | 0 | 14 | 0 | 243 | 1 | 0 | 258 |
| New York | 12 | 57 | 0 | 98 | 0 | 6 | 173 |
| N. Carolina | 0 | 9 | 0 | 94 | 0 | 7 | 110 |
| N. Dakota | 0 | 4 | 2 | 14 | 0 | 0 | 20 |
| Ohio | 0 | 49 | 0 | 57 | 1 | 1 | 108 |
| Oklahoma | 0 | 61 | 0 | 34 | 0 | 0 | 95 |
| Oregon | 0 | 9 | 0 | 30 | 1 | 0 | 40 |
| Pennsylvania | 0 | 59 | 0 | 100 | 1 | 1 | 161 |
| Rhode Island | 0 | 4 | 0 | 9 | 0 | 0 | 13 |
| S. Carolina | 0 | 4 | 0 | 74 | 0 | 1 | 79 |
| S. Dakota | 0 | 4 | 6 | 29 | 0 | 0 | 39 |
| Tennessee | 0 | 5 | 0 | 36 | 0 | 2 | 43 |
| Texas | 0 | 73 | 0 | 231 | 8 | 2 | 314 |
| Utah | 0 | 62 | 0 | 22 | 1 | 0 | 85 |
| Vermont | 0 | 1 | 0 | 62 | 0 | 7 | 70 |
| Virginia | 0 | 27 | 0 | 40 | 3 | 18 | 88 |
| Washington | 1 | 28 | 0 | 88 | 1 | 6 | 124 |
| W. Virginia | 0 | 39 | 0 | 14 | 0 | 0 | 53 |
| Wisconsin | 0 | 20 | 1 | 112 | 0 | 0 | 133 |
| Wyoming | 0 | 18 | 0 | 35 | 1 | 0 | 54 |
| Total | 51 | 1,267 | 49 | 4,153 | 46 | 490 | 6,058 |

Source:

U.S. Department of Energy, Alternative Fuels Data Center web site, www.afdc.doe.gov/refuel/state_tot.shtml, January 2000.

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. It establishes a plan, carried out at the local level, for creating a sustainable, nationwide alternative fuels market.

Table 9.6
List of Clean Cities as of 12/1/99 by Designation

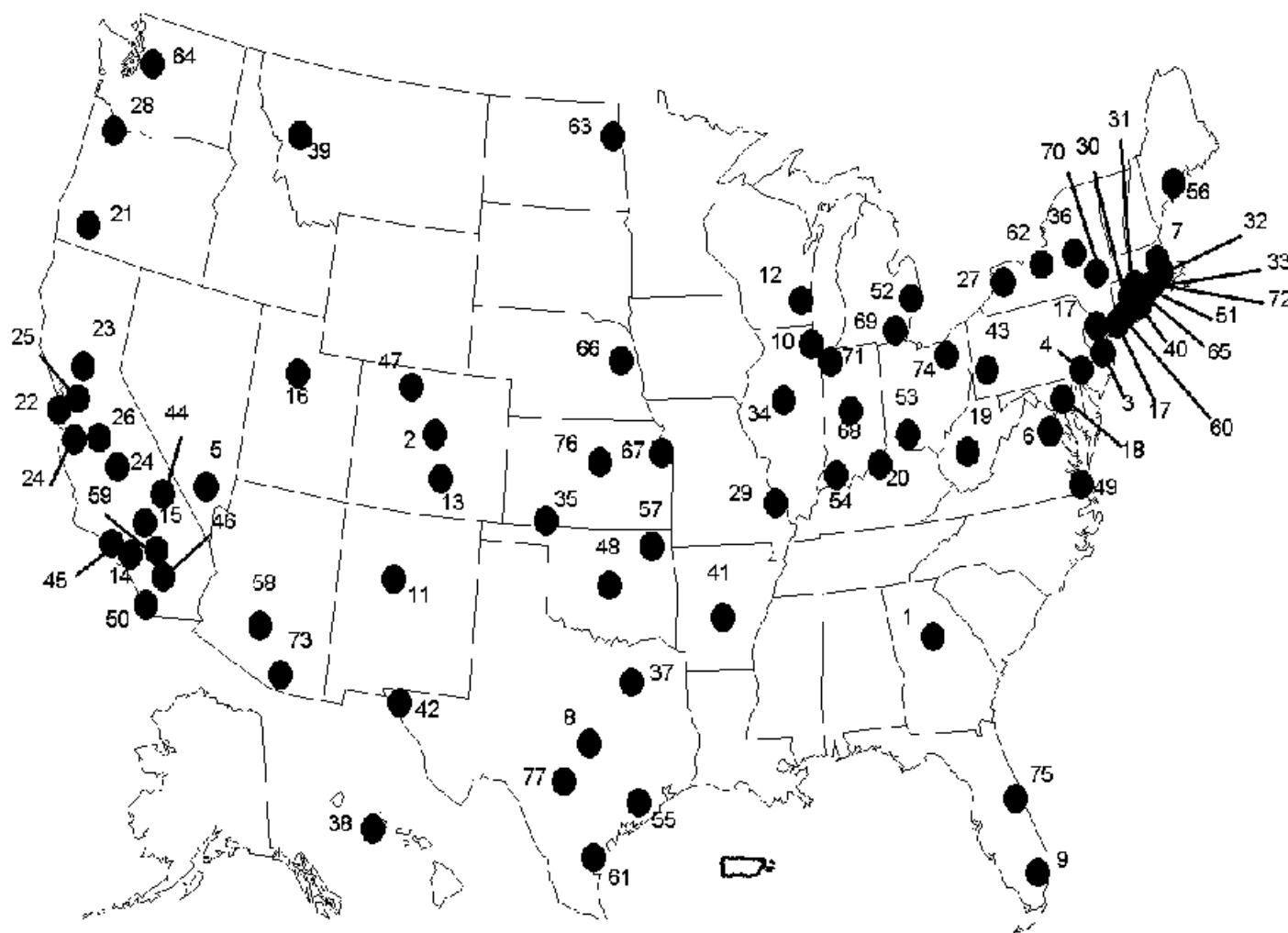
| | |
|---|--|
| 1. Atlanta, GA - 9/8/93 | 40. New Haven, CT - 10/5/95 |
| 2. Denver, CO - 9/13/93 | 41. Central Arkansas - 10/25/95 |
| 3. Philadelphia, PA - 9/22/93 | 42. Paso Del Norte - 11/17/95 |
| 4. State of Delaware - 10/12/93 | 43. Pittsburgh, PA - 12/5/95 |
| 5. Las Vegas, NV - 10/18/93 | 44. S. California Assn. Gov. - 3/1/96 |
| 6. Washington, DC - 10/21/93 | 45. Los Angeles, CA - 3/22/96 |
| 7. Boston, MA - 3/18/94 | 46. Coachella Valley, CA - 4/22/96 |
| 8. Austin, TX - 4/18/94 | 47. Weld/Larimer/Rocky Mountain National Park - 5/21/96 |
| 9. Florida Gold Coast - 5/3/94 | 48. Central Oklahoma - 5/29/96 |
| 10. Chicago, IL - 5/13/94 | 49. Hampton Roads, VA - 10/4/96 |
| 11. Land of Enchantment, NM - 6/1/94 | 50. San Diego, CA - 12/12/96 |
| 12. Wisconsin - SE Area - 6/30/94 | 51. Long Island, NY - 10/18/96 |
| 13. Colorado Springs, CO - 7/13/94 | 52. Detroit, MI/Toronto, ON - 12/18/96 |
| 14. Long Beach, CA - 8/31/94 | 53. Cincinnati, OH - 1/29/97 |
| 15. Lancaster, CA - 9/22/94 | 54. Evansville, IN - 1/30/97 |
| 16. Salt Lake City, UT - 10/3/94 | 55. Houston-Galveston, TX - 9/4/97 |
| 17. White Plains, NY - 10/4/94 | 56. Portland, ME - 9/4/97 |
| 18. Baltimore, MD - 10/7/94 | 57. Tulsa, OK - 9/22/97 |
| 19. State of WV - 10/18/94 | 58. Maricopa Assn. of Govts. - 10/8/97 |
| 20. Commonwealth CC Partnership, KY - 10/18/94 | 59. Riverside, CA - 10/24/97 |
| 21. Rogue Valley, OR - 11/10/94 | 60. North Jersey, NJ - 10/31/97 |
| 22. San Francisco, CA - 10/21/94 | 61. Texas Coastal (Corpus Christi), TX - 3/30/98 |
| 23. Sacramento, CA - 10/21/94 | 62. Genesee Region (Rochester), NY - 5/28/98 |
| 24. South Bay (San Jose), CA - 10/21/94 | 63. Red River Valley/Grand Forks, ND - 8/10/98 |
| 25. East Bay, CA - 10/21/94 | 64. Puget Sound, WA - 8/13/98 |
| 26. San Joaquin Valley, CA - 10/21/94 | 65. RI - Ocean States - 9/14/98 |
| 27. Western New York - 11/4/94 | 66. Omaha, NE - 9/18/98 |
| 28. Columbia-Willamette, OR - 11/10/94 | 67. Kansas City, KS/MO - 11/18/98 |
| 29. St. Louis, MO - 11/18/94 | 68. Central Indiana CC Alliance, IN - 3/4/99 |
| 30. Waterbury, CT - 11/21/94 | 69. Ann Arbor, MI - 4/19/99 |
| 31. Connecticut Southwestern Area, - 11/21/94 | 70. Capital District (Albany), NY - 4/26/99 |
| 32. Norwich, CT - 11/22/94 | 71. South Shore, IN - 6/15/99 |
| 33. New London, CT - 11/22/94 | 72. Capital Clean Cities of CT - 6/21/99 |
| 34. Peoria, IL - 11/22/94 | 73. Tucson, AZ - 8/24/99 |
| 35. Kansas - SW Area - 3/30/95 | 74. NE Clean Fuels Coalition (Cleveland) - 9/14/99 |
| 36. Central New York - 6/15/95 | 75. Florida Space Coast - 10/1/99 |
| 37. Dallas/Ft. Worth, TX - 7/25/95 | 76. Manhattan Area, KS - 10/4/99 |
| 38. Honolulu, HI - 8/29/95 | 77. The Alamo Area (San Antonio) - 11/10/99 |
| 39. Missoula, MT - 9/21/95 | |

For more information, contact the Clean Cities Hotline at (800) CCITIES, or write to: U.S. Department of Energy, EE-33, Clean Cities Program, 1000 Independence Avenue SW, Washington, DC 20585.

Source:

U.S. Department of Energy, Alternative Fuel Information, *Clean Cities: Guide to Alternative Fuel Vehicle Incentives & Laws*, Washington, DC, November 1996, and updates from web site, February 2000.
(Additional resources: www.ccities.doe.gov)

Figure 9.1 Map of Clean Cities as of 12/1/99

**Source:**

U.S. Department of Energy, Alternative Fuel Information, *Clean Cities: Guide to Alternative Fuel Vehicle Incentives & Laws*, Washington, DC, November 1996, and updates from the web site, February 2000. (Additional resources: www.cities.doe.gov)

Electric and hybrid-electric vehicles are required to be sold in California under the California Low-Emission Vehicle (LEV) program. Other states, such as New York, Texas, and Massachusetts, have indicated that they will also enforce the LEV program. The U.S. Advanced Battery Consortium (USABC) was established in January 1991 to concentrate efforts on battery development for future electric vehicles. The USABC consists of the Big Three U.S. auto manufacturers (Daimler-Chrysler, Ford, General Motors), the Electric Power Research Institute, and the U.S. Department of Energy.

Table 9.7
U.S. Advanced Battery Consortium Goals for Electric Vehicle Batteries

| Primary criteria | Long-term goals ^a (2000) |
|---|--|
| Power density ^b W/L | 460 |
| Specific power ^b W/kg (80% DOD/30 sec) | 300 |
| Energy density ^b Wh/L (C/3 discharge rate) | 230 |
| Specific energy ^b Wh/kg (C/3 discharge rate) | 150 |
| Life (years) | 10 |
| Cycle life ^b (cycles) (80% DOD) | 1000 1800 (@ 50% DOD) 2670 (@ 30% DOD) |
| Power and capacity degradation ^b (% of rated spec) | 20% |
| Ultimate price ^c (\$/kWh) (10,000 units @ 40 kWh) | < \$150 (desired to 75) |
| Operating environment | -30 to 65°C |
| Recharge time ^b | < 6 hours |
| Continuous discharge in 1 hour (no failure) | 75% (of rated energy capacity) |
| Secondary criteria | |
| Efficiency (C/3 discharge & C/3 charge) ^d | 80% |
| Self discharge ^b | < 20% in 12 days |
| Maintenance | No maintenance. Service by qualified personnel only. |
| Thermal loss ^b | Covered by self discharge |
| Abuse resistance ^b | Tolerant Minimized by on-board controls |

Source:

U.S. Department of Energy, Office of Transportation Technologies, Washington, DC, February, 1998.

Note:

W=watt; kg=kilogram; L=liter; DOD=depth of discharge; Wh=watt-hour; kWh=kilowatt-hour.

Additional information about USABC is available at: www.uscar.org/techno/store.htm.

^aFor interim commercialization (Reflects USABC revisions of September 1996).

^bSpecifics on criteria can be found in "USABC Electric Vehicle Battery Test Procedures Manual Revision 2" DOE/ID-10479, Rev. 2, January 1996.

^cCost to the Original Equipment Manufacturers.

^dRoundtrip charge/discharge efficiency.

The Partnership for a New Generation of Vehicles (PNGV) is an historic public/private partnership between the U.S. federal government (led by the Technology Administration at the Department of Commerce, and including 7 agencies and 19 federal laboratories) and DaimlerChrysler, Ford, and General Motors that aims to strengthen America's competitiveness by developing technologies for a new generation of vehicles.

PNGV's long term goal is to develop an environmentally friendly car with up to triple the fuel efficiency of today's midsize cars-- without sacrificing affordability, performance, or safety. Two other PNGV goals are to significantly improve national competitiveness in automotive manufacturing and to apply commercially viable innovation to conventional vehicles.

Table 9. 8
PNGV Goals and Specifications of Hybrid-Electric Vehicles

| Parameter | PNGV Goals | PNGV Concept Vehicles | | | Toyota Prius | Honda Insight |
|-------------------------|----------------------------------|---|---|---|-------------------------|-------------------------|
| | | Dodge ESX3 | Ford Prodigy | GM Precept | | |
| Fuel economy | up to 80 mpg (3x current mpg) | 72 mpg gas equiv. 80 mpg diesel ^a | 72 mpg gas equiv. 80 mpg diesel ^a | 80 mpg gas equiv. 90 mpg diesel ^a | 56 mpg gas | 64 mpg gas |
| Range | 380 miles | 400 miles | 660 miles | 380 miles | 550 miles | 600 miles |
| Acceleration (0–60 mph) | 12.0 seconds | 11.0 seconds | 12.0 seconds | 11.5 seconds | 14.1 seconds | 12.0 seconds |
| Emissions | Default Tier 2 | Target is Tier 2 | Target is Tier 2 | Target is Tier 2 | SULEV | ULEV |
| Aerodynamics | 0.20 Cd | 0.22 Cd | 0.199 Cd | 0.163 Cd | 0.30 Cd | 0.25 Cd |
| Curb weight | 1,980 lbs. | 2,250 lbs. | 2,387 lbs. | 2,592 lbs. | 2,734 lbs. | 1,856 lbs. |
| Passenger capacity | Up to 6 | 5 | 5 | 5 | 5 | 2 |
| Dimensions: Length | | 192.8 in. | 186.9 in. | 193.2 in. | 168.3 in. | 155.1 in. |
| Width | | 74.2 in. | 69.1 in. | 67.9 in. | 66.7 in. | 66.7 in. |
| Cargo Capacity | 16.8 ft ³ | 16.0 ft ³ | 14.6 ft ³ | 4.4 ft ³ | 10.0 ft ³ | 7.0 ft ³ |
| Safety | Meet FMVSS ^b | Meet FMVSS ^b | Meet FMVSS ^b | Meet FMVSS ^b | Meet FMVSS ^b | Meet FMVSS ^b |

Source:

Partnership for a New Generation of Vehicles, Media Information, 2000. (Additional resources: www.ta.doc.gov/pngv/cover/pngvcover.htm)

^aFuel economy for Dodge using “Designer” diesel (0 ppm sulfur); Ford using Swedish clean diesel (<10 ppm sulfur); GM using California low-sulfur diesel (<30 ppm sulfur).

^bFederal Motor Vehicle Safety Standards.

Chapter 10

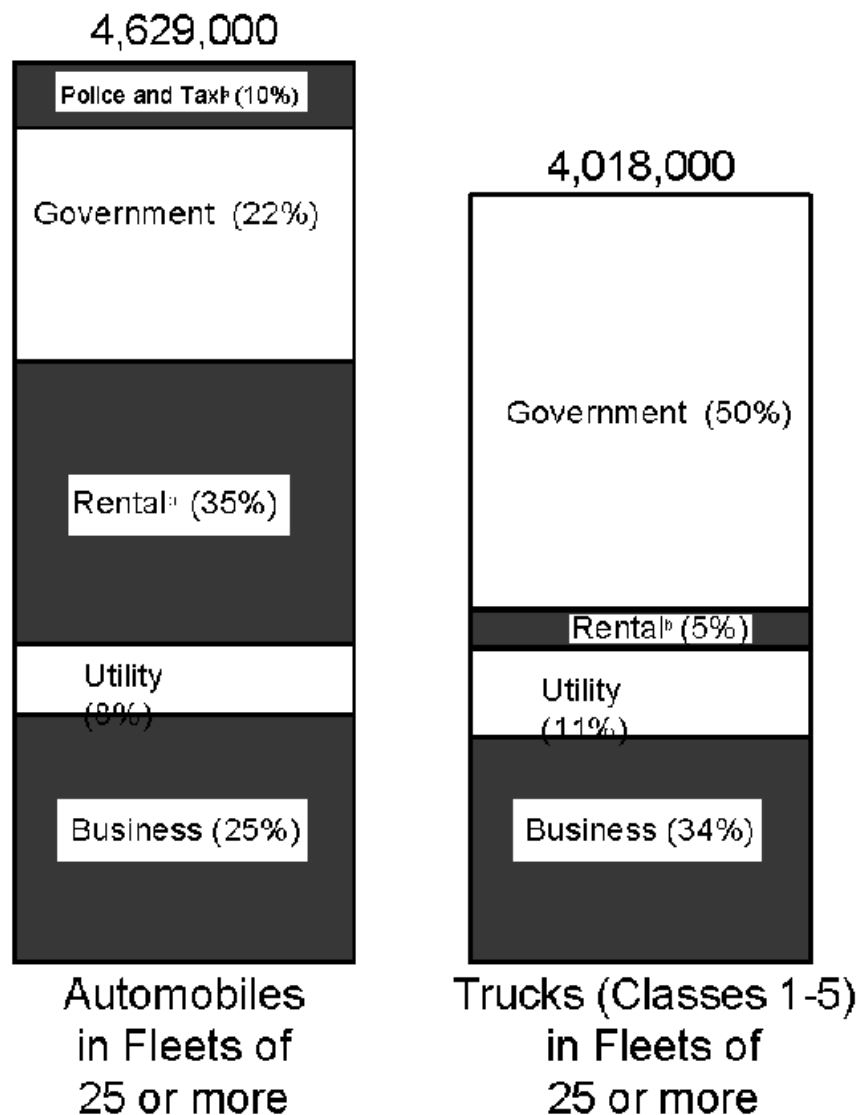
Fleet Vehicles and Characteristics

Summary Statistics from Tables/Figures in this Chapter

| Source | | |
|-------------|--------------------------------------|-----------|
| Figure 10.1 | Fleet automobiles, 1999 | 4,629,000 |
| Figure 10.1 | Fleet Class 1-5 Trucks, 1999 | 4,018,000 |
| Table 10.4 | Average annual miles per automobile | |
| | <i>Business fleets</i> | 29,200 |
| | <i>Utility fleets</i> | 14,500 |
| | <i>Government fleets</i> | 13,700 |
| Table 10.5 | Federal Government vehicles, FY 1997 | 548,978 |
| | <i>Automobiles</i> | 113,460 |
| | <i>Buses</i> | 6,048 |
| | <i>Light trucks</i> | 381,674 |
| | <i>Medium trucks</i> | 29,817 |
| | <i>Heavy trucks</i> | 17,979 |

Significant changes have been made in recent years to fleet vehicle estimations. Newly available data improve the accuracy of fleet vehicle estimates but, at the same time, make it impossible to compare the data historically. Therefore, only the 1999 data are presented here.

Figure 10.1. Fleet Vehicles in Service as of January 1, 1999



Source:

Bobit Publishing Company, Automotive Fleet Research Department, *Automotive Fleet Factbook 1999*, Redondo Beach, CA, 1999. (Additional resources: www.fleet-central.com)

Note:

Truck classes 1-5 are 19,500 lbs. and less.

^aTaxi category includes vans.

^bRental category includes vans and sports utility vehicles under *automobiles*, not trucks.

These are the top ten states in terms of fleets and fleet vehicles, according to Dwight's Energydata, Denver, CO. Autos and light trucks make up the largest share of fleet vehicles in each of the states. The average number of vehicles per fleet is the highest in Florida and California.

Table 10.1
Top Ten States with Fleets of Ten Vehicles or More, 1999

| <i>States</i> | <i>Fleets of ten vehicles or more</i> | <i>Fleet vehicles</i> | | | | <i>Total</i> | <i>Average vehicles per fleet¹</i> |
|-----------------------|---|-----------------------|-------------------------------|-------------------------------|-------------------------------|--------------|---|
| | | <i>Autos</i> | <i>Trucks (class 1-2)</i> | <i>Trucks (class 3-5)</i> | <i>Trucks (class 6-8)</i> | | |
| <i>California</i> | 12,005 | 474,627 | 443,869 | 205,883 | 321,332 | 1,457,716 | 121 |
| <i>Texas</i> | 8,851 | 260,885 | 262,270 | 107,599 | 247,960 | 887,565 | 100 |
| <i>New York</i> | 6,706 | 227,144 | 191,415 | 78,215 | 182,015 | 685,495 | 102 |
| <i>Pennsylvania</i> | 5,973 | 166,880 | 148,086 | 52,840 | 179,086 | 552,865 | 93 |
| <i>Florida</i> | 5,986 | 233,209 | 208,919 | 88,230 | 199,408 | 735,752 | 123 |
| <i>Illinois</i> | 5,653 | 178,939 | 149,886 | 76,441 | 179,770 | 590,689 | 104 |
| <i>Ohio</i> | 5,418 | 177,830 | 130,846 | 60,350 | 163,627 | 538,071 | 99 |
| <i>Michigan</i> | 3,945 | 149,536 | 103,684 | 53,670 | 104,373 | 415,208 | 105 |
| <i>New Jersey</i> | 3,919 | 139,327 | 121,717 | 35,172 | 119,839 | 419,974 | 107 |
| <i>North Carolina</i> | 3,821 | 102,047 | 109,667 | 38,342 | 142,354 | 396,231 | 104 |

Source:

Bobit Publishing Company, *Automotive Fleet Industry Statistics* web site:

[www.fleet-central.com /AF/Resources/Stats/chart3.htm](http://www.fleet-central.com/AF/Resources/Stats/chart3.htm). Original data source: Dwight's Energydata, Denver, CO. (Additional resources: www.fleet-central.com/AF)

These fleet data, which were generated from a 1991–92 ORNL study, are still the latest available data of this kind.

Table 10.2
Fleet Vehicle Composition by Vehicle Type, 1991
(percent)

| <i>Fleet type</i> | <i>Cars</i> | <i>Light trucks^a and vans</i> | <i>Medium trucks^b</i> | <i>Heavy trucks^c</i> | <i>Total</i> |
|-------------------|-------------|--|--------------------------------------|-------------------------------------|--------------|
| <i>Business</i> | 24.2% | 21.1% | 45.8% | 8.9% | 100% |
| <i>Utility</i> | 22.6% | 39.0% | 15.0% | 23.4% | 100% |
| <i>Government</i> | 48.5% | 42.8% | 6.8% | 1.8% | 100% |

Table 10.3
Average Length of Time Fleet Vehicles are Kept Before Sold to Others, 1991
(months)

| | <i>Business</i> | <i>Utility</i> | <i>Government</i> |
|----------------------------------|-----------------|----------------|-------------------|
| <i>Cars</i> | 35 | 68 | 81 |
| <i>Light trucks^a</i> | 56 | 60 | 82 |
| <i>Medium trucks^b</i> | 83 | 86 | 96 |
| <i>Heavy trucks^c</i> | 103 | 132 | 117 |

Table 10.4
Average Annual and Daily Vehicle-Miles of Travel for Fleet Vehicles, 1991

| <i>Vehicle type</i> | <i>Business</i> | | <i>Utility</i> | | <i>Government</i> | |
|----------------------------------|-------------------------------|---------------------------------|-------------------------------|---------------------------------|-------------------------------|---------------------------------|
| | <i>Miles/year</i> | <i>Miles/day</i> | <i>Miles/year</i> | <i>Miles/day</i> | <i>Miles/year</i> | <i>Miles/day</i> |
| | <i>(thousands</i> <i>)</i> | <i>@250</i> <i>days/year</i> | <i>(thousands</i> <i>)</i> | <i>@250</i> <i>days/year</i> | <i>(thousands</i> <i>)</i> | <i>@250</i> <i>days/year</i> |
| <i>Cars</i> | 29.2 | 117 | 14.5 | 58 | 13.7 | 55 |
| <i>Light trucks^a</i> | 26.6 | 106 | 17.5 | 70 | 13.9 | 56 |
| <i>Medium trucks^b</i> | 17.5 | 70 | 11.8 | 47 | 11.9 | 48 |
| <i>Heavy trucks^c</i> | 64.4 | 258 | 13.8 | 55 | 10.7 | 43 |

Source:

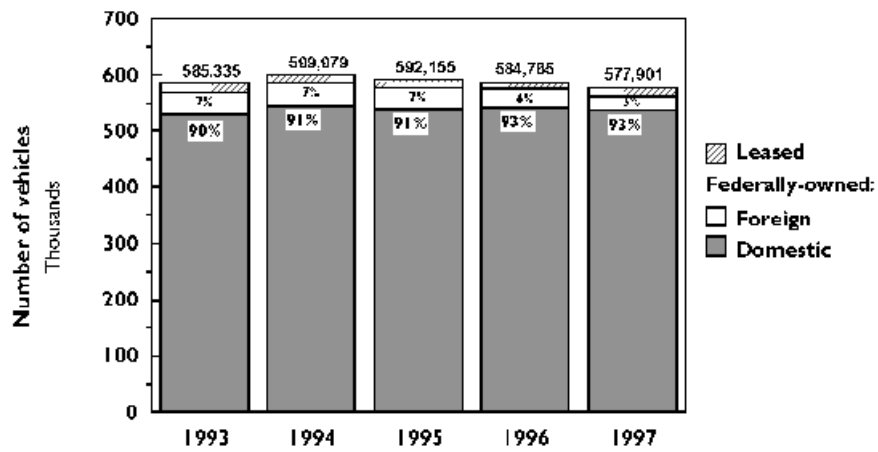
Miaou, S. P., et. al., *Fleet Vehicles in the United States: Composition, Operating Characteristics, and Fueling Practices*, (ORNL-6717), Oak Ridge National Laboratory, Oak Ridge, TN, May 1992.
(Additional resources: www-cta.ornl.gov)

^aIn this study, light trucks are <8,500 lbs gross vehicle weight.

^bIn this study, medium trucks are between 8,500–26,000 lbs gross vehicle weight.

^cIn this study, heavy trucks are >26,000 lbs gross vehicle weight.

Figure 10.2. Worldwide Federal Inventory, 1992–97

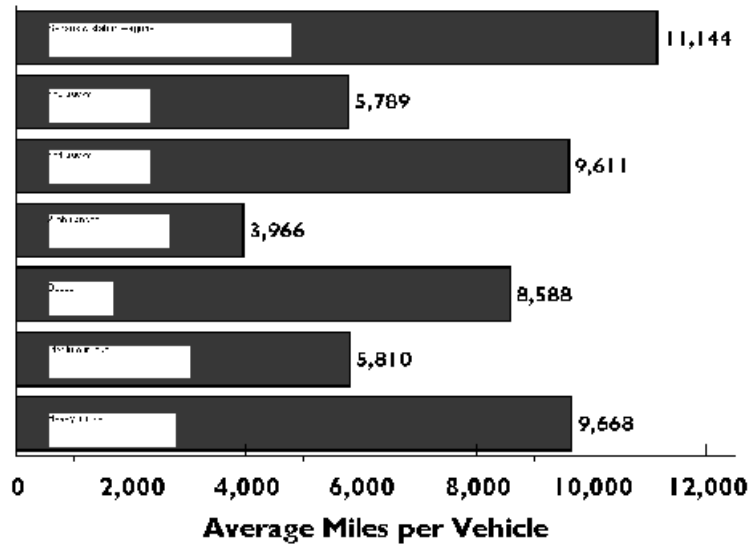


Source:

U.S. General Services Administration, Federal Vehicle Policy Division, FY 1997 Federal Fleet Report, Washington, DC, 1999, Tables 1 and 12.

(Additional resources: policyworks.gov/org/main/mt/homepage/mtv/mtvhp.htm)

Figure 10.3. Average Miles per Federal Vehicle by Vehicle Type, 1997



Source:

U.S. General Services Administrations, Federal Vehicle Policy Division, FY 1997 Federal Fleet Report, Washington, DC, 1999, Table 5.

(Additional resources: policyworks.gov/org/main/mt/homepage/mtv/mtvhp.htm)

Table 10.5
Federal Government Vehicles by Agency, Fiscal Year 1997^a

| <i>Department or Agency</i> | <i>Autos</i> | <i>Buses</i> | <i>Light trucks^b</i> | <i>Medium trucks^c</i> | <i>Heavy trucks^d</i> | <i>Total</i> |
|--|--------------------|------------------|---------------------------------|----------------------------------|---------------------------------|--------------------|
| <i>Department of Agriculture</i> | 3,273 | 42 | 24,614 | 5,247 | 602 | 33,778 |
| <i>Department of Commerce</i> | 144 | 2 | 416 | 228 | 12 | 802 |
| <i>Department of Education</i> | 1 | 0 | 2 | 0 | 0 | 3 |
| <i>Department of Energy</i> | 784 | 164 | 3,606 | 919 | 794 | 6,267 |
| <i>Department of Health & Human</i> | 89 | 7 | 326 | 147 | 58 | 627 |
| <i>Department of Housing & Urban Dev.</i> | 3 | 0 | 1 | 0 | 0 | 4 |
| <i>Department of Justice</i> | 25,190 | 314 | 12,742 | 976 | 271 | 39,493 |
| <i>Department of Labor</i> | 19 | 1 | 144 | 14 | 3 | 181 |
| <i>Department of State</i> | 103 | 0 | 84 | 0 | 11 | 198 |
| <i>Department of Interior</i> | 1,374 | 80 | 9,160 | 3,506 | 1,420 | 15,540 |
| <i>Department of Treasury</i> | 10,960 | 18 | 3,760 | 307 | 96 | 15,141 |
| <i>Department of Transportation</i> | 30 | 16 | 411 | 96 | 67 | 620 |
| <i>Department of Veterans Affairs</i> | 470 | 120 | 1,036 | 243 | 115 | 1,984 |
| <i>Environmental Protection Agency</i> | 57 | 0 | 233 | 70 | 15 | 375 |
| <i>Federal Communications Comm</i> | 55 | 0 | 63 | 2 | 0 | 120 |
| <i>Federal Emergency Mgmt Agency</i> | 28 | 6 | 253 | 25 | 0 | 312 |
| <i>General Services Administration^e</i> | 54,263 | 2,932 | 88,808 | 3,636 | 3,707 | 153,346 |
| <i>Natl Aeronautics & Space Admin.</i> | 103 | 43 | 806 | 326 | 75 | 1,353 |
| <i>Small Business Administration</i> | 115 | 0 | 0 | 0 | 0 | 115 |
| <i>Tennessee Valley Authority</i> | 427 | 0 | 1,012 | 999 | 226 | 2,664 |
| <i>Others</i> | 94 | 19 | 396 | 37 | 50 | 596 |
| CIVILIAN AGENCIES | 97,582 | 3,764 | 147,873 | 16,778 | 7,522 | 273,519 |
| U.S. POSTAL SERVICE | 9,342 | 6 | 180,346 | 9,293 | 4,927 | 203,914 |
| <i>Department of the Air Force</i> | 2,591 | 1,191 | 22,679 | 970 | 2,348 | 29,779 |
| <i>Department of the Army</i> | 124 | 26 | 247 | 163 | 122 | 682 |
| <i>Department of the Navy</i> | 2,845 | 677 | 22,756 | 1,379 | 2,340 | 29,997 |
| <i>Other Defense Agencies</i> | 283 | 25 | 1,988 | 110 | 116 | 2,522 |
| <i>Corps of Engineers</i> | 223 | 4 | 2,410 | 575 | 311 | 3,523 |
| <i>U.S. Marine Corps</i> | 470 | 355 | 3,375 | 549 | 293 | 5,042 |
| MILITARY AGENCIES | 6,536 | 2,278 | 53,455 | 3,746 | 5,530 | 71,545 |
| TOTAL | 113,460 | 6,048 | 381,674 | 29,817 | 17,979 | 548,978 |

Source:

U.S. General Services Administration, *Federal Supply Service, FY 1997 Federal Fleet Report*, Washington, DC, 1999, Table 14. (Additional resources: policyworks.gov/org/main/mt/homepage/mtv/mtvhp.htm)

^a Federally-owned and commercially-leased vehicles.

^b Less than 8,500 lbs GVWR. Includes ambulances.

^c 8,501–23,999 lbs GVWR.

^d 24,000 lbs. Or more GVWR.

^e GSA Fleet vehicles.

Table 10.6
Federal Fleet Vehicle Acquisitions
by Fuel Type, FY 1997^a

| | <i>Vehicle acquisitions</i> |
|--------------------|-----------------------------|
| <i>Gasoline</i> | 14,097 |
| <i>Diesel</i> | 489 |
| <i>Natural gas</i> | 172 |
| <i>E-85</i> | 160 |
| <i>Electricity</i> | 139 |
| <i>Other</i> | 12 |
| <i>M-85</i> | 9 |
| <i>LPG</i> | 1 |
| <i>Biodiesel</i> | 0 |
| <i>Hydrogen</i> | 0 |
| <i>Total</i> | 15,079 ^a |

Source:

U.S. General Services Administrations, *Federal Vehicle Policy Division, FY 1997 Federal Fleet Report*, Washington, DC, 1999, Table 18.
 (Additional resources: policyworks.gov/org/main/mt/homepage/mtv/mtvhp.htm)

Table 10.7
Fuel Consumed by Federal Government Fleets, FY 1997^a

| | <i>Thousand gasoline equivalent gallons</i> |
|--------------------|---|
| <i>Gasoline</i> | 280,051 |
| <i>Diesel</i> | 64,834 |
| <i>NG</i> | 4,076 |
| <i>Electricity</i> | 287 |
| <i>Biodiesel</i> | 186 |
| <i>Methanol</i> | 151 |
| <i>M-85</i> | 137 |
| <i>LPG</i> | 37 |
| <i>Ethanol</i> | 19 |
| <i>Total</i> | 349,780 ^a |

Source:

U.S. General Services Administrations, *Federal Vehicle Policy Division, FY 1997 Federal Fleet Report*, Washington, DC, 1999, Table 6.
 (Additional resources: policyworks.gov/org/main/mt/homepage/mtv/mtvhp.htm)

^aThese data are reported under new requirements for FY 1997. Data for some agencies may be missing or incomplete.

The Energy Policy Act of 1992 (EPACT) set alternative fuel vehicle acquisition requirements for Federal and State Governments, fuel providers and the private sector. Additional rule making has adjusted the original purchase requirements. State government and fuel providers requirements began in 1997.

Table 10.8
Energy Policy Act Purchase Requirements of Light Alternative Fuel Vehicles

| <i>Year</i> | <i>Federal</i> | <i>State</i> | <i>Fuel providers</i> | <i>Private^a</i> |
|-------------|----------------|--------------|-----------------------|----------------------------|
| 1993 | 5,000 | - | - | - |
| 1994 | 7,500 | - | - | - |
| 1995 | 10,000 | - | - | - |
| 1996 | 25% | - | - | - |
| 1997 | 33% | 10% | 30% | - |
| 1998 | 50% | 15% | 50% | - |
| 1999 | 75% | 25% | 70% | - |
| 2000 | 75% | 50% | 90% | - |
| 2001 | 75% | 75% | 90% | - |
| 2002 | 75% | 75% | 90% | 20% |
| 2003 | 75% | 75% | 90% | 40% |
| 2004 | 75% | 75% | 90% | 60% |
| 2005 | 75% | 75% | 90% | 70% |
| 2006–on | 75% | 75% | 90% | 70% |

Source:

Final rule for the alternative fuels transportation programs, Federal Register, Vol. 61, p. 10622, March 14, 1996.

Private alternative fueled vehicle acquisition requirements for private and local government fleets, Federal Register, vol. 62, p. 19701, April 23, 1997.

Note:

The Department of Energy has provided an Alternative Fuel Vehicles Acquisitions and Credits Database on the Internet to provide fleet managers with a convenient way to report their compliance with this mandate. (www.ott.doe.gov/credits)

^aThe Department of Energy is presently considering implementation of private and municipal fleet rule making.

Chapter 11

Household Vehicles and Characteristics

Summary Statistics from Tables/Figures in this Chapter

| Source | | |
|-------------|--|----------------------|
| Table 11.1 | Vehicles per licensed driver, 1998 | 1.11 |
| Table 11.2 | Average household transportation expense, 1998 | 18.2% |
| Table 11.8 | Share of households owning 3 or more vehicles | |
| | <i>1960</i> | <i>2.5%</i> |
| | <i>1970</i> | <i>5.5%</i> |
| | <i>1980</i> | <i>17.5%</i> |
| | <i>1990</i> | <i>17.3%</i> |
| Table 11.12 | Average annual miles per household vehicle, 1995 | 11,800 |
| Figure 11.1 | Average occupancy rates by vehicle type, 1995 | |
| | <i>Automobile</i> | <i>1.6</i> |
| | <i>Pickup truck</i> | <i>1.4</i> |
| | <i>Sports Utility</i> | <i>1.7</i> |
| | <i>Van</i> | <i>2.1</i> |
| Table 11.13 | Share of workers who car pooled, 1990 | 13.4% |
| Figure 11.3 | Long-distance trips in the U.S., 1995 | |
| | <i>Trips</i> | <i>1,001 million</i> |
| | <i>Person-miles</i> | <i>827 billion</i> |

Table 11.1
Population and Vehicle Profile, 1950–98

| 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) | Vehicles per capita | Vehicle- miles per capita | Licensed drivers per household | Vehicles per licensed driver | Vehicles per civilian employed persons |
|---|--|------------------------------------|--|--|---|---|---------------------------|------------------------------------|---|---------------------------------------|--|
| 1950 | 151,868 | 43,554 | 43,256 | 458,246 | 62,194 | 58,918 | 0.28 | 3,029 | 1.43 | 0.70 | 0.73 |
| 1955 | 165,069 | 47,874 | 55,804 | 605,646 | 74,686 | 62,170 | 0.34 | 3,656 | 1.56 | 0.75 | 0.90 |
| 1960 | 179,979 | 52,799 | 66,582 | 718,762 | 87,253 | 65,778 | 0.37 | 3,994 | 1.65 | 0.76 | 1.01 |
| 1965 | 193,526 | 57,251 | 82,067 | 887,812 | 98,502 | 71,088 | 0.42 | 4,587 | 1.72 | 0.83 | 1.15 |
| 1970 | 203,984 | 63,401 | 98,136 | 1,109,724 | 111,543 | 78,678 | 0.48 | 5,440 | 1.76 | 0.88 | 1.25 |
| 1975 | 215,465 | 71,120 | 120,054 | 1,327,664 | 129,791 | 85,846 | 0.56 | 6,162 | 1.82 | 0.92 | 1.40 |
| 1980 | 227,225 | 80,776 | 139,832 | 1,527,295 | 145,295 | 99,303 | 0.62 | 6,722 | 1.80 | 0.96 | 1.41 |
| 1981 | 229,466 | 82,368 | 141,908 | 1,555,308 | 147,075 | 100,397 | 0.62 | 6,778 | 1.79 | 0.96 | 1.41 |
| 1982 | 231,664 | 83,527 | 143,854 | 1,595,010 | 150,234 | 99,526 | 0.62 | 6,885 | 1.80 | 0.96 | 1.45 |
| 1983 | 233,792 | 83,918 | 147,104 | 1,652,788 | 154,389 | 100,834 | 0.63 | 7,069 | 1.84 | 0.95 | 1.46 |
| 1984 | 235,825 | 85,407 | 152,162 | 1,720,269 | 155,424 | 105,005 | 0.65 | 7,295 | 1.82 | 0.98 | 1.45 |
| 1985 | 237,924 | 86,789 | 157,048 | 1,774,826 | 156,868 | 107,150 | 0.66 | 7,460 | 1.81 | 1.00 | 1.47 |
| 1986 | 240,133 | 88,458 | 162,094 | 1,834,872 | 159,487 | 109,597 | 0.68 | 7,641 | 1.80 | 1.02 | 1.48 |
| 1987 | 242,289 | 89,479 | 167,193 | 1,921,204 | 161,975 | 112,440 | 0.69 | 7,929 | 1.81 | 1.03 | 1.49 |
| 1988 | 244,499 | 91,061 | 171,741 | 2,025,962 | 162,853 | 114,968 | 0.70 | 8,286 | 1.79 | 1.05 | 1.49 |
| 1989 | 246,819 | 92,830 | 175,960 | 2,096,487 | 165,555 | 117,342 | 0.71 | 8,494 | 1.78 | 1.06 | 1.50 |
| 1990 | 249,439 | 93,347 | 179,299 | 2,144,362 | 167,015 | 118,793 | 0.72 | 8,597 | 1.79 | 1.07 | 1.51 |
| 1991 | 252,127 | 94,312 | 181,438 | 2,172,050 | 168,995 | 117,718 | 0.72 | 8,615 | 1.79 | 1.07 | 1.54 |
| 1992 | 254,995 | 95,689 | 181,519 | 2,247,151 | 173,125 | 118,492 | 0.71 | 8,782 | 1.81 | 1.05 | 1.53 |
| 1993 | 257,746 | 96,391 | 186,315 | 2,296,378 | 173,149 | 120,259 | 0.72 | 8,909 | 1.80 | 1.08 | 1.55 |
| 1994 | 260,289 | 97,107 | 188,714 | 2,357,588 | 175,403 | 123,060 ^b | 0.73 | 9,057 | 1.81 | 1.08 | 1.53 |
| 1995 | 262,765 | 98,990 | 193,441 | 2,422,696 | 176,628 | 124,900 ^b | 0.74 | 9,220 | 1.78 | 1.10 | 1.55 |
| 1996 | 265,190 | 99,627 | 198,294 | 2,485,848 | 179,539 | 126,708 ^b | 0.75 | 9,374 | 1.80 | 1.10 | 1.56 |
| 1997 | 267,744 | 101,018 | 201,071 | 2,561,695 | 182,709 | 129,558 ^b | 0.75 | 9,567 | 1.81 | 1.10 | 1.55 |
| 1998 | 270,299 | 102,528 | 205,043 | 2,625,367 | 184,980 | 131,463 | 0.76 | 9,713 | 1.80 | 1.11 | 1.56 |
| <i>Average annual percentage change</i> | | | | | | | | | | | |
| 1950–98 | 1.2% | 1.8% | 3.3% | 3.7% | 2.3% | 1.7% | 2.1% | 2.5% | 0.5% | 1.0% | 1.6% |
| 1988–98 | 1.0% | 1.2% | 1.8% | 2.6% | 1.3% | 1.3% | 0.8% | 1.6% | 0.1% | 0.6% | 0.5% |

Source:

Resident population, total households, and civilian employed persons - U.S. Department of Commerce, Bureau of the Census, *Statistical Abstract of the United States–1999*, 119th edition, Washington, DC, 1999, pp. 8, 60, 412, and annual. (Additional resources: www.census.gov)

Vehicles in operation - The Polk Company. FURTHER REPRODUCTION PROHIBITED. (Additional resources: www.polk.com)

Licensed drivers and vehicle-miles - U.S. Department of Transportation, Federal Highway Administration, *Highway Statistics 1998*, Tables DL-20 and VM-1, and annual. (Additional resources: www.fhwa.dot.gov)

^aEstimates as of July 1. Includes Armed Forces stationed in the United States.

^bData are not comparable to earlier years due to changes in definitions and methodology. See original source for more details.

Transportation (18.2%) is second only to housing (31.8%) as the largest expenditure for the average household. In 1998, approximately 15% of transportation expenditures were for purchasing gasoline and motor oil. There is an average of two vehicles per household.

Table 11.2
Average Annual Expenditures of Households by Income, 1998^a

| | All households | Income before taxes | | | | | | | | |
|---|-----------------|---------------------|-----------------|------------------|-------------------|-------------------|-------------------|-------------------|-------------------|-------------------|
| | | Less than \$5,000 | \$5,000–\$9999 | \$10,000–\$14999 | \$15,000–\$19,999 | \$20,000–\$29,999 | \$30,000–\$39,999 | \$40,000–\$49,999 | \$50,000–\$69,999 | \$70,000 and over |
| Total expenditures | \$37,260 | \$17,502 | \$14,838 | \$19,958 | \$22,810 | \$27,941 | \$33,616 | \$39,934 | \$49,376 | \$73,786 |
| Percentage of total expenditures ^b | | | | | | | | | | |
| Food^c | 14.4% | 18.1% | 18.5% | 15.4% | 16.3% | 15.5% | 15.3% | 14.8% | 14.0% | 12.5% |
| Housing | 31.8% | 34.8% | 39.0% | 36.8% | 34.8% | 33.3% | 32.2% | 30.0% | 29.4% | 30.6% |
| Apparel and services | 4.7% | 6.4% | 4.7% | 4.1% | 4.0% | 4.8% | 5.2% | 5.1% | 4.3% | 4.7% |
| Transportation | 18.2% | 16.4% | 13.7% | 17.9% | 18.4% | 19.1% | 18.6% | 18.8% | 19.9% | 17.4% |
| Vehicle purchases (net outlay) | 8.2% | 6.8% | 5.6% | 8.6% | 8.2% | 8.6% | 7.7% | 8.2% | 9.4% | 7.8% |
| Gasoline and motor oil | 2.8% | 3.2% | 2.9% | 3.0% | 3.2% | 3.2% | 3.1% | 3.1% | 2.8% | 2.2% |
| Other vehicle expenditures | 6.1% | 5.2% | 4.1% | 5.3% | 5.9% | 6.2% | 6.7% | 6.5% | 6.7% | 5.9% |
| Public transportation | 1.1% | 1.2% | 1.1% | 1.0% | 1.0% | 1.0% | 1.0% | 1.0% | 0.9% | 1.5% |
| Health care | 5.3% | 4.9% | 7.9% | 8.3% | 9.4% | 6.6% | 5.5% | 5.2% | 4.4% | 3.9% |
| Entertainment | 4.9% | 5.2% | 3.8% | 4.5% | 3.9% | 4.3% | 4.3% | 4.9% | 5.3% | 5.4% |
| Personal Insurance & pensions | 11.0% | 2.7% | 2.1% | 3.0% | 4.4% | 6.5% | 9.3% | 11.7% | 13.2% | 15.8% |
| Others^d | 9.7% | 11.6% | 10.3% | 10.1% | 8.9% | 9.9% | 9.7% | 9.5% | 9.4% | 9.8% |
| Households (thousands) | 84,115 | 4,259 | 8,143 | 8,469 | 7,352 | 12,621 | 10,123 | 7,654 | 11,300 | 14,193 |
| Percentage of households | 100% | 5.1% | 9.7% | 10.1% | 8.7% | 15.0% | 12.0% | 9.1% | 13.4% | 16.9% |
| Average number of vehicles in HH | 2.0 | 1.0 | 0.9 | 1.3 | 1.5 | 1.9 | 2.1 | 2.3 | 2.6 | 2.9 |

Source:

U.S. Department of Labor, Bureau of Labor Statistics, web site: www.bls.gov/csx/1998/Standard/income.pdf, February 2000. (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.

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

Table 11.3
Household Vehicle Ownership, 1960–90 Census
(percentage)

| | No vehicles | One vehicle | Two vehicles | Three or more vehicles | Total vehicles ^a |
|------|----------------|----------------|-----------------|---------------------------|--------------------------------|
| 1960 | 21.53% | 56.94% | 19.00% | 2.53% | 54,766,718 |
| 1970 | 17.47% | 47.71% | 29.32% | 5.51% | 79,002,052 |
| 1980 | 12.92% | 35.53% | 34.02% | 17.52% | 129,747,911 |
| 1990 | 11.53% | 33.74% | 37.35% | 17.33% | 152,380,479 |

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. (Additional resources: www.census.gov)

^aCompiled by the Census Bureau, these data on the total number of vehicles do not match the figures on Table 4.1. The figures on Table 4.1, from R.L. Polk and Company, are the preferred data.

1995 Nationwide Personal Travel Survey

The 1995 Nationwide Personal Travel Survey (NPTS) is a national survey designed to collect data on the nature and characteristics of personal travel. The definition of a trip in the NPTS is “any one-way travel from one address to another by private motor vehicle, public transportation, bicycle, or walking.” Excluded from the survey are jogging and walking for exercise, as is all bicycling and walking for individuals under 5 years of age. The survey collects detailed data on household trips, their purposes and the transportation modes used. The NPTS is sponsored by several agencies of the U.S. Department of Transportation and is conducted approximately every seven years. Since each of the surveys differ somewhat in terminology, survey procedure, and target population, one should be cautious when comparing statistics from one survey to the next. Improved methodologies used in the collection of the trip information in the 1995 NPTS make it impossible to compare these data with past NPTS survey data. Thus, the 1990 NPTS trip data have been adjusted to make it comparable with the latest survey. Both the original 1990 data and the adjusted 1990 data are shown in tables comparing trip information. The 1995 trip data should only be compared to the adjusted 1990 trip data, and the original trip 1990 data should be compared with previous surveys. Additional analyses can be done on the 1995 NPTS data through the Internet site: www-cta.ornl.gov/npts.

Table 11.4
Demographic Statistics
1969, 1977, 1983, 1990, and 1995 NPTS

| | 1969 | 1977 | 1983 | 1990 | 1995 | Percent change 1969–95 |
|-------------------------------------|------|------|------|------|------|------------------------------|
| Persons per household | 3.16 | 2.83 | 2.69 | 2.56 | 2.63 | -17% |
| Vehicles per household | 1.16 | 1.59 | 1.68 | 1.77 | 1.78 | 53% |
| Workers per household | 1.21 | 1.23 | 1.21 | 1.27 | 1.33 | 10% |
| Vehicles per worker | 0.96 | 1.29 | 1.39 | 1.40 | 1.34 | 40% |
| Average vehicle trip length (miles) | 8.89 | 8.34 | 7.90 | 8.98 | 9.06 | 2% |

Source:

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 were generated from the Internet site www-cta.ornl.gov/npts.
(Additional resources: www.fhwa.dot.gov)

Note:

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

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

Table 11.5
Average Annual Vehicle-Miles, Vehicle Trips and
Trip Length per Household
1969, 1977, 1983, 1990, and 1995 NPTS

| | Journey-to- work ^a | All trips |
|---|----------------------------------|---------------|
| <i>Average annual vehicle-miles per household</i> | | |
| 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 |
| <i>Average annual vehicle trips per household</i> | | |
| 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 |
| <i>Average vehicle trip length (miles)</i> | | |
| 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 |

Source:

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

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

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

Table 11.6
Average Annual Person-Miles Traveled (PMT), Person Trips and Trip Length
per Household by Selected Trip Purposes
1983, 1990, and 1995 NPTS

| | J o u r n e y - t o - work^a | Shopping | Social and recreational | All purposes^b |
|--|---|-----------------|------------------------------------|-------------------------------------|
| <i>Average annual PMT per household</i> | | | | |
| 1983 | 4,586 | 2,567 | 8,964 | 22,802 |
| 1990 original | 5,637 | 2,674 | 8,567 | 24,803 |
| 1990 adjusted | 5,637 | 3,343 | 11,308 | 30,316 |
| 1995 | 7,740 | 4,659 | 10,571 | 34,459 |
| <i>Average annual person trips per household</i> | | | | |
| 1983 | 537 | 474 | 728 | 2,628 |
| 1990 original | 539 | 504 | 662 | 2,673 |
| 1990 adjusted | 539 | 630 | 874 | 3,262 |
| 1995 | 676 | 775 | 953 | 3,828 |
| <i>Average person trip length (miles)</i> | | | | |
| 1983 | 8.5 | 5.4 | 12.3 | 8.7 |
| 1990 original | 10.7 | 5.4 | 13.2 | 9.5 |
| 1990 adjusted | 10.7 | 5.4 | 13.2 | 9.5 |
| 1995 | 11.6 | 6.1 | 11.3 | 9.1 |

Source:

U.S. Department of Transportation, Federal Highway Administration, Nationwide Personal Transportation Study, Public Use Tapes, Washington, DC. Data for 1995 were generated from the Internet site www-cta.ornl.gov/npts. 1990 adjusted data - Oak Ridge National Laboratory, Oak Ridge, TN, August 1998. (Additional resources: www.fhwa.dot.gov, www-cta.ornl.gov/npts)

Note:

Average person trip length for 1990 and 1995 is calculated using only those records with trip mileage information present. "All purposes" includes unreported trip purposes.

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

^bIncludes trip purposes not shown on this table.

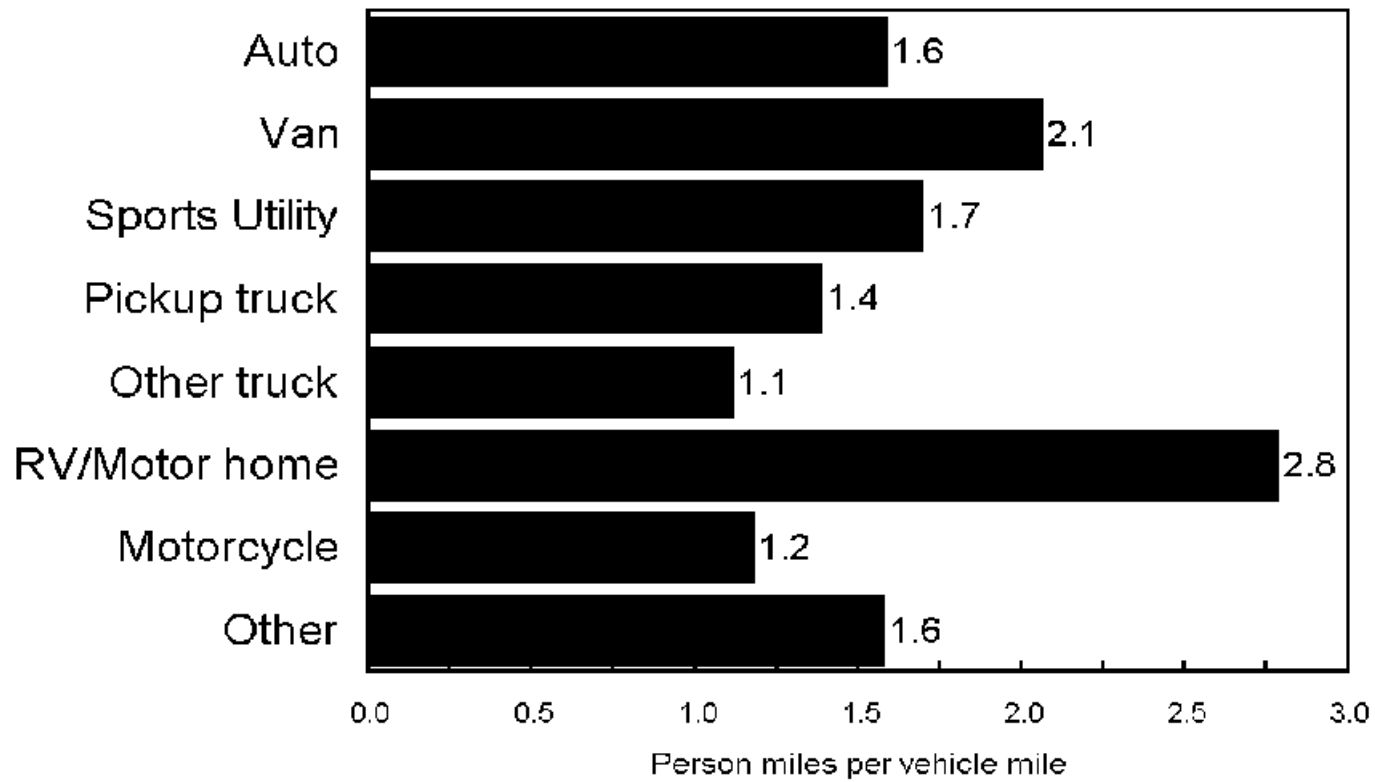
Table 11.7
Average Number of Vehicles and Vehicle Travel per Household,
1990 and 1995 NPTS

| | Average number of vehicles per household | | Average vehicle-miles traveled per household | |
|-------------------------------|--|-------------|--|---------------|
| Number of Drivers | 1990 | 1995 | 1990 | 1995 |
| 1 | 1.5 | 1.2 | 15,200 | 11,000 |
| 2 | 2.1 | 2.1 | 22,900 | 22,600 |
| 3 | 2.9 | 2.8 | 29,400 | 30,100 |
| 4 or more | 3.8 | 3.6 | 40,500 | 39,600 |
| Household size | | | | |
| 1 person | 1.2 | 1.2 | 11,400 | 10,800 |
| 2 persons | 1.9 | 1.9 | 19,300 | 19,400 |
| 3 persons | 2.2 | 2.2 | 23,700 | 24,800 |
| 4 persons | 2.4 | 2.3 | 25,300 | 25,600 |
| 5 persons | 2.4 | 2.3 | 24,900 | 27,200 |
| 6 or more persons | 2.7 | 2.5 | 29,200 | 27,900 |
| Household urban status | | | | |
| Urban | 1.9 | 1.6 | 19,000 | 16,500 |
| Rural | 2.1 | 2.0 | 22,200 | 22,600 |
| Household composition | | | | |
| With children | 2.2 | 2.2 | 24,100 | 25,000 |
| Without children | 1.8 | 1.8 | 17,600 | 17,100 |
| Total | 1.8 | 1.8 | 18,300 | 18,700 |

Source:

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

Figure 11.1. Average Vehicle Occupancy by Vehicle Type, 1995 NPTS



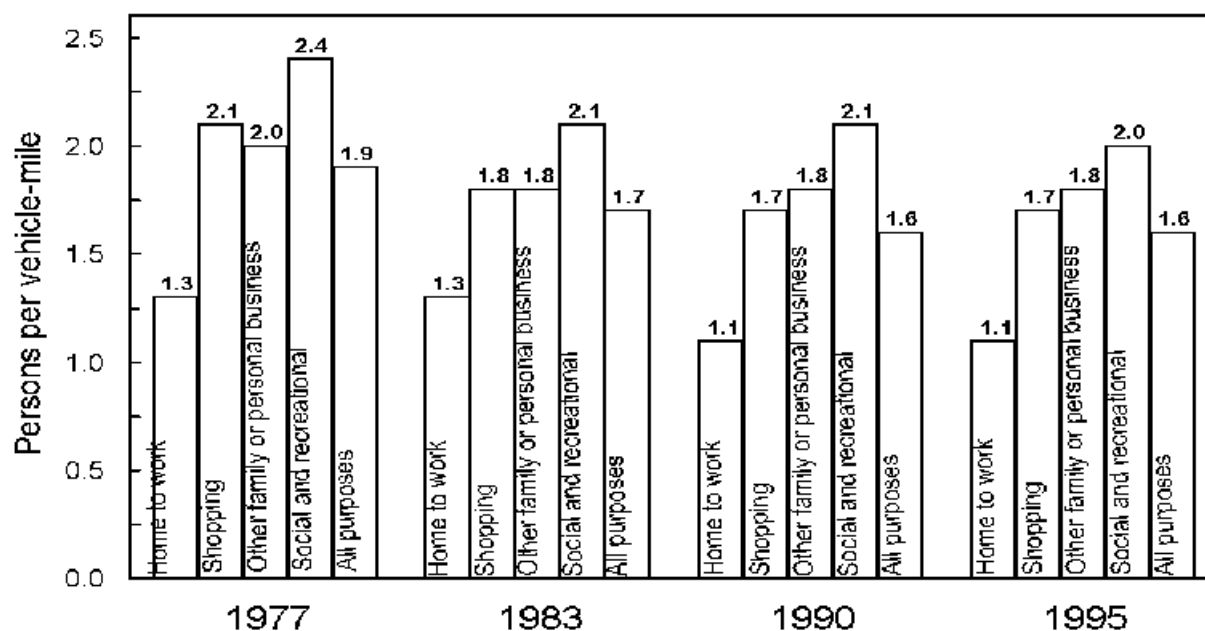
Source:

U.S. Department of Transportation, Federal Highway Administration, Nationwide Personal Transportation Survey, Washington, DC, 1997.

(Additional resources: www.fhwa.dot.gov, www-cta.ornl.gov/npts)

The average vehicle occupancy, calculated as person-miles per vehicle-mile, was nearly identical in 1990 and 1995 for every trip purpose. The highest vehicle occupancy levels were in 1977. The increased number of vehicles per household and the decrease in average household size could have contributed to the decline since then.

**Figure 11.2. Average Vehicle Occupancy by Trip Purpose
1977, 1983, 1990, and 1995 NPTS**



Source:

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 1995 were generated from the public use file.
(Additional resources: www.fhwa.dot.gov, www.cta.ornl.gov/npts)

Less than 27% of all household vehicle-miles are trips to or from work. Errands such as family and personal business and shopping (combined) make up a third of vehicle travel. One quarter of all trips 75 miles or longer (one way) were for the purpose of visiting friends or relatives.

Table 11.8
Vehicle-Miles by Trip Purpose, 1995 NPTS

| Purpose of trip | Daily trip vehicle-miles | | Long trip vehicle-miles^a | | Total trip vehicle-miles | |
|--|---------------------------------|------------------|--|------------------|---------------------------------|------------------|
| | (millions) | (percent) | (millions) | (percent) | (millions) | (percent) |
| To or from work | 642,610 | 31.1% | 16,032 | 4.2% | 658,642 | 26.8% |
| Work-related business | 137,867 | 6.7% | 56,613 | 14.7% | 194,480 | 7.9% |
| Shopping | 277,860 | 13.4% | 13,377 | 3.5% | 291,237 | 11.9% |
| Other family or personal business | 426,330 | 20.6% | 54,722 | 14.2% | 481,052 | 19.6% |
| School/church | 78,313 | 3.8% | 11,874 | 3.1% | 90,187 | 3.7% |
| Doctor/dentist | 30,613 | 1.5% | 5,016 | 1.3% | 35,629 | 1.5% |
| Vacation | 20,318 | 1.0% | 38,765 | 10.0% | 59,083 | 2.4% |
| Visit friends or relatives | 195,068 | 9.4% | 99,308 | 25.7% | 294,376 | 12.0% |
| Other social or recreational | 256,169 | 12.4% | 85,989 | 22.3% | 342,158 | 13.9% |
| Other | 2,797 | 0.1% | 4,281 | 1.1% | 7,078 | 0.3% |
| Not ascertained | 422 | 0.0% | 20 | 0.0% | 442 | 0.0% |
| All | 2,068,368 | 100.0% | 385,997 | 100.0% | 2,454,365 | 100.0% |

Source:

U.S. Department of Transportation, Federal Highway Administration, Nationwide Personal Transportation Survey web site: www-cta.ornl.gov/npts.

^a Defined as a trip which is 75 miles or longer one way.

As households owned more vehicles, the average annual miles for the most frequently driven vehicle increased. For example, the most frequently driven vehicle in five-vehicle households was driven 26% more per year than the one in two-vehicle households (21,177 miles vs. 16,804 miles).

Table 11.9
Average Annual Miles per Vehicle by Household Vehicle Ownership, 1995 NPTS

| Vehicle ^a | One-vehicle household | Two-vehicle household | Three-vehicle household | Four-vehicle household | Five-vehicle household |
|-----------------------------|------------------------------|------------------------------|--------------------------------|-------------------------------|-------------------------------|
| #1 | 12,379 | 16,804 | 18,853 | 20,724 | 21,177 |
| #2 | - | 8,322 | 9,806 | 11,311 | 12,880 |
| #3 | - | - | 4,555 | 6,395 | 7,319 |
| #4 | - | - | - | 3,218 | 4,177 |
| #5 | - | - | - | - | 2,321 |
| Average | 12,379 | 12,855 | 11,604 | 11,100 | 10,372 |

Source:

Generated from the Department of Transportation, Federal Highway Administration, Nationwide Personal Transportation Survey Public Use Files, Washington, DC, 1998. (Additional resources: www.cta.ornl.gov/npts)

Table 11.10
Average Age of Vehicles by Household Vehicle Ownership, 1995 NPTS

| Vehicle^a | One-vehicle household | Two-vehicle household | Three-vehicle household | Four-vehicle household | Five-vehicle household |
|----------------------------|------------------------------|------------------------------|--------------------------------|-------------------------------|-------------------------------|
| #1 | 7.48 | 6.45 | 6.74 | 7.01 | 7.35 |
| #2 | - | 8.54 | 8.55 | 8.68 | 9.54 |
| #3 | - | - | 12.25 | 11.36 | 11.89 |
| #4 | - | - | - | 14.52 | 14.60 |
| #5 | - | - | - | - | 17.81 |
| Average | 7.48 | 7.42 | 8.93 | 10.03 | 11.62 |

Source:

Generated from the Department of Transportation, Federal Highway Administration, Nationwide Personal Transportation Survey Public Use Files, Washington, DC, 1998. (Additional resources: www.cta.ornl.gov/npts)

^aVehicles are ranked by descending annual miles driven.

Historically, the data from the Nationwide Personal Transportation Study (NPTS) are based on estimates reported by survey respondents. For the 1995 survey, odometer data was also collected. These data indicate that respondents may overestimate the number of miles driven in a year.

Table 11.11
Average Annual Miles Per Household Vehicle by Vehicle Age

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

Source:

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

(Additional resources: www.fhwa.dot.gov, www.eia.doe.gov)

Note:

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

In 1995 the average journey-to-work speed was faster (miles per hour increased to 34.6), but the travel time still increased, due to an increase in the average travel distance. Journeys-to-work using public transportation continued to take twice as long as private transportation, though there is only a slight difference in travel distance.

Table 11.12
Journey-to-Work Statistics
1983, 1990, and 1995 NPTS^a

| Year | Private transportation | Public transportation | Other^b | Total |
|--|-----------------------------------|----------------------------------|--------------------------|--------------|
| <i>Average travel time (minutes)^c</i> | | | | |
| 1983 | 17.6 | 39.8 | 10.6 | 18.2 |
| 1990 | 19.1 | 41.1 | 12.4 | 19.6 |
| 1995 | 20.1 | 42.0 | 18.8 | 20.7 |
| <i>Average trip length (miles)</i> | | | | |
| 1983 | 8.9 | 11.8 | 1.4 | 8.5 |
| 1990 | 11.0 | 12.8 | 2.2 | 10.7 |
| 1995 | 11.8 | 12.9 | 8.2 | 11.6 |
| <i>Average speed (miles per hour)</i> | | | | |
| 1983 | 30.2 | 17.8 | 7.6 | 28.2 |
| 1990^d | 34.7 | 18.2 | 7.6 | 33.3 |
| 1995^d | 35.4 | 19.3 | 25.9 | 34.6 |

Source:

U.S. Department of Transportation, Federal Highway Administration, Nationwide Personal Transportation Study, Public Use Tapes, Washington, DC. Data for 1995 were generated from the Internet site www-cta.ornl.gov/npts. (Additional resources: www.fhwa.dot.gov, www-cta.ornl.gov/npts)

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

^bIncludes airplane, Amtrak, taxi, bicycle, school bus, moped, walk and other.

^cDoes not include time spent waiting for transportation.

^dDoes not include segmented trips.

According to the U.S. Census data, the percentage of workers who car pooled has dropped from 19.7% in 1980 to 13.4% in 1990. The percent of workers using public transit declined from 6.4% to 5.3% during the same time period. The average travel time increased by 0.7 minutes from 1980 to 1990.

Table 11.13
Means of Transportation to Work, 1980 and 1990 Census

| Means of transportation | 1980 Census | | 1990 Census | |
|---------------------------------------|-------------------|---------------|--------------------|---------------|
| | Number of workers | Percentage | Number of workers | Percentage |
| Private vehicle | 81,258,496 | 84.1% | 99,592,932 | 86.5% |
| Drove alone | 62,193,449 | 64.4% | 84,215,298 | 73.2% |
| Car pooled | 19,065,047 | 19.7% | 15,377,634 | 13.4% |
| Public transportation | 6,175,061 | 6.4% | 6,069,589 | 5.3% |
| Bus or trolley bus ^a | 3,924,787 | 4.1% | 3,445,000 | 3.0% |
| Streetcar or trolley car ^a | b | b | 78,130 | 0.1% |
| Subway or elevated | 1,528,852 | 1.6% | 1,755,476 | 1.5% |
| Railroad | 554,089 | 0.6% | 574,052 | 0.5% |
| Ferryboat | b | b | 37,497 | 0.0% |
| Taxicab | 167,133 | 0.2% | 179,434 | 0.2% |
| Other means | 703,273 | 0.7% | 808,582 | 0.7% |
| Motorcycle | 419,007 | 0.4% | 237,404 | 0.2% |
| Bicycle | 468,348 | 0.5% | 466,856 | 0.4% |
| Walked only | 5,413,248 | 5.6% | 4,488,886 | 3.9% |
| Worked at home | 2,179,863 | 2.3% | 3,406,025 | 3.0% |
| Total workers | 96,617,296 | 100.0% | 115,070,274 | 100.0% |
| Average travel time (minutes) | 21.7 | | 22.4 | |

Source:

Data provided by the Journey-to-Work and Migration Statistics Branch, Population Division, U.S. Bureau of the Census. (Additional resources: www.census.gov)

^aThis category was "Bus or streetcar" in 1980.

^bData are not available.

Table 11.14
National and Metropolitan Area Comparisons of Journey-to-Work Statistics, 1990 Census

| | National | Metropolitan areas^a |
|---|-----------------|---------------------------------------|
| Workers per household | 1.25 | 1.31 |
| Workers per vehicle | 0.76 | 0.82 |
| Average travel time (minutes) | 22.38 | 25.20 |
| Commute length (percentage) | | |
| Less than 15 minutes | 15.87% | 11.45% |
| 15–29 minutes | 51.64% | 49.22% |
| 30–39 minutes | 14.66% | 17.48% |
| 40–59 minutes | 9.01% | 11.77% |
| 60 minutes or more | 5.86% | 7.52% |
| Mode (percentage) | | |
| Drive alone | 73.19% | 70.75% |
| Percentage car pooled | 13.36% | 12.69% |
| Public transit | 5.27% | 8.98% |
| Motorcycle | 0.21% | 0.21% |
| Walk | 3.90% | 3.76% |
| Bicycle | 0.41% | 0.43% |
| Other | 0.70% | 0.62% |
| Work at home | 2.96% | 2.57% |
| Time workers leave home (percentage) | | |
| 5:00 AM–6:59 AM | 26.04% | 25.49% |
| 7:00 AM–8:29 AM | 41.87% | 42.44% |
| 8:30 AM–9:59 AM | 10.28% | 11.57% |
| All other departures | 18.85% | 17.93% |

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*, FHWA-PL-94-012, Cambridge, MA, 1994, p. 2-6. (Additional resources: www.census.gov)

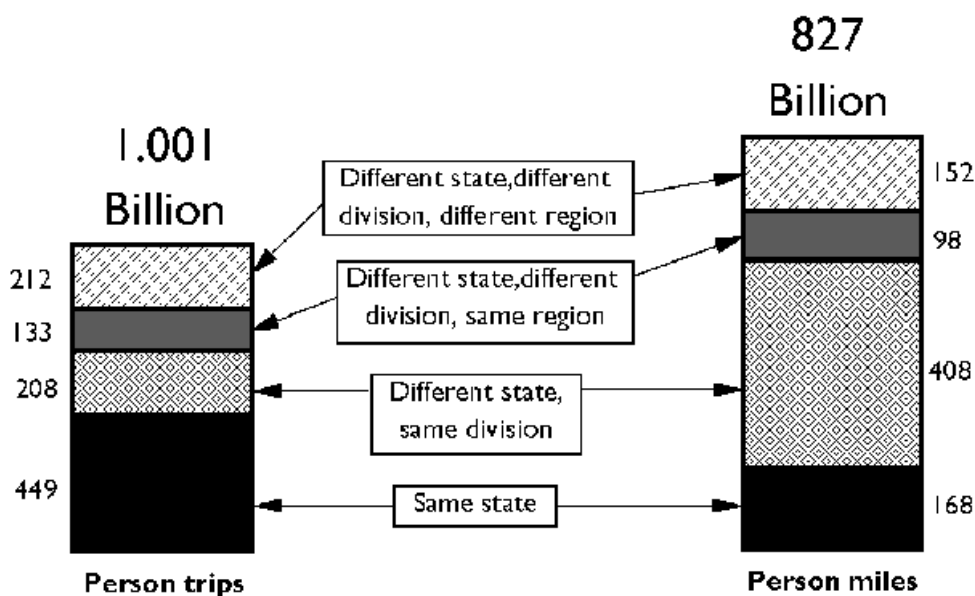
^aMetropolitan areas over 1 million population. There were 39 such areas in the 1990 Census.

1995 American Travel Survey

The American Travel Survey (ATS) was conducted by the Bureau of Transportation Statistics to obtain information about the long-distance travel of persons living in the United States. Approximately 80,000 randomly selected households were interviewed for the survey, which collected information about all trips of 100 miles or more, one-way, taken by household members in 1995. The ATS data provide detailed information on state-to-state travel, as well as travel to and from metropolitan areas by mode of transportation.

For additional information about the American Travel Survey, contact the Bureau of Transportation Statistics at (202) 366-3282 or visit the following Internet site: www.bts.gov/ats

Figure 11.3 Long-Distance Trips by Destination, 1995



Source:

U.S. Department of Transportation, Bureau of Transportation Statistics, *1995 American Travel Survey Profile*, Washington, DC, October 1997, p. 2. (Additional resources: www.bts.gov/ats)

Note:

Definitions of divisions and regions are in Appendix C.

Table 11.15
Long-Distance Trips^a by Mode and Purpose, 1995

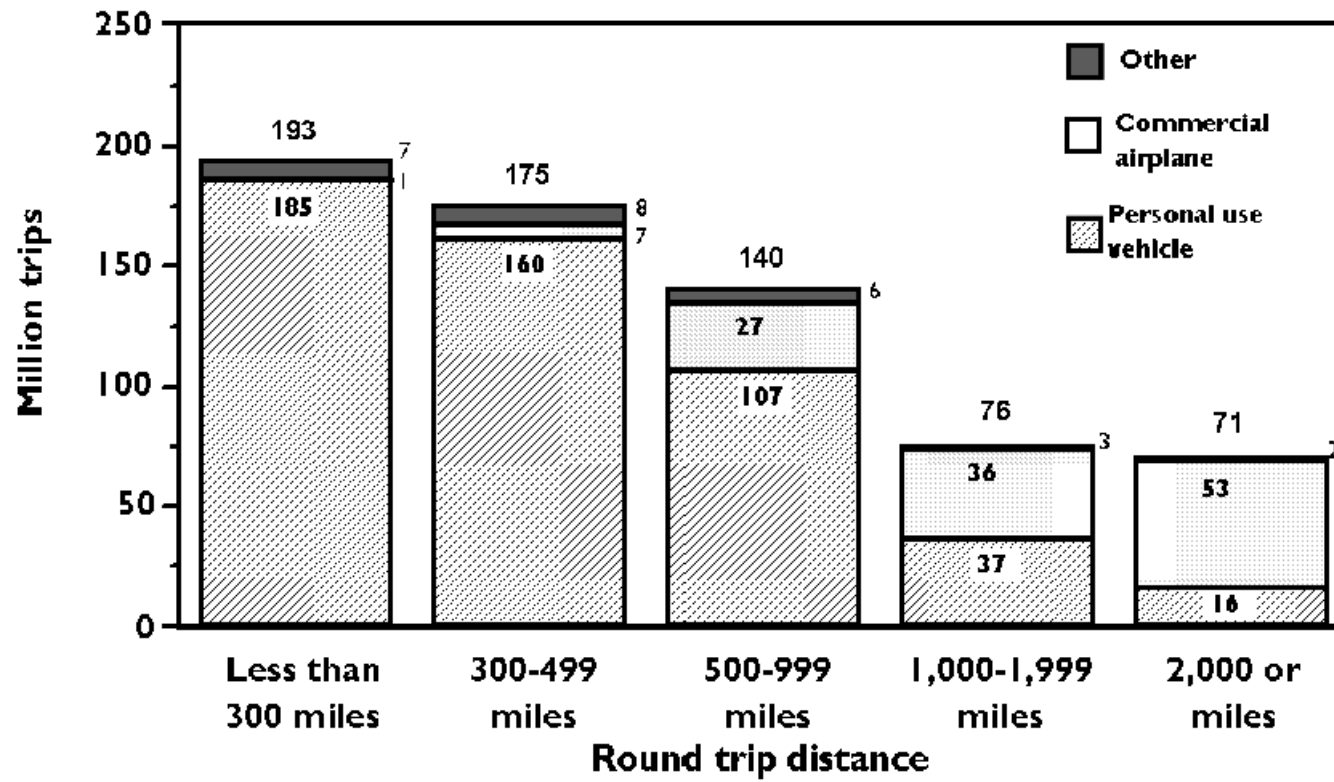
| Principal means of transportation | Main purpose of trip | | | | | |
|-----------------------------------|----------------------|----------------------------|---------|---------|-------------------|-----------|
| | Business | Pleasure | | | Personal business | Total |
| | | Visit friends or relatives | Leisure | Total | | |
| Person trips (thousands) | | | | | | |
| Personal use vehicle | 151,697 | 283,153 | 254,186 | 537,339 | 124,791 | 813,858 |
| Commercial airplane | 67,083 | 41,881 | 31,581 | 73,462 | 15,386 | 155,936 |
| Intercity bus | 286 | 1,830 | 690 | 2,519 | 439 | 3,244 |
| Charter or tour bus | 1,281 | 1,198 | 9,253 | 10,451 | 2,514 | 14,247 |
| Train | 1,342 | 2,004 | 944 | 2,948 | 704 | 4,994 |
| Ship, boat, or ferry | 68 | 43 | 483 | 525 | 20 | 614 |
| Total | 224,835 | 330,755 | 299,355 | 630,110 | 146,338 | 1,001,319 |
| Percentage | | | | | | |
| Personal use vehicle | 18.6 | 34.8 | 31.2 | 66.0 | 15.3 | 100.0 |
| Commercial airplane | 43.0 | 26.9 | 20.3 | 47.1 | 9.9 | 100.0 |
| Intercity bus | 8.8 | 56.4 | 21.3 | 77.7 | 13.5 | 100.0 |
| Charter or tour bus | 9.0 | 8.4 | 64.9 | 73.4 | 17.6 | 100.0 |
| Train | 26.9 | 40.1 | 18.9 | 59.0 | 14.1 | 100.0 |
| Ship, boat, or ferry | 11.1 | 7.0 | 78.7 | 85.5 | 3.3 | 100.0 |
| Total | 22.5 | 33.0 | 29.9 | 62.9 | 14.6 | 100.0 |

Source:

U.S. Department of Transportation, Bureau of Transportation Statistics, *1995 American Travel Survey Profile*, Washington, DC, October 1997, p. 13. (Additional resources: www.bts.gov/ats)

^aA long-distance trip is any trip of 100 miles or more, one way.

Figure 11.4. Long-Distance Household Trips by Mode and Trip Distance, 1995

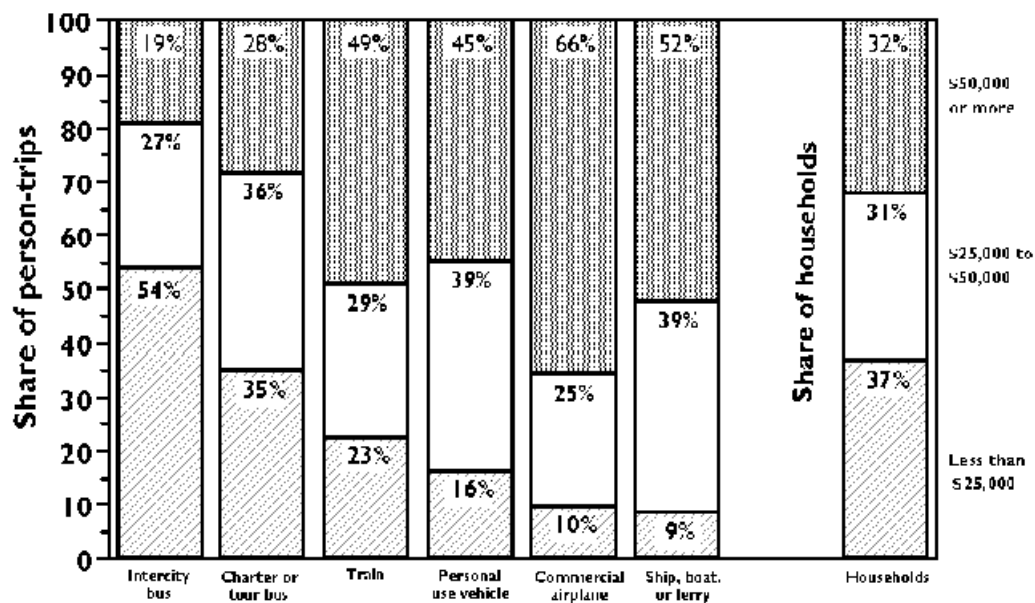


Source:

U.S. Department of Transportation, Bureau of Transportation Statistics, *1995 American Travel Survey Profile*, Washington, DC, October 1997, p. 3.

(Additional resources: www.bts.gov/ats)

Figure 11.5. Shares of Long-Distance Person Trips by Mode and Household Income, 1995



Source:

U.S. Department of Transportation, Bureau of Transportation Statistics, *1995 American Travel Survey Profile*, Washington, DC, October 1997, p. 8.

U.S. Department of Commerce, Bureau of the Census, *Statistical Abstract of the United States*, 117th Edition, Washington, DC, 1997, p. 465.

(Additional resources: www.bts.gov/ats, www.census.gov)

Chapter 12

Nonhighway Modes

Summary Statistics from Tables in this Chapter

| Source | | |
|--------------------|---|------------------|
| <hr/> | | |
| | Passenger-miles, 1998 | (millions) |
| <i>Table 12.1</i> | <i>Domestic and international air carrier</i> | <i>636,410</i> |
| <i>Table 12.2</i> | <i>General aviation</i> | <i>13,300</i> |
| <i>Table 12.10</i> | <i>Amtrak</i> | <i>5,325</i> |
| <i>Table 12.11</i> | <i>Transit rail</i> | <i>13,402</i> |
| | Freight ton-miles, 1998 | (millions) |
| <i>Table 12.4</i> | <i>Domestic waterborne commerce</i> | <i>673,000</i> |
| <i>Table 12.7</i> | <i>Class I railroad</i> | <i>1,376,802</i> |
| | Passenger energy use, 1998 | (trillion Btus) |
| <i>Table 12.1</i> | <i>Domestic and international air carrier</i> | <i>2,550.1</i> |
| <i>Table 12.2</i> | <i>General aviation</i> | <i>147.4</i> |
| <i>Table 12.10</i> | <i>Amtrak energy use</i> | <i>13.1</i> |
| <i>Table 12.11</i> | <i>Transit rail</i> | <i>43.1</i> |
| | Freight energy use, 1998 | (trillion Btus) |
| <i>Table 12.4</i> | <i>Domestic waterborne commerce</i> | <i>293.1</i> |
| <i>Table 12.7</i> | <i>Class I railroad</i> | <i>502.0</i> |

Table 12.1
Summary Statistics for U.S. Domestic and International Certificated Route Air Carriers (Combined Totals), 1970–98^a

| Year | Revenue aircraft-miles (millions) | Average passenger trip length ^b (miles) | Revenue passenger-miles (millions) | Available seat-miles (millions) | Available seats per aircraft ^c | Passenger load factor (percentage) ^d | Revenue cargo ton-miles (millions) | Energy use (trillion Btu) ^e | Percent domestic of total energy use (percentage) |
|---|-----------------------------------|--|------------------------------------|---------------------------------|---|---|------------------------------------|--|---|
| 1970 | 2,383 | 678 | 131,719 ^f | 264,904 ^f | 111 | 49.7% ^f | 4,994 | 1,363.4 | ^g |
| 1975 | 2,241 | 698 | 173,324 | 315,823 | 135 | 54.9% | 5,944 | 1,283.4 | ^g |
| 1976 | 2,320 | 704 | 191,823 | 338,349 | 139 | 56.7% | 6,222 | 1,324.1 | ^g |
| 1977 | 2,418 | 704 | 206,082 | 361,172 | 143 | 57.1% | 6,587 | 1,386.2 | ^g |
| 1978 | 2,608 | 719 | 236,998 | 381,113 | 147 | 62.2% | 7,395 | 1,436.3 | 82.0% |
| 1979 | 2,859 | 714 | 269,719 | 425,411 | 146 | 63.4% | 7,580 | 1,534.8 | 82.5% |
| 1980 | 2,924 | 736 | 267,722 | 448,479 | 148 | 59.7% | 7,515 | 1,489.6 | 82.4% |
| 1981 | 2,703 | 749 | 260,063 | 438,778 | 157 | 59.3% | 7,917 | 1,429.3 | ^g |
| 1982 | 2,804 | 766 | 272,435 | 455,938 | 157 | 59.8% | 7,807 | 1,406.6 | 81.1% |
| 1983 | 2,923 | 765 | 295,144 | 480,977 | 159 | 61.4% | 8,497 | 1,439.2 | 84.4% |
| 1984 | 3,264 | 759 | 319,504 | 534,104 | 164 | 59.8% | 9,328 | 1,607.4 | ^g |
| 1985 | 3,462 | 758 | 351,073 | 565,677 | 163 | 62.1% | 9,048 | 1,701.5 | ^g |
| 1986 | 3,873 | 767 | 378,923 | 623,073 | 161 | 60.8% | 10,987 | 1,847.1 | 81.4% |
| 1987 | 4,182 | 779 | 417,830 | 670,871 | 160 | 62.3% | 13,130 | 1,945.4 | 80.4% |
| 1988 | 4,355 | 786 | 437,649 | 696,337 | 160 | 62.9% | 14,633 | 2,049.4 | 78.5% |
| 1989 | 4,442 | 792 | 447,480 | 703,888 | 158 | 63.6% | 16,347 | 2,087.4 | 77.0% |
| 1990 | 4,724 | 803 | 472,236 | 753,211 | 159 | 62.7% | 16,411 | 2,191.3 | 75.9% |
| 1991 | 4,661 | 806 | 463,296 | 738,030 | 158 | 62.8% | 16,149 | 2,069.2 | 74.5% |
| 1992 | 4,899 | 806 | 493,715 | 772,869 | 158 | 63.9% | 17,306 | 2,144.2 | 74.1% |
| 1993 | 5,118 | 799 | 505,996 | 793,959 | 155 | 63.7% | 19,083 | 2,168.8 | 74.4% |
| 1994 | 5,360 | 787 | 537,506 | 809,240 | 151 | 66.4% | 21,773 | 2,249.5 | 74.3% |
| 1995 | 5,627 | 791 | 558,757 | 845,012 | 150 | 66.1% | 23,375 | 2,310.4 | 74.0% |
| 1996 | 5,855 | 802 | 596,164 | 859,720 | 147 | 69.3% | 24,892 | 2,396.6 | 74.0% |
| 1997 | 6,025 | 814 | 619,969 | 880,607 | 146 | 70.4% | 27,610 | 2,494.5 | 73.4% |
| 1998 | 6,222 | 813 | 636,410 | 899,115 | 145 | 70.8% | 28,015 | 2,550.1 | 72.8% |
| <i>Average annual percentage change</i> | | | | | | | | | |
| 1970–98 | 3.5% | 0.7% | 5.8% | 4.5% | 1.0% | | 6.4% | 2.3% | |
| 1988–98 | 3.6% | 0.3% | 3.8% | 2.6% | -1.0% | | 6.7% | 2.2% | |

Source:

U.S. Department of Transportation, Bureau of Transportation Statistics, *Air Carrier Traffic Statistics Monthly*, December 1998/1997, Washington, DC, pp. 1–2, and annual.

1970–81 Energy Use - Department of Transportation, Civil Aeronautics Board, *Fuel Cost and Consumption*, Washington, DC, 1981, and annual.

1982–98 Energy Use - Department of Transportation, Research and Special Programs Administration, "Fuel Cost and Consumption Tables," Washington, DC, monthly. Annual totals are derived by summing monthly totals for domestic and international air carriers. (Additional resources: www.bts.gov, www.faa.gov)

^aData are for all U.S. air carriers reporting on Form 41.

^bScheduled services of domestic operations only. The average passenger trip length for international operations is more than three and a half times longer than for domestic operations.

^cAvailable seats per aircraft is calculated as the ratio of available seat-miles to revenue aircraft-miles.

^dPassenger load factor is calculated as the ratio of revenue passenger-miles to available seat-miles for scheduled and nonscheduled services.

^eEnergy use includes fuel purchased abroad for international flights.

^fScheduled services only.

^gData are not available.

Table 12.2
Summary Statistics for General Aviation, 1970–98

| Calendar year | Total number of aircraft | Hours flown (thousands) | Intercity passenger travel (billion passenger-miles) | Energy use (trillion btu) |
|---|--------------------------|-------------------------|--|---------------------------|
| 1970 | 131,700 ^a | 26,030 ^b | 9.1 | 94.4 |
| 1971 | 131,100 ^a | 25,512 ^b | 9.2 | 91.6 |
| 1972 | 145,000 ^a | 26,974 ^b | 10.0 | 103.4 |
| 1973 | 148,000 ^a | 28,599 | 10.7 | 90.4 |
| 1974 | 161,502 | 29,758 | 11.2 | 101.4 |
| 1975 | 168,475 | 30,298 | 11.4 | 121.5 |
| 1976 | 177,964 | 31,950 | 12.1 | 130.3 |
| 1977 | 184,294 | 33,679 | 12.8 | 149.7 |
| 1978 | 199,178 | 36,844 | 14.1 | 159.4 |
| 1979 | 210,339 | 40,432 | 15.5 | 167.2 |
| 1980 | 211,045 | 41,016 | 14.7 | 169.0 |
| 1981 | 213,226 | 40,704 | 14.6 | 162.4 |
| 1982 | 209,779 | 36,457 | 13.1 | 170.5 |
| 1983 | 213,293 | 35,249 | 12.7 | 143.9 |
| 1984 | 220,943 | 36,119 | 13.0 | 148.9 |
| 1985 | 196,500 | 31,456 | 12.3 | 144.0 |
| 1986 | 205,300 | 31,782 | 12.4 | 148.0 |
| 1987 | 202,700 | 30,883 | 12.1 | 139.1 |
| 1988 | 196,200 | 31,114 | 12.6 | 148.6 |
| 1989 | 205,000 | 32,332 | 13.1 | 134.0 |
| 1990 | 198,000 | 32,096 | 13.0 | 131.9 |
| 1991 | 196,874 | 30,490 | 12.1 | 120.4 |
| 1992 | 185,650 | 27,471 | 10.8 | 104.7 |
| 1993 | 177,120 | 24,455 | 9.9 | 97.5 |
| 1994 | 172,935 | 24,092 | 9.8 | 95.3 |
| 1995 | 188,089 | 26,612 | 10.4 | 106.6 |
| 1996 | 191,129 | 26,909 | 10.6 | 111.1 |
| 1997 | 192,414 | 27,713 | 12.5 | 121.1 |
| 1998 | 204,710 | 28,100 | 13.3 | 147.4 |
| <i>Average annual percentage change</i> | | | | |
| 1970–98 | 1.6% | 0.3% | 1.4% | 1.6% |
| 1988–98 | 0.4% | -1.0% | 0.5% | -0.1% |

Sources:

Intercity passenger-miles - Eno Foundation for Transportation, *Transportation in America 1999*, Sixteenth edition, Lansdowne, VA, 2000, p. 47, and annual.

All other- U.S. Department of Transportation, Federal Aviation Administration, *General Aviation Activity and Avionics Survey: Calendar Year 1998*, pp. 1-7, 1-16, 5-2, 5-3, 5-4, and annual. (Additional resources: www.faa.gov)

^aActive fixed-wing general aviation aircraft only.

^bInclude rotocraft.

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 and has continued to grow each year since.

Table 12.3
Tonnage Statistics for Domestic and
International Waterborne Commerce, 1970–98
(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% |
| 1971 | 1,513 | 566 | 947 | 62.6% |
| 1972 | 1,617 | 630 | 987 | 61.0% |
| 1973 | 1,762 | 767 | 994 | 56.4% |
| 1974 | 1,747 | 764 | 983 | 56.3% |
| 1975 | 1,695 | 749 | 946 | 55.8% |
| 1976 | 1,835 | 856 | 979 | 53.4% |
| 1977 | 1,908 | 935 | 973 | 51.0% |
| 1978 | 2,021 | 946 | 1,075 | 53.2% |
| 1979 | 2,073 | 993 | 1,080 | 52.1% |
| 1980 | 1,999 | 921 | 1,077 | 53.9% |
| 1981 | 1,942 | 887 | 1,054 | 54.3% |
| 1982 | 1,777 | 820 | 957 | 53.9% |
| 1983 | 1,708 | 751 | 957 | 56.0% |
| 1984 | 1,836 | 803 | 1,033 | 56.3% |
| 1985 | 1,788 | 774 | 1,014 | 56.7% |
| 1986 | 1,874 | 837 | 1,037 | 55.3% |
| 1987 | 1,967 | 891 | 1,076 | 54.7% |
| 1988 | 2,088 | 976 | 1,112 | 53.3% |
| 1989 | 2,140 | 1,038 | 1,103 | 51.5% |
| 1990 | 2,164 | 1,042 | 1,122 | 51.8% |
| 1991 | 2,092 | 1,014 | 1,079 | 51.6% |
| 1992 | 2,132 | 1,037 | 1,095 | 51.4% |
| 1993 | 2,128 | 1,060 | 1,068 | 50.2% |
| 1994 | 2,215 | 1,116 | 1,099 | 49.6% |
| 1995 | 2,240 | 1,147 | 1,093 | 48.8% |
| 1996 | 2,284 | 1,183 | 1,101 | 48.2% |
| 1997 | 2,334 | 1,221 | 1,113 | 47.7% |
| 1998 | 2,339 | 1,245 | 1,094 | 46.8% |
| <i>Average annual percentage change</i> | | | | |
| 1970–98 | 1.5% | 2.8% | 0.5% | |
| 1988–98 | 1.1% | 2.5% | -0.2% | |

Source:

U.S. Department of the Army, Corps of Engineers, *Waterborne Commerce of the United States, Calendar Year 1998*, Part 5: National Summaries, New Orleans, Louisiana, 2000, Table 1-1, p. 1-3, and annual. (Additional resources: www.wrc-ndc.usace.army.mil/ndc)

^aAll movements between the U.S. and foreign countries and between Puerto Rico and the Virgin Islands and foreign countries are classified as foreign trade.

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

Table 12.4
Summary Statistics for Domestic Waterborne Commerce, 1970–98

| Year | Number of vessels ^a | Ton-miles (billions) | Tons shipped ^b (millions) | Average length of haul (miles) | Energy intensity (Btu/ton-mile) | Energy use (trillion Btu) |
|---|--------------------------------|----------------------|--------------------------------------|--------------------------------|---------------------------------|---------------------------|
| 1970 | 25,832 | 596 | 949 | 628.2 | 545 | 324.8 |
| 1971 | 26,063 | 593 | 944 | 628.1 | 506 | 300.0 |
| 1972 | 27,347 | 604 | 985 | 612.8 | 522 | 315.1 |
| 1973 | 28,431 | 585 | 990 | 590.7 | 576 | 337.0 |
| 1974 | 29,328 | 586 | 979 | 599.1 | 483 | 283.3 |
| 1975 | 31,666 | 566 | 944 | 599.9 | 549 | 311.0 |
| 1976 | 33,204 | 592 | 976 | 606.3 | 468 | 277.3 |
| 1977 | 35,333 | 599 | 969 | 618.0 | 458 | 274.3 |
| 1978 | 35,723 | 827 | 1,072 | 771.6 | 383 | 316.6 |
| 1979 | 36,264 | 829 | 1,076 | 770.0 | 457 | 378.7 |
| 1980 | 38,792 | 922 | 1,074 | 856.4 | 358 | 329.8 |
| 1981 | 42,079 | 929 | 1,051 | 884.0 | 360 | 334.5 |
| 1982 | 42,079 | 886 | 954 | 929.0 | 310 | 274.9 |
| 1983 | 41,784 | 920 | 953 | 964.6 | 319 | 293.7 |
| 1984 | 41,784 | 888 | 1,029 | 862.5 | 346 | 307.3 |
| 1985 | 41,672 | 893 | 1,011 | 883.5 | 446 | 398.6 |
| 1986 | 40,308 | 873 | 1,033 | 845.3 | 463 | 404.0 |
| 1987 | 40,000 | 895 | 1,072 | 835.0 | 402 | 370.7 |
| 1988 | 39,192 | 890 | 1,106 | 804.3 | 361 | 321.3 |
| 1989 | 39,209 | 816 | 1,097 | 743.2 | 403 | 328.6 |
| 1990 | 39,233 | 834 | 1,118 | 745.7 | 388 | 323.2 |
| 1991 | 39,233 | 848 | 1,074 | 789.9 | 386 | 327.5 |
| 1992 | 39,210 | 857 | 1,090 | 785.7 | 398 | 341.0 |
| 1993 | 39,064 | 790 | 1,063 | 742.7 | 389 | 307.0 |
| 1994 | 39,064 | 815 | 1,093 | 745.5 | 369 | 300.7 |
| 1995 | 39,641 | 808 | 1,086 | 743.6 | 374 | 302.2 |
| 1996 | 41,104 | 765 | 1,093 | 699.4 | 412 | 314.9 |
| 1997 | 41,419 | 707 | 1,106 | 639.5 | 415 | 293.2 |
| 1998 | 42,032 | 673 | 1,087 | 619.0 | 436 | 293.1 |
| <i>Average annual percentage change</i> | | | | | | |
| 1970–98 | 1.8% | 0.4% | 0.5% | -0.1% | -0.8% | -0.4% |
| 1988–98 | 0.7% | -2.8% | -0.2% | -2.6% | 1.9% | -0.9% |

Source:

Number of vessels -

1970–92, 1995–98 - U.S. Department of the Army, Corps of Engineers, "Summary of U.S. Flag Passenger and cargo vessels, 1998," New Orleans, LA, 2000, and annual.

1993–94 - U.S. Dept 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 1998 Part 5: National Summaries*, New Orleans, LA, 2000, Table 1-4, pp. 1-6, 1-7, and annual.

Energy use - See Appendix A for Table 2.5.

(Additional resources: www.wrc-ndc.usace.army.mil/ndc)

^aGrand total for self-propelled and non-self-propelled.

^bThese figures are not consistent with the figures on Table 6.4 because intra-territory tons are not included in this table. Intra-territory traffic is traffic between ports in Puerto Rico and the Virgin Islands.

Fifty-six percent of all domestic marine cargo in 1998 were energy-related products (petroleum, coal, coke). The majority of the energy-related products were shipped internally and locally (64%). Barge traffic accounted for 96% of all internal and local waterborne commerce.

Table 12.5
Breakdown of Domestic Marine Cargo by Commodity Class, 1998

| Commodity class | Coastwise | | Lakewise | | Internal and local | | Total domestic ^a | | |
|------------------------------|-------------------------|-----------------------------------|-------------------------|-----------------------------------|-------------------------|-----------------------------------|-----------------------------|--------------|-----------------------------------|
| | Tons shipped (millions) | Average haul ^b (miles) | Tons shipped (millions) | Average haul ^b (miles) | Tons shipped (millions) | Average haul ^b (miles) | Tons shipped (millions) | Percentage | Average haul ^b (miles) |
| Petroleum and products | 177 | 1,300 | 2 | 291 | 196 | 200 | 376 | 34.6 | 720 |
| Chemicals and related | 15 | 2,064 | ^c | 322 | 62 | 492 | 78 | 7.1 | 800 |
| Crude materials | 19 | 618 | 94 | 511 | 133 | 348 | 246 | 22.6 | 431 |
| Coal and coke | 15 | 659 | 22 | 525 | 192 | 365 | 229 | 21.1 | 400 |
| Primary manufactured goods | 7 | 680 | 3 | 295 | 30 | 865 | 41 | 3.8 | 784 |
| Food and farm products | 7 | 1,696 | ^c | 929 | 84 | 993 | 92 | 8.4 | 1,047 |
| Manufactured equipment | 9 | 1,655 | ^c | ^c | 12 | 93 | 21 | 1.9 | 738 |
| Waste and scrap | ^c | 667 | 0 | 0 | 5 | 68 | 5 | 0.5 | 68 |
| Unknown | ^c | 2,133 | ^c | ^c | ^c | ^c | ^c | 0.0 | 1,684 |
| Total | 250 | 1,261 | 122 | 504 | 715 | 416 | 1,087 | 100.0 | 620 |
| Barge traffic (million tons) | 115 | | 14 | | 684 | | 813 | | |
| Percentage by barge | 46.0% | | 11.1% | | 95.7% | | 74.8% | | |

Source:

U.S. Department of the Army, Corps of Engineers, *Waterborne Commerce of the United States, Calendar Year 1998, Part 5: National Summaries*, New Orleans,

Louisiana, 2000, Tables 2-1, 2-2, and 2-3, pp. 2-1—2-8, and annual.

(Additional resources: www.wrc-ndc.usace.army.mil/ndc)

Note:

Coastwise applies to domestic traffic receiving a carriage over the ocean or between the Great Lakes ports and seacoast ports when having a carriage over the ocean. Lakewise applies to traffic between United States ports on the Great Lakes. Internal applies to traffic between ports or landings wherein the entire movement takes place on inland waterways. Local applies to movements of freight within the confines of a port.

^aDoes not include intra-territory tons.

^bCalculated as ton-miles divided by tons shipped.

^cNegligible.

The Interstate Commerce Commission designates Class I railroads on the basis of annual gross revenues. In 1998, nine railroads were given this classification.

Table 12.6
Class I Railroad Freight Systems in the United States
Ranked by Revenue Ton-Miles, 1998

| Railroad | Revenue ton-miles (billions) | Percent |
|---|---|----------------|
| Burlington Northern and Sante Fe Railway | 469 | 34.1% |
| Union Pacific Railroad Company | 432 | 31.4% |
| CSX Transportation | 166 | 12.1% |
| Norfolk Southern Corporation | 133 | 9.7% |
| Consolidated Rail Corporation (Conrail) | 101 | 7.3% |
| Illinois Central Railroad Company | 23 | 1.7% |
| Kansas City Southern Railway Company | 22 | 1.6% |
| Soo Line Railroad Company | 20 | 1.5% |
| Grand Trunk Western Railroad Inc. | 9 | 0.7% |
| Total | 1,375 | 100.0% |

Source:

Association of American Railroads, *Railroad Facts*, 1999 Edition, Washington, DC, October 1999, p. 66. (Additional resources: www.aar.org)

Table 12.7
Summary Statistics for Class I Freight Railroads, 1970–98

| 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 |
| 1971 | 27,160 ^d | 1,422 | 430 | 29,181 | 1,391 | 507 | 739,723 | 717 | 530.2 |
| 1972 | 27,044 | 1,411 | 451 | 30,309 | 1,448 | 511 | 776,746 | 714 | 554.4 |
| 1973 | 27,438 | 1,395 | 469 | 31,248 | 1,532 | 531 | 851,809 | 677 | 577.1 |
| 1974 | 27,627 | 1,375 | 469 | 30,719 | 1,531 | 527 | 850,961 | 681 | 579.1 |
| 1975 | 27,855 | 1,359 | 403 | 27,656 | 1,395 | 541 | 754,252 | 687 | 518.3 |
| 1976 | 27,233 | 1,332 | 425 | 28,530 | 1,407 | 540 | 794,059 | 680 | 540.3 |
| 1977 | 27,298 | 1,287 | 428 | 28,749 | 1,395 | 549 | 826,292 | 669 | 552.7 |
| 1978 | 26,959 | 1,226 | 433 | 29,076 | 1,390 | 617 | 858,105 | 641 | 550.4 |
| 1979 | 27,660 | 1,217 | 438 | 29,436 | 1,502 | 611 | 913,669 | 618 | 564.8 |
| 1980 | 28,094 | 1,168 | 428 | 29,277 | 1,492 | 616 | 918,621 | 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 | 470.0 |
| 1985 | 22,548 | 867 | 347 | 24,920 | 1,320 | 664 | 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 |
| <i>Average annual percentage change</i> | | | | | | | | | |
| 1970–98 | -1.0% | -3.2% | 0.4% | 0.3% | 0.4% | 1.7% | 2.1% | -2.3% | -0.2% |
| 1988–98 | 0.5% | -2.3% | 2.3% | 2.2% | 1.4% | 1.8% | 3.3% | -1.9% | 1.3% |

Source:

Association of American Railroads, *Railroad Facts*, 1999 Edition, Washington, DC, October 1999, pp. 27, 28, 33, 34, 36, 48, 50, 60.

(Additional resources: www.aar.org)

^aDoes not include self-powered units. From 1972 to 1979, the number of locomotives used in Amtrak passenger operations are subtracted from the total locomotives used in passenger and freight service to calculate the number of Class I locomotives in service.

^bDoes not include private or shipper-owned cars.

^cTons originated is a more accurate representation of total tonnage than revenue tons. Revenue tons often produces double-counting of loads switched between rail companies.

^dData represent total locomotives used in freight and passenger service. Separate estimates are not available.

The “other” category, which consists primarily of intermodal traffic, has grown 126% in carloads from 1974 to 1998. Coal now accounts for one quarter of all carloads.

Table 12.8
Railroad Revenue Carloads by Commodity Group, 1974 and 1998

| Commodity group | Carloads (thousands) | | Percent distribution | | Percentage change 1974–98 |
|----------------------------------|-------------------------|---------------|-------------------------|---------------|---------------------------------|
| | 1974 | 1998 | 1974 | 1998 | |
| Coal | 4,544 | 7,027 | 17.0% | 27.3% | 54.6% |
| Farm products | 3,021 | 1,404 | 11.3% | 5.5% | -53.5% |
| Chemicals and allied products | 1,464 | 1,680 | 5.5% | 6.5% | 14.8% |
| Nonmetallic minerals | 821 | 1,256 | 3.1% | 4.9% | 53.0% |
| Food and kindred products | 1,777 | 1,282 | 6.6% | 5.0% | -27.9% |
| Lumber and wood products | 1,930 | 645 | 7.2% | 2.5% | -66.6% |
| Metallic ores | 1,910 | 311 | 7.1% | 1.2% | -83.7% |
| Stone, clay and glass | 2,428 | 475 | 9.1% | 1.8% | -80.4% |
| Pulp, paper, and allied products | 1,180 | 547 | 4.4% | 2.1% | -53.6% |
| Petroleum products | 877 | 483 | 3.3% | 1.9% | -44.9% |
| Primary metal products | 1,366 | 671 | 5.1% | 2.6% | -50.9% |
| Waste and scrap material | 889 | 581 | 3.3% | 2.3% | -34.6% |
| Transportation equipment | 1,126 | 1,546 | 4.2% | 6.0% | 37.3% |
| Others | 3,451 | 7,797 | 12.9% | 30.3% | 125.9% |
| Total | 26,784 | 25,705 | 100.0% | 100.0% | -4.0% |

Source:

1974 - Association of American Railroads, *Railroad Facts*, 1976 Edition, Washington, DC, 1975, p. 26.

1997 - Association of American Railroads, *Railroad Facts*, 1999 Edition, Washington, DC,
October 1999, p. 25.

(Additional resources: www.aar.org)

The number of trailers and containers moved by railroads has increased more than four-fold from 1965 to 1998. Containerization has increased in recent years, evidenced by the 135% increase in the number of containers from 1988 to 1997. According to the 1997 Commodity Flow Survey, 5% of all freight ton-miles are rail intermodal shipments (truck/rail or rail/water). See Table 8.11 for details.

Table 12.9
Intermodal Rail Traffic, 1965–98

| Year | Trailers & containers | Trailers | Containers |
|---|-----------------------|-----------|------------|
| 1965 | 1,664,929 | a | a |
| 1970 | 2,363,200 | a | a |
| 1975 | 2,238,117 | a | a |
| 1980 | 3,059,402 | a | a |
| 1981 | 3,150,522 | a | a |
| 1982 | 3,396,973 | a | a |
| 1983 | 4,090,078 | a | a |
| 1984 | 4,565,743 | a | a |
| 1985 | 4,590,952 | a | a |
| 1986 | 4,997,229 | a | a |
| 1987 | 5,503,819 | a | a |
| 1988 | 5,779,547 | 3,481,020 | 2,298,527 |
| 1989 | 5,987,355 | 3,496,262 | 2,491,093 |
| 1990 | 6,206,782 | 3,451,953 | 2,754,829 |
| 1991 | 6,246,134 | 3,201,560 | 3,044,574 |
| 1992 | 6,627,841 | 3,264,597 | 3,363,244 |
| 1993 | 7,156,628 | 3,464,126 | 3,692,502 |
| 1994 | 8,128,228 | 3,752,502 | 4,375,726 |
| 1995 | 8,070,309 | 3,519,664 | 4,550,645 |
| 1996 ^b | 8,153,942 | 3,320,312 | 4,833,630 |
| 1997 ^b | 8,695,860 | 3,453,081 | 5,242,779 |
| 1998 ^b | 8,772,663 | 3,353,032 | 5,419,631 |
| <i>Average annual percentage change</i> | | | |
| 1965–98 | 5.2% | a | a |
| 1988–98 | 4.3% | -0.4% | 9.0% |

Source:

Association of American Railroads, *Railroad Facts*,
1999 edition, Washington, DC, October 1999 p.26.
(Additional resources: www.aar.org)

^a Data are not available.

^b The Grand Trunk Western Railroad and the Soo Line Railroad Company data are excluded.

Table 12.10
Summary Statistics for the National Railroad Passenger Corporation (Amtrak), 1971–98

| 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 |
| 1972 | 285 | 1,571 | 26,302 | 213,261 | 3,039 | 183 | ^a | ^a |
| 1973 | 352 | 1,777 | 27,151 | 239,775 | 3,807 | 224 | 3,756 | 14.3 |
| 1974 | 457 | 1,848 | 29,538 | 260,060 | 4,259 | 233 | 3,240 | 13.8 |
| 1975 | 355 | 1,913 | 30,166 | 253,898 | 3,753 | 224 | 3,677 | 13.8 |
| 1976 | 379 | 2,062 | 30,885 | 263,589 | 4,268 | 229 | 3,397 | 14.5 |
| 1977 | 369 | 2,154 | 33,200 | 261,325 | 4,204 | 221 | 3,568 | 15.0 |
| 1978 | 441 | 2,084 | 32,451 | 255,214 | 4,154 | 217 | 3,683 | 15.3 |
| 1979 | 437 | 2,026 | 31,379 | 255,129 | 4,867 | 226 | 3,472 | 16.9 |
| 1980 | 448 | 2,128 | 29,487 | 235,235 | 4,503 | 217 | 3,176 | 14.3 |
| 1981 | 398 | 1,830 | 30,380 | 222,753 | 4,397 | 226 | 2,979 | 13.1 |
| 1982 | 396 | 1,929 | 28,833 | 217,385 | 3,993 | 220 | 3,156 | 12.6 |
| 1983 | 388 | 1,880 | 28,805 | 223,509 | 4,227 | 223 | 2,957 | 12.5 |
| 1984 | 387 | 1,844 | 29,133 | 234,557 | 4,427 | 227 | 3,027 | 13.4 |
| 1985 | 382 | 1,818 | 30,038 | 250,642 | 4,785 | 238 | 2,800 | 13.4 |
| 1986 | 369 | 1,793 | 28,604 | 249,665 | 5,011 | 249 | 2,574 | 12.9 |
| 1987 | 381 | 1,850 | 29,515 | 261,054 | 5,361 | 259 | 2,537 | 13.6 |
| 1988 | 391 | 1,845 | 30,221 | 277,774 | 5,686 | 265 | 2,462 | 14.0 |
| 1989 | 312 | 1,742 | 31,000 | 285,255 | 5,859 | 274 | 2,731 | 16.0 |
| 1990 | 318 | 1,863 | 33,000 | 300,996 | 6,057 | 273 | 2,609 | 15.8 |
| 1991 | 316 | 1,786 | 34,000 | 312,484 | 6,273 | 285 | 2,503 | 15.7 |
| 1992 | 336 | 1,796 | 34,000 | 307,282 | 6,091 | 286 | 2,610 | 15.9 |
| 1993 | 360 | 1,853 | 34,936 | 302,739 | 6,199 | 280 | 2,646 | 16.4 |
| 1994 | 411 | 1,874 | 34,940 | 305,600 | 5,869 | 276 | 2,351 | 13.8 ^b |
| 1995 | 422 | 1,907 | 31,579 | 282,579 | 5,401 | 266 | 2,314 | 12.5 ^c |
| 1996 | 348 | 1,501 | 30,542 | 277,750 | 5,066 | 257 | 2,389 | 12.1 ^c |
| 1997 | 292 | 1,572 | 32,000 | 287,760 | 5,166 | 255 | 2,458 | 12.7 ^c |
| 1998 | 362 | 1,347 | 32,926 | 315,823 | 5,325 | 251 | 2,460 | 13.0 ^c |
| <i>Average annual percentage change</i> | | | | | | | | |
| 1971–98 | 0.9% ^d | 0.5% | 2.6% | 3.1% | 3.7% | 1.1% | -1.7% ^d | -0.3% ^d |
| 1988–98 | -0.8% | -3.1% | 0.9% | 1.3% | -0.7% | -0.5% | 0.0% | -0.7% |

Source:

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.

1994–98- 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*, 1999 Edition, Washington, DC, 1999, p. 77.

Energy use - Personal communication with the Amtrak, Washington, DC, and estimates thereafter based on train-miles.

(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.

^c Estimated using train-miles.

^d Average annual percentage change is from earliest year available to 1998.

Table 12.11
Summary Statistics for Rail Transit Operations, 1970–98^a

| Year | Number of passenger vehicles | Vehicle-miles (millions) | Passenger trips (millions) ^b | Estimated passenger- miles | Average trip length (miles) ^c | Energy intensity (Btu/passenger-mile) ^d | Energy use (trillion Btu) |
|---|---------------------------------|-----------------------------|--|-------------------------------|---|---|------------------------------|
| 1970 | 10,548 | 440.8 | 2,116 | 12,273 | ^e | 2,453 | 30.1 |
| 1971 | 10,550 | 440.4 | 2,000 | 11,600 | ^f | 2,595 | 30.1 |
| 1972 | 10,599 | 417.8 | 1,942 | 11,264 | ^f | 2,540 | 28.6 |
| 1973 | 10,510 | 438.5 | 1,921 | 11,142 | ^f | 2,460 | 27.4 |
| 1974 | 10,471 | 458.8 | 1,876 | 10,881 | ^f | 2,840 | 30.9 |
| 1975 | 10,617 | 446.9 | 1,797 | 10,423 | ^f | 2,962 | 31.1 |
| 1976 | 10,625 | 428.1 | 1,744 | 10,115 | ^f | 2,971 | 30.3 |
| 1977 | 10,579 | 381.7 | 1,713 | 10,071 | 5.8 | 2,691 | 27.1 |
| 1978 | 10,459 | 383.0 | 1,810 | 10,722 | 5.9 | 2,210 | 23.7 |
| 1979 | 10,429 | 399.6 | 1,884 | 11,167 | 5.9 | 2,794 | 31.2 |
| 1980 | 10,654 | 402.2 | 2,241 | 10,939 | 4.9 | 3,008 | 32.9 |
| 1981 | 10,824 | 436.6 | 2,217 | 10,590 | 4.8 | 2,946 | 31.2 |
| 1982 | 10,831 | 445.2 | 2,201 | 10,428 | 4.6 | 3,069 | 32.0 |
| 1983 | 10,904 | 423.5 | 2,304 | 10,741 | 4.7 | 3,212 | 34.5 |
| 1984 | 10,848 | 452.7 | 2,388 | 10,531 | 4.4 | 3,732 | 39.3 |
| 1985 | 11,109 | 467.8 | 2,422 | 10,777 | 4.4 | 3,461 | 37.3 |
| 1986 | 11,083 | 492.8 | 2,467 | 11,018 | 4.5 | 3,531 | 38.9 |
| 1987 | 10,934 | 508.6 | 2,535 | 11,603 | 4.6 | 3,534 | 41.0 |
| 1988 | 11,370 | 538.3 | 2,462 | 11,836 | 4.8 | 3,565 | 42.2 |
| 1989 | 11,261 | 553.4 | 2,704 | 12,539 | 4.6 | 3,397 | 42.6 |
| 1990 | 11,332 | 560.9 | 2,521 | 12,046 | 4.8 | 3,453 | 41.6 |
| 1991 | 11,426 | 554.8 | 2,356 | 11,190 | 4.7 | 3,727 | 41.7 |
| 1992 | 11,303 | 554.1 | 2,396 | 11,441 | 4.8 | 3,575 | 40.9 |
| 1993 | 11,286 | 549.8 | 2,234 | 10,936 | 4.9 | 3,687 | 42.2 |
| 1994 | 11,192 | 565.8 | 2,453 | 11,501 | 4.8 | 3,828 | 44.0 |
| 1995 | 11,156 | 571.8 | 2,284 | 11,419 | 5.0 | 3,818 | 43.6 |
| 1996 | 11,341 | 580.7 | 2,417 | 12,484 | 5.2 | 3,444 | 43.0 |
| 1997 | 11,471 | 598.9 | 2,692 | 13,091 | 4.9 | 3,253 | 42.6 |
| 1998 | 11,506 | 609.1 | 2,668 | 13,402 | 5.0 | 3,216 | 43.1 |
| <i>Average annual percentage change</i> | | | | | | | |
| 1970–98 | 0.3% | 1.2% | 0.8% | 0.3% | -0.7% ^f | 1.0% | 1.3% |
| 1988–98 | 0.1% | 1.2% | 0.8% | 1.3% | 0.4% | -1.0% | 0.2% |

Source:

American Public Transit Association, *2000 Transit Fact Book*, Washington, DC, March 2000, pp. 69, 70, 78, 83. (Additional resources: www.apta.com)

Energy use - See Appendix A for Table 2.5.

^aHeavy 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.

^b1970–79 data represents total passenger rides; after 1979, data represents unlinked passenger trips.

^cCalculated as the ratio of passenger-miles to passenger trips.

^dLarge system-to-system variations exist within this category.

^eData are not available.

^fAverage annual percentage change is calculated for years 1977-98.

APPENDIX A

SOURCES

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 table number and 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.

List of Abbreviations Used in Appendix A

| | |
|--------|--|
| AAMA | American Automobile Manufacturers Association |
| AAR | Association of American Railroads |
| APTA | American Public Transit Association |
| Amtrak | National Railroad Passenger Corporation |
| Btu | British thermal unit |
| DOC | Department of Commerce |
| DOE | Department of Energy |
| DOT | Department of Transportation |
| EIA | Energy Information Administration |
| EPA | Environmental Protection Agency |
| FAA | Federal Aviation Administration |
| FHWA | Federal Highway Administration |
| gvw | gross vehicle weight |
| lpg | liquefied petroleum gas |
| mpg | miles per gallon |
| NHTSA | National Highway Traffic Safety Administration |
| NPTS | Nationwide Personal Transportation Study |
| ORNL | Oak Ridge National Laboratory |
| pmt | passenger-miles traveled |
| RECS | Residential Energy Consumption Survey |
| RTECS | Residential Transportation Energy Consumption Survey |
| TIUS | Truck Inventory and Use Survey |
| TSC | Transportation Systems Center |
| VIUS | Vehicle Inventory and Use Survey |
| vmt | vehicle-miles traveled |

Table 2.5
Domestic Consumption of Transportation Energy by Mode
and Fuel Type, 1998

Most of the source data were given in gallons. Fuel use was converted to Btu using the conversion factors in Appendix B.

Highway

Automobiles

Total gallons of fuel taken from DOT, FHWA, *Highway Statistics 1998*, Table VM-1. These were distributed as follows: 97.% gasoline, 1.0% gasohol, and 1.3% diesel. Percentages were derived from the DOE, EIA, Office of Markets and End Use, Energy End Use Division, *Household Vehicles Energy Consumption 1994*, August 1997, p. 46. Natural gas data are from the DOE, EIA *Natural Gas Annual 1998*, Table 1; transit bus natural gas was subtracted from the total and the remainder was assumed to be light vehicle use. Automobiles were assumed to use 25% of light vehicle natural gas use. Methanol use was estimated using data from DOE, EIA, *Alternatives to Traditional Transportation Fuels 1998*, Washington, DC, 1999, Table 12.

Motorcycles

DOT, FHWA, *Highway Statistics 1998*, Table VM-1. For conversion purposes, fuel for all motorcycles was assumed to be gasoline.

Buses

Transit:

APTA, *2000 Transit Fact Book*, 2000, Washington, DC.

Non-diesel fossil fuel consumption was assumed to be used by motor buses.

Intercity:

Eno Transportation Foundation, *Transportation in America 1999*, Seventeenth Edition, 2000, Lansdowne, VA, p. 56. For conversion purposes, fuel for all intercity buses was assumed to be diesel fuel.

School:

Gasoline and Diesel - Eno Transportation Foundation, *Transportation in America 1999*, Seventeenth Edition, 2000, Lansdowne, VA, p. 56. For conversion purposes, fuel for school buses was assumed to be 90% diesel fuel and 10% gasoline based on estimates from the National Association of State Directors of Pupil Transportation Services.

Trucks

Total:

Sum of light trucks and other trucks.

Light Trucks:

DOT, FHWA, *Highway Statistics 1998*, Table VM-1, for single-unit, 2-axle, 4-tire trucks. 96.3% of fuel assumed to be gasoline, 3.4% diesel, 0.2% lpg; percentages were generated from the 1997 VIUS Public Use CD. Natural gas data are from the DOE, *EIA Natural Gas Annual 1998*, Table 1; transit bus natural gas was subtracted from the total and the remainder was assumed to be light vehicle use. Light trucks were assumed to use 75% of light vehicle natural gas use.

Other Trucks:

DOT, FHWA, *Highway Statistics 1998*, Table VM-1. Total gallons for other trucks was the difference between total and 2-axle, 4-tire trucks. These gallons were distributed as follows based on data from the 1997 VIUS Public Use CD: 12.4% of fuel assumed to be gasoline, 87.1% diesel, and 0.5% lpg.

Off-Highway

Diesel:

Data supplied by Marianne Mintz, Argonne National Laboratory, from the Public Use Data Base, *National Energy Accounts*, DOC, OBA-NEA-10, August 1988.

Gasoline:

DOT, FHWA, *Highway Statistics 1999*, Table MF-24. Agriculture and Construction totals.

Nonhighway

Air

General Aviation:

DOT, FAA, *General Aviation Activity and Avionics Survey: Annual Summary Report Calendar Year 1998*, Table 5.1. Jet fuel was converted from gallons to Btu using 135,000 Btu/gallon (kerosene-type jet fuel).

Domestic and International Air Carrier:

DOT, Bureau of Transportation Statistics, "Fuel Cost and Consumption Tables;" annual figures were obtained by summing monthly totals. Because the data for international included fuel purchased abroad, the international total was divided in half to estimate domestic fuel use for international flights.

Water

Freight:

Total - DOE, EIA, *Fuel Oil and Kerosene Sales 1998*, Table 23. Adjusted sales of distillate and residual fuel oil for vessel bunkering. (This may include some amounts of bunker fuels used for recreational purposes.)

Recreational Boating:

Fuel use by recreational boating was calculated using the methodology developed by D. L. Greene in the report, *Off-Highway Use of Gasoline in the United States* (DOT, FHWA, July 1986, p. 3-22). Results from Model 1 in the report indicated an average annual consumption of 205 gallons per boat. Total consumption in gallons was then calculated using the following equation: Total = 0.95 (Gal/boat) (number of boats). An estimate of number of recreational boats in operation is from the U.S. Coast Guard (numbered boats).

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 1998*, 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 horse power was generated more efficiently, mostly by electric motors. The energy consumed by natural gas pipeline pumps that were electrically powered was not known. In order to estimate the electricity consumed, the Btu of natural gas pipeline fuel consumed was multiplied by a factor of 0.015. From this computed value, electricity efficiency and generation loss must be taken into account. The electricity energy use in Btu must be converted to kWhr, using the conversion factor 29.305 x 10⁻⁵ kWhr/Btu. Electricity generation and distribution efficiency was 29%. When generation and distribution efficiency are taken into account, 1 kWhr equals 11,765 Btu.

Crude petroleum and petroleum product:

J. N. Hooker, *Oil Pipeline Energy Consumption and Efficiency*, ORNL-5697, ORNL, Oak Ridge, TN, 1981. (Latest available data.)

Coal slurry and water:

W. F. Banks, Systems, Science and Software, *Energy Consumption in the Pipeline Industry*, LaJolla, CA, October 1977. (Latest available data.)

Rail

Total:

Sum of freight and passenger rail.

Freight:

AAR, *Railroad Facts*, 1999 Edition, Washington, DC, 1999.

Passenger:

Transit and Commuter - APTA, *2000 Transit Fact Book*, Washington, DC, 2000.

Transit was defined as the sum of "heavy rail," "light rail," and "other."

Intercity - Personal communication with Amtrak, Washington, DC. (1998 data were estimated using train-mile information.)

Table 2.7
Transportation Energy Consumption by Mode, 1970–98

Highway

Automobiles

Total gallons of fuel for automobiles was taken from DOT, FHWA, *Highway Statistics Summary to 1995*, Table VM-201A; and Table VM-1 in the 1996–1998 annual editions. Fuel for automobiles was distributed between fuel types for conversion into Btu's as follows:

- 1970–80 - 94.7% gasoline, 5.3% diesel as reported in the DOE, EIA, Office of Energy Markets and End Use, *Residential Energy Consumption Survey: Consumption Patterns of Household Vehicles, June 1979 to December 1980*, p. 10.
- 1981–82 - 94.1% gasoline, 5.9% diesel as reported in the DOE, EIA, Office of Energy Markets and End Use, *Residential Energy Consumption Survey: Consumption Patterns of Household Vehicles, Supplement: January 1981 to September 1981*, pp. 11, 13.
- 1983–84 - 97.5% gasoline, 2.5% diesel as reported in the DOE, EIA, Office of Markets and End Use, Energy End Use Division, *Residential Transportation Energy Consumption Survey: Consumption Patterns of Household Vehicles, 1983, Jan., 1985*, pp. 7, 9.
- 1985–87 - 98.5% gasoline, 1.5% diesel as reported in the DOE, EIA, Office of Energy Markets and End Use, *Residential Transportation Energy Consumption Survey: Consumption Patterns of Household Vehicles 1985*, April 1987, pp. 25, 27.
- 1988–90 - 98.8% gasoline and 1.2% diesel as reported in the DOE, EIA, Office of Markets and End Use, Energy End Use Division, *Household Vehicles Energy Consumption 1988*, March 1990, p. 65.
- 1991–93 - 97.8% gasoline, 1.0% gasohol, and 1.2% diesel as reported in the DOE, EIA, Office of Markets and End Use, Energy End Use Division, *Household Vehicles Energy Consumption 1991*, December 1993, p. 46.
- 1994–98 - 97.7% gasoline, 1.0% gasohol, 1.3% diesel as reported in the DOE, EIA, Office of Energy Markets and End Use, *Household Vehicles Energy Consumption, 1994*, Washington, DC, August 1997, p. 46.
- 1993–98 - Natural gas data are from the DOE, EIA *Natural Gas Annual 1998*, Table 1; transit bus natural gas was subtracted from the total and the remainder was assumed to be light vehicle use. Automobiles were assumed to use 25% of light vehicle natural gas use.

Motorcycles

Department of Transportation, Federal Highway Administration, *Highway Statistics Summary to 1995*, Table VM-201A; and Table VM-1 in the 1996–98 annual editions. For conversion purposes, fuel for all motorcycles was assumed to be gasoline.

Buses

Sum of transit, intercity and school.

Transit:

APTA, *2000 Transit Fact Book*, 2000, Washington, DC, and annual.

Non-diesel fossil fuel consumption was assumed to be used by motor buses. For the years 1988–92, motor bus gasoline use was estimated as 5% of "other" fuels, based on personal communication with the APTA Research and Statistics Department.

Intercity:

1970–84 - American Bus Association, *Annual Report*, Washington, DC, annual.

1985–98- Eno Transportation Foundation, *Transportation in America 1999*, Seventeenth Edition, 2000, Lansdowne, VA, p. 56. For conversion purposes, fuel for all intercity buses was assumed to be diesel fuel.

School:

1970–84 - DOT, FHWA, *Highway Statistics 1984*, Washington, DC, Table VM-1, and annual.

1985–86 - DOT, Research and Special Programs Administration, *National Transportation Statistics*, Figure 2, p. 5, and annual.

1987–98- Eno Transportation Foundation, *Transportation in America 1999* , Seventeenth Edition, 1999, Lansdowne, VA, p. 56. For conversion purposes, fuel for school buses was assumed to be 90% diesel fuel and 10% gasoline based on estimates from the National Association of State Directors of Pupil Transportation Services.

Trucks

Light Trucks:

Defined as 2-axle, 4-tire trucks. Total gallons of fuel was taken from DOT, FHWA, *Highway Statistics Summary to 1995*, Table VM-201A, and Table VM-1 of the 1996–98 annual editions. Based on data from the 1982 TIUS Public Use Tape, fuel use for 1970–87 was distributed among fuel types as follows: 95.3% gasoline; 3.5% diesel; and 1.2% lpg. Fuel use for 1988–93 was distributed based on the 1987 TIUS: 96.6% gasoline; 3.3% diesel; and 0.1% lpg. Fuel use for 1994–97 was distributed based on the 1992 TIUS: 96.4% gasoline; 3.3% diesel; 0.3% lpg. Fuel use for 1998 was based on the 1997 VIUS: 96.3% gasoline, 3.4% diesel, 0.2% lpg. Natural gas data are from the DOE, EIA *Natural Gas Annual 1998*, Table 1; transit bus natural gas was subtracted from the total and the remainder was assumed to be light vehicle use. Light trucks were assumed to use 75% of light vehicle natural gas use.

Other Trucks:

Defined as the difference between total trucks and 2-axle, 4-tire trucks. Total gallons of fuel was taken from DOT, FHWA, *Highway Statistics Summary to 1995*, Table VM-201A, and Table VM-1 of the 1996–98 annual editions. Based on data from the 1982 TIUS Public Use Tape, fuel use for 1970–87 was distributed among fuel types as follows: 39.6% gasoline; 59.4% diesel; and 1.0% lpg. Fuel use for 1988–93 was distributed based on the 1987 TIUS: 19.4% gasoline; 80.4% diesel; and 0.2% lpg. Fuel use for 1994–96 was distributed based on the 1992 TIUS: 16.2% gasoline; 83.3% diesel; and 0.5% lpg. Fuel use for 1997–98 was distributed as follows based on data from the 1997 VIUS Public Use CD: 12.4% of fuel assumed to be gasoline, 87.1% diesel, and 0.5% lpg.

Total Highway

Sum of autos, motorcycles, buses, light trucks, and other trucks.

Nonhighway**Air**

Sum of fuel use by General Aviation and Certificated Route Air Carrier.

General Aviation:

1970–74 - DOT, TSC, *National Transportation Statistics*, Cambridge, MA, 1981.

1975–85 - DOT, FAA, *FAA Aviation Forecasts*, Washington, DC, annual.

1985–97 - DOT, FAA, *General Aviation Activity and Avionics Survey: Annual Summary Report, Calendar Year 1998*, Table 5.1. Jet fuel was converted from gallons to Btu using 135,000 Btu/gallon (kerosene-type jet fuel).

Certificated Route Air Carrier:

1970–81 - DOT, Civil Aeronautics Board, *Fuel Cost and Consumption*, Washington, DC, annual.

1982–98 - DOT, Bureau of Transportation Statistics, "Fuel Cost and Consumption Tables;" annual figures were obtained by summing monthly totals. These data are for domestic carriers, but include the international operations of those domestic carriers. The international operations total was divided in half to estimate domestic fuel use for international flights.

Water

Sum of vessel bunkering fuel (i.e., freight) and fuel used by recreational boats.

Freight:

Total - DOE, EIA, *Fuel Oil and Kerosene Sales 1998*, Table 23. Adjusted sales of distillate and residual fuel oil for vessel bunkering. (This may include some amounts of bunker fuels used for recreational purposes.)

Recreational Boating:

1970–84 - DOT, FHWA, *Highway Statistics*, Washington, DC, Table MF-24, annual.

1985–98 - Fuel use by recreational boating was calculated using the methodology developed by D. L. Greene in the report, *Off-Highway Use of Gasoline in the United States* (DOT, FHWA, July 1986, p. 3-22). Results from Model 1 in the report indicated an average annual consumption of 205 gallons per boat. Total consumption in gallons was then calculated using the following equation: Total = 0.95 (Gal/boat) (number of boats). An estimate of number of recreational boats in operation is from the U.S. Coast Guard (numbered boats).

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 1998*, 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 horse power was generated more efficiently, mostly by electric motors. The energy consumed by natural gas pipeline pumps that were electrically powered was not known. In order to estimate the electricity consumed, the Btu of natural gas pipeline fuel consumed was multiplied by a factor of 0.015. From this computed value, electricity efficiency and generation loss must be taken into account. The electricity energy use in Btu must be converted to kWhr, using the conversion factor 29.305×10^{-5} kWhr/Btu. Electricity generation and distribution efficiency was 29%. When generation and distribution efficiency are taken into account, 1 kWhr equals 11,765 Btu.

Crude petroleum and petroleum product:

J. N. Hooker, *Oil Pipeline Energy Consumption and Efficiency*, ORNL-5697, ORNL, Oak Ridge, Tennessee, 1981. (Latest available data.)

Coal slurry and water:

W. F. Banks, Systems, Science and Software, *Energy Consumption in the Pipeline Industry*, LaJolla, California, October 1977. (Latest available data.)

Rail**Total:**

Sum of freight and passenger rail.

Freight:

AAR, *Railroad Facts*, 1999 Edition, Washington, DC.

Passenger:

Transit and Commuter - APTA, *2000 Transit Fact Book*, 2000, Washington, DC , annual.

Transit was defined as the sum of "heavy rail," "light rail," and "other."

Intercity - Personal communication with Amtrak, Washington, DC. (1995–98 data were estimated using train-mile information.)

Table 2.11
Passenger Travel and Energy Use in the United States, 1998

Highway

Automobiles

Number of Vehicles - DOT, FHWA, *Highway Statistics 1998* Table VM-1.

Vmt - DOT, FHWA, *Highway Statistics 1998*, Table VM-1.

Pmt - Calculated by ORNL (load factor times vmt).

Load Factor - DOT, FHWA, Office of Highway Information Management, 1995 NPTS, Public Use Tape, 1997.

Energy Use - Total gallons of fuel taken from DOT, FHWA, *Highway Statistics 1998*, Table VM-1. These were distributed as follows: 97.8% gasoline, 1.0% gasohol, and 1.2% diesel. Percentages were derived from the DOE, EIA, Office of Markets and End Use, Energy End Use Division, *Household Vehicles Energy Consumption 1991*, December 1993, p. 46. Natural gas data are from the DOE, EIA *Natural Gas Annual 1998*, Table 1; transit bus natural gas was subtracted from the total and the remainder was assumed to be light vehicle use. Automobiles were assumed to use 25% of light vehicle natural gas use.

Personal Trucks

Number of Vehicles - Based on the 1997 TIUS, 75.2% of total 2-axle, 4-tire trucks and 16.9% of total other trucks were for personal use. Therefore, 75.2% of total 2-axle, 4-tire trucks (as reported by DOT, FHWA in *Highway Statistics 1998*, Table VM-1) and 16.9% of total other trucks were estimated to be for personal use.

Vmt - 70.7% of total vehicle miles traveled by 2-axle, 4-tire trucks (as reported by DOT, FHWA in *Highway Statistics 1998*, Table VM-1) and 7.1% of total vehicle miles traveled by other trucks were for personal use. The percentages were derived by ORNL from the 1997 VIUS Micro Data File on CD.

Pmt - Calculated by ORNL as vmt multiplied by load factor.

Load Factor - DOT, FHWA, Office of Highway Information Management, 1995 NPTS, Public Use Tape, 1997.

Energy Use - Assuming that there is no difference in fuel economy (measured in miles per gallon) between personal-use trucks and non-personal use trucks, 68.5% of total fuel consumption by 2-axle, 4-tire trucks (as reported by DOT, FHWA in *Highway Statistics 1998*, Table VM-1) and 3.7% of total other truck fuel consumption was for personal use. These percentages were derived by ORNL from the 1997 VIUS Public Use tape. Total truck energy use was the sum of light truck and other truck energy use.

Light Trucks: DOT, FHWA, *Highway Statistics 1998*, Table VM-1, for single-unit, 2-axle, 4-tire trucks. 96.3% of fuel assumed to be gasoline, 3.4% diesel, 0.2% lpg; percentages were generated from the 1997 VIUS Public Use CD. Natural gas data are from the DOE, EIA *Natural Gas Annual 1998*, Table 1; transit bus natural gas was subtracted from the total and the remainder was assumed to be light vehicle use. Light trucks were assumed to use 75% of light vehicle natural gas use.

Other Trucks: DOT, FHWA, *Highway Statistics 1998*, Table VM-1. Total gallons for other trucks was the difference between total and 2-axle, 4-tire trucks. These gallons were distributed as follows based on data from the 1997 VIUS Public Use CD: 12.4% of fuel assumed to be gasoline, 87.1% diesel, and 0.5% lpg.

Motorcycles

Number of Vehicles and Vmt - DOT, FHWA, *Highway Statistics 1998*, Table VM-1.

Pmt - Calculated by ORNL as vmt multiplied by load factor.

Load Factor - DOT, FHWA, Office of Highway Information Management, 1995 NPTS, Public Use Tape, 1997.

Energy Use - DOT, FHWA, *Highway Statistics 1998*, Table VM-1. For conversion purposes, fuel for all motorcycles was assumed to be gasoline.

Buses

Transit:

Number of Vehicles, Vmt, Pmt, and Energy Use - Motor bus only. APTA, *2000 Transit Fact Book*, 2000, Washington, DC.

Load Factor - Calculated by ORNL as pmt/vmt.

Intercity:

Number of Vehicles - Estimated by ORNL as 18% of commercial bus registrations, DOT, FHWA, *Highway Statistics 1998*, Table MV-10.

Pmt - Eno Transportation Foundation, *Transportation in America, 1999*, Seventeenth Edition, Lansdowne, VA, 2000, p. 47.

Vmt - Estimated using passenger travel and an average load factor of 23.2 persons/vehicle.

Load Factor - Estimated as 23.2 based on historical data.

Energy Use - Eno Transportation Foundation, *Transportation in America 1999*, Seventeenth Edition, 2000, Lansdowne, VA, p. 56. For conversion purposes, fuel for all intercity buses was assumed to be diesel fuel.

School:

Number of Vehicles - School and other nonrevenue as reported in DOT, FHWA, *Highway Statistics 1998*, Table MV-10.

Vmt, Pmt - National Safety Council, *Accident Facts*, 1999 Edition, Chicago, IL.

Load Factor - Calculated by ORNL as pmt/vmt.

Energy Use - Eno Transportation Foundation, *Transportation in America 1999*, Sixteenth Edition, 2000, Lansdowne, VA, p. 56. For conversion purposes, fuel for school buses was assumed to be 90% diesel fuel and 10% gasoline based on estimates from the National Association of State Directors of Pupil Transportation Services.

Nonhighway

Air

Large Certified Route Air Carriers:

Vmt, Pmt - DOT, Bureau of Transportation Statistics, *Air Carrier Traffic Statistics Monthly*, December 1998/1999, Washington, DC, p.2.

Load Factor - Calculated by ORNL as pmt/vmt .

Energy Use - DOT, Bureau of Transportation Statistics, "Fuel Cost and Consumption Tables;" annual figures were obtained by summing monthly totals for domestic only.

General Aviation:

Number of Vehicles, Vmt, Energy Use - DOT, FAA, *General Aviation Activity and Avionics, Survey: Calendar Year 1998*, pp. 1-7, 3-11, 5-3.

Pmt - Eno Transportation Foundation, *Transportation in America 1999*, Seventeenth Edition, Lansdowne, VA, 2000, p. 47.

Load Factor - Calculated by ORNL as pmt/vmt .

Recreational Boating

Number of Vehicles - U.S. Coast Guard, Office of Boating Safety, Washington, DC, May 2000.

Energy Use - Fuel use by recreational boating was calculated using the methodology developed by D. L. Greene in the report, *Off-Highway Use of Gasoline in the United States* (DOT, FHWA, July 1986, p. 3-22). Results from Model 1 in the report indicated an average annual consumption of 205 gallons per boat. Total consumption in gallons was then calculated using the following equation: $\text{Total} = 0.95 (\text{Gal/boat}) (\text{number of boats})$. An estimate of number of recreational boats in operation is from the U.S. Coast Guard (numbered boats).

Rail

Intercity:

Number of Vehicles, Vmt and Pmt - AAR, *Railroad Facts*, 1999 Edition, Washington, DC, p. 78.

Load Factor - Calculated by ORNL as pmt/vmt .

Energy Use - Personal communication with Amtrak, Washington, DC. (1998 data estimated using train-mile information.)

Transit and Commuter:

Number of Vehicles, Vmt and Pmt - APTA, *2000 Transit Fact Book*, Washington, DC, 2000.

Load Factor - Calculated by ORNL as pmt/vmt .

Energy Use - APTA, *2000 Transit Fact Book*, 2000, Washington, DC. Transit was defined as the sum of "heavy rail," "light rail," and "other."

Table 2.13
Intercity Freight Movement and Energy Use in the
United States, 1998

Highway

Trucks

Vehicles - 0.4% of total 2-axle, 4-tire trucks (as reported by DOT, FHWA in *Highway Statistics 1998*, Table VM-1) and 29% of total other trucks were engaged in intercity freight movement. These percentages were derived by ORNL from the 1997 VIUS Micro Data File on CD. Intercity freight trucks were defined as any truck whose:

- greatest share of miles were traveled more than 50 miles away from the vehicle's home base; **and**
- principal use was not personal or passenger transportation; **and**
- body type was not pickup, minivan, or utility vehicle.

Vmt - 0.7% of total vehicle miles traveled by 2-axle, 4-tire trucks (as reported by DOT, FHWA in *Highway Statistics 1998*, Table VM-1) and 65.2% of total vehicle miles traveled by other trucks were used in intercity freight movement. These percentages were derived by ORNL from the 1997 VIUS Micro Data File on CD.

Ton Miles, Tons Shipped and Average Length of Haul - Eno Transportation Foundation, *Transportation in America 1999*, Seventeenth Edition, Lansdowne, VA, 2000, pp. 44, 46, 71.

Energy Intensity - Energy use divided by ton-miles.

Energy Use - 1.0% of total fuel consumption by 2-axle, 4-tire trucks (as reported by DOT, FHWA in *Highway Statistics 1998*, Table VM-1) and 71.3% of total other truck fuel consumption were used in intercity freight movement. These percentages were derived by ORNL from the 1997 VIUS Micro Data File on CD.

Nonhighway

Waterborne Commerce

Vehicles - U.S. Department of the Army, Army Corps of Engineers, "Summary of U.S. Flag Passenger and Cargo Vessels, 1998," New Orleans, LA, 2000.

Ton Miles, Tons Shipped, and Average Length of Haul - U.S. Department of the Army, Corps of Engineers, *Waterborne Commerce of the United States, Calendar Year 1998, Part 5: National Summaries*, New Orleans, LA, 2000, pp. 1-6, 1-7.

Energy Intensity - Energy use divided by ton miles.

Energy Use - DOE, EIA, *Fuel Oil and Kerosene Sales 1998* Table 23. Adjusted sales of distillate and residual fuel oil for vessel bunkering. (This may include some amounts of bunker fuels used for recreational purposes.)

Domestic freight energy use was calculated as:

Distillate fuel - 77.5% domestic

Residual fuel - 9.3% domestic.

Percentages were derived from the DOC, U.S. Foreign Trade, *Bunker Fuels*, "Oil and Coal Laden in the U.S. on Vessels Engaged in Foreign Trade," 1988.

Pipeline

Natural Gas:

Tons shipped - DOE, EIA, *Natural Gas Annual 1998*, Washington, DC, 1999, Table 1. Total natural gas disposition divided by 44,870 ft³/ton.

Energy use - The amount of natural gas used to transport natural gas was defined as "pipeline fuel" as reported in DOE, EIA, *Natural Gas Annual 1998*, 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 horse power was generated more efficiently, mostly by electric motors. The energy consumed by natural gas pipeline pumps that were electrically powered was not known. In order to estimate the electricity consumed, the Btu of natural gas pipeline fuel consumed was multiplied by a factor of 0.015. From this computed value, electricity efficiency and generation loss must be taken into account. The electricity energy use in Btu must be converted to kWhr, using the conversion factor 29.305×10^{-5} kWhr/Btu. Electricity generation and distribution efficiency was 29%. When generation and distribution efficiency are taken into account, 1 kWhr equals 11,765 Btu.

Crude Oil and Petroleum Product:

Ton Miles and Tons Shipped - Eno Transportation Foundation, *Transportation in America 1999*, Seventeenth Edition, Lansdowne, VA, 2000, pp. 44, 46.

Energy Use - W. F. Banks, Systems, Science, and Software, Inc., *Energy Consumption in the Pipeline Industry*, LaJolla, CA, 1977.

Rail

Vehicles, Vmt, Tons, Ton Miles, Average Length of Haul and Energy Use - AAR, *Railroad Facts*, 1999 Edition, Washington, DC, 1999.

Table 2.12
Energy Intensities of Passenger Modes, 1970–98

In reference to transportation, the energy intensity of a mode is the ratio of the energy inputs to a process to a measure of the useful outputs from that process; for example, Btu per pmt or Btu per ton-mile. The energy intensity ratios were calculated for each passenger mode using the following data sources:

Highway

Automobiles

Vmt - DOT, FHWA, *Highway Statistics Summary to 1995*, Table VM-201A, and Table VM-1 of the 1996–98 editions.

Pmt - vmt multiplied by the load factor.

Energy Use - Total gallons of fuel for automobiles was taken from DOT, FHWA, *Highway Statistics Summary to 1995*, Table VM-201A; and Table VM-1 in the 1996–98 annual editions. Fuel for automobiles was distributed between fuel types for conversion into Btu's as follows:

1970–80 - 94.7% gasoline, 5.3% diesel as reported in the DOE, EIA, Office of Energy Markets and End Use, *Residential Energy Consumption Survey: Consumption Patterns of Household Vehicles, June 1979 to December 1980*, p. 10.

1981–82 - 94.1% gasoline, 5.9% diesel as reported in the DOE, EIA, Office of Energy Markets and End Use, *Residential Energy Consumption Survey: Consumption Patterns of Household Vehicles, Supplement: January 1981 to September 1981*, pp. 11, 13.

1983–84 - 97.5% gasoline, 2.5% diesel as reported in the DOE, EIA, Office of Markets and End Use, Energy End Use Division, *Residential Transportation Energy Consumption Survey: Consumption Patterns of Household Vehicles, 1983, Jan., 1985*, pp. 7, 9.

1985–87 - 98.5% gasoline, 1.5% diesel as reported in the DOE, EIA, Office of Energy Markets and End Use, *Residential Transportation Energy Consumption Survey: Consumption Patterns of Household Vehicles 1985*, April 1987, pp. 25, 27.

1988–90 - 98.8% gasoline and 1.2% diesel as reported in the DOE, EIA, Office of Markets and End Use, Energy End Use Division, *Household Vehicles Energy Consumption 1988*, March 1990, p. 65.

1991–93 - 97.8% gasoline, 1.0% gasohol, and 1.2% diesel as reported in the DOE, EIA, Office of Markets and End Use, Energy End Use Division, *Household Vehicles Energy Consumption 1991*, December 1993, p. 46.

1994–98 - 97.7% gasoline, 1.0% gasohol, 1.3% diesel as reported in the DOE, EIA, Office of Energy Markets and End Use, *Household Vehicles Energy Consumption 1994*, Washington, DC, August 1997, p. 46.

1993–98 - Methanol use was estimated using data from DOE, EIA, *Alternatives to Traditional Transportation Fuels 1999*, Washington, DC, 1998, Table 12.

1993–98 - Natural gas data are from the DOE, EIA *Natural Gas Annual 1998*, Table 1; transit bus natural gas was subtracted from the total and the remainder was assumed to be light vehicle use. Automobiles were assumed to use 25% of light vehicle natural gas use.

Light Trucks

Vmt - DOT, FHWA, *Highway Statistics Summary to 1995*, Table VM-201A, and Table VM-1 of the 1996–98 editions. Light trucks were defined as 2-axle, 4-tire trucks.

Energy Use - Defined as 2-axle, 4-tire trucks. Total gallons of fuel was taken from DOT, FHWA, *Highway Statistics Summary to 1995*, Table VM-201A, and Table VM-1 of the 1996–98 annual editions. Based on data from the 1982 TIUS Public Use Tape, fuel use for 1970–87 was distributed among fuel types as follows: 95.3% gasoline; 3.5% diesel; and 1.2% lpg. Fuel use for 1988–93 was distributed based on the 1987 TIUS: 96.6% gasoline; 3.3% diesel; and 0.1% lpg. Fuel use for 1994–96 was distributed based on the 1992 TIUS: 96.4% gasoline; 3.3% diesel; 0.3% lpg. Fuel use for 1997–98 was based on the 1997 VIUS: 96.3% gasoline, 3.4% diesel, 0.2% lpg. Natural gas data are from the DOE, EIA *Natural Gas Annual 1998*, Table 1; transit bus natural gas was subtracted from the total and the remainder was assumed to be light vehicle use. Light trucks were assumed to use 75% of light vehicle natural gas use.

Buses

Transit:

Vmt, Pmt, Energy Use - APTA, *2000 Transit Fact Book*, Washington, DC, 2000, and annual.

Non-diesel fossil fuel consumption was assumed to be used by motor buses. For the years 1988–94, motor bus gasoline use was estimated as 5% of "other" fuels, based on personal communication with the APTA Research and Statistics Department.

Intercity:

Pmt - 1970–84 - American Bus Association, *Annual Report*, Washington, DC, annual.

1985–98 - Eno Transportation Foundation, *Transportation in America 1999*, Seventeenth Edition, Lansdowne, VA, 2000, p. 47.

Vmt - 1990–98 - Estimated using passenger travel and an average load factor of 23.2.

Energy Use - 1970–84 - American Bus Association, *Annual Report*, Washington, DC, annual.

1985–98 - Eno Transportation Foundation, *Transportation in America 1999*, Seventeenth Edition, Lansdowne, VA, p. 56, and annual. For conversion purposes, fuel for all intercity buses was assumed to be diesel fuel.

School:

Vmt - 1970–84 - DOT, FHWA, *Highway Statistics 1984*, Washington, DC, Table VM-1, p. 175, and annual.

1985–87 - DOT, TSC, *National Transportation Statistics*, 1989, Figure 2, p. 7, and annual.

1988–98 - National Safety Council, *Accident Facts*, 1999 Edition, Chicago, IL, and annual.

Energy Use - 1970–84 - DOT, FHWA, *Highway Statistics 1984*, Washington, DC, Table VM-1, and annual.

1985–86 - DOT, TSC, *National Transportation Statistics*, Figure 2, p. 5, and annual.

1987–98 - Eno Transportation Foundation, *Transportation in America 1999*, Seventeenth Edition, Lansdowne, VA, p. 56, and annual. For conversion purposes, fuel for school buses was assumed to be 90% diesel fuel and 10% gasoline based on estimates from the National Association of State Directors of Pupil Transportation Services.

Nonhighway

Air

Certificated Air Carriers:

Pmt - DOT, Bureau of Transportation Statistics, *Air Carrier Traffic Statistics Monthly*, December 1998/99, Washington, DC, p. 2.

Energy Use - 1970–81 - DOT, Civil Aeronautics Board, *Fuel Cost and Consumption*, Washington, DC, annual.

1982–98 - DOT, Bureau of Transportation Statistics, "Fuel Cost and Consumption Tables;" annual figures were obtained by summing monthly totals for domestic only.

General Aviation:

Pmt - Eno Transportation Foundation, *Transportation In America 1999*, Seventeenth Edition, Washington, DC, 1999, p.47.

Energy Use - 1970–74 - DOT, TSC, *National Transportation Statistics*, Cambridge, MA, 1981.

1975–85 - DOT, FAA, *FAA Aviation Forecasts*, Washington, DC, annual.

1985–98 - DOT, FAA, *General Aviation Activity and Avionics Survey: Calendar Year 1998*, Table 5.1. Jet fuel was converted from gallons to Btu using 135,000 Btu/gallon (kerosene-type jet fuel).

Rail

Passenger (Amtrak):

Pmt - 1971–83 - AAR, *Statistics of Class I Railroads*, Washington, DC, annual.

1984–88, 1995–96 - AAR, *Railroad Facts*, 1987 Edition, Washington, DC, December 1987, p. 78, and annual.

1989–94 - Personal communication with Amtrak.

1995–98 - AAR, *Railroad Facts*, 1999 Edition, Washington, DC, 1999, p. 77, and annual.

Energy Use - Personal communication with Amtrak. (1995–98 were estimated using train-mile information.)

Transit:

Pmt and Energy Use - APTA, *2000 Transit Fact Book*, Washington, DC, 2000.

Transit was defined as the sum of "heavy rail," "light rail."

Table 2.14
Energy Intensities of Freight Modes, 1970–98

In reference to transportation, the energy intensity of a mode is the ratio of the energy inputs to a process to a measure of the useful outputs from that process; for example, Btu per pmt or Btu per ton-mile. The energy intensity ratios were calculated for each freight mode using the following data sources:

Highway

Heavy Single-Unit and Combination Trucks

Vmt - DOT, FHWA, *Highway Statistics Summary to 1995*, Table VM-201A, and Table VM-1 of the 1996–98 editions. Heavy single-unit and combination trucks were defined as the difference between total trucks and 2-axle, 4-tire trucks.

Energy Use - Defined as the difference between total trucks and 2-axle, 4-tire trucks. Total gallons of fuel was taken from DOT, FHWA, *Highway Statistics Summary to 1995*, Table VM-201A, and Table VM-1 of the 1996–98 annual editions. Based on data from the 1982 TIUS Public Use Tape, fuel use for 1970–87 was distributed among fuel types as follows: 39.6% gasoline; 59.4% diesel; and 1.0% lpg. Fuel use for 1988–93 was distributed based on the 1987 TIUS: 19.4% gasoline; 80.4% diesel; and 0.2% lpg. Fuel use for 1994–96 was distributed based on the 1992 TIUS: 16.2% gasoline; 83.3% diesel; and 0.5% lpg. Fuel use for 1997–98 was distributed as follows based on data from the 1997 VIUS Public Use CD: 12.4% of fuel assumed to be gasoline, 87.1% diesel, and 0.5% lpg.

Nonhighway

Water

Ton Miles - U.S. Department of the Army, Corps of Engineers, *Waterborne Commerce of the United States, Calendar Year 1999, Part 5: National Summaries*, New Orleans, LA, 2000, p. 1-6, and annual.

Energy Use - Calculated as the difference between total water freight energy use and foreign water freight energy use.

Total - DOE, EIA, *Fuel Oil and Kerosene Sales 1998*, Table 23. Adjusted sales of distillate and residual fuel oil for vessel bunkering. (This may include some amounts of bunker fuels used for recreational purposes.)

Rail

Freight Car Miles, Ton Miles and Energy Use - AAR, *Railroad Facts*, 1999 Edition, Washington, DC, 1999, and annual.

Table 6.4
Vehicle Stock and New Sales in the
United States, 1998 Calendar Year

Highway

Automobiles

Stock -The number of vehicles in use by EPA size class were derived as follows: Market Shares by EPA size class for new car sales from 1970–75 were taken from the DOT, NHTSA, *Automotive Characteristics Historical DataBase*, Washington, DC. Market shares for the years 1976–90 were found in Linda S. Williams and Patricia S. Hu, *Highway Vehicle MPG and Market Shares Report: Model Year 1990*, ORNL-6672, April 1991, and Table 7 and the ORNL MPG and Market Shares Database, thereafter. These data were assumed to represent the number of cars registered in each size class for each year. These percentages were applied to the automobiles in operation for that year as reported by The Polk Company (FURTHER REPRODUCTION PROHIBITED) and summed to calculate the total mix. This method assumed that all vehicles, large and small, were scrapped at the same rate.

Sales - Domestic, import, and total sales were from *Ward's Motor Vehicle Facts and Figures 1999*, p. 15. The domestic sales were distributed by size class according to the following percentages: Two seater, 0.0%; Minicompact, 18.9%; Subcompact, 27.6%; Compact 37.3%; Midsize, 15.4%; and Large, 0.8%. The import sales were distributed by size class according to the following percentages: Two-seater, 0.9%; Minicompact, 16.4%; Subcompact, 33.7%; Compact, 44.2%; Midsize, 1.3%; and Large, 3.5%. These percentages were derived from the ORNL MPG and Market Shares Database. Domestic-sponsored imports (captive imports) were included in the import figure only.

Business fleet autos - Bobit Publishing Company, Automotive Fleet Research Department, *Automotive Fleet Factbook 1999*, Redondo Beach, CA, 1999.

Personal autos - Difference between total vehicle stock and business fleet autos.

See Glossary for definition of Automobile Size Classifications.

Motorcycles

Stock - DOT, FHWA, *Highway Statistics 1998*, Table VM-1, 1999.

Recreational Vehicles

Sales - *Ward's Automotive Yearbook 1999*, U.S. Recreation Vehicle Shipments by Type, "Total," p. 242.

Trucks

Stock - Vehicles in use by weight class were determined by applying the percentage in use by weight class as reported in DOC, Bureau of the Census, 1997 VIUS, (0–10,000 lbs, 93.5%; 10,001–19,500 lbs, 2.0%; 19,501–26,000 lbs, 1.0%; 26,001 lbs and over, 3.5%) to the total number of trucks in use as reported by R. L. Polk and Company (FURTHER REPRODUCTION PROHIBITED).

Sales - *Ward's Motor Vehicle Facts and Figures 1999*, p. 25.

Business fleet trucks - Bobit Publishing Company, Automotive Fleet Research Department, *Automotive Fleet Factbook 1998*, Redondo Beach, CA, 1998.

Personal trucks - Difference between total stock and business fleet trucks.

Table 8.13
Summary Statistics on Buses by Type, 1970–98

Number in Operation

Transit buses:

American Public Transit Association, *2000 Transit Fact Book*, Washington, DC, 2000, p. 83, and annual.

Intercity buses:

1970–80 - American Bus Association, *1984 Annual Report*, Washington, DC, and annual.

1985 - U.S. Department of Transportation, Transportation Systems Center, *National Transportation Statistics*, Cambridge, MA, August 1990, Figure 5, p. 8, and annual.

1990–98 - Estimated as 38% of commercial buses (less transit motor buses). Commercial bus total found in *Highway Statistics 1998*, Table MV-10, and annual.

School buses:

U.S. Department of Transportation, Federal Highway Administration, *Highway Statistics 1998*, Washington, DC, 1999, Table MV-1,0 and annual.

Vehicle-miles and Passenger-miles

Transit buses:

American Public Transit Association, *2000 Transit Fact Book*, Washington, DC, 2000, pp. 70, 78, and annual.

Intercity buses:

1970–80 - American Bus Association, *Annual Report*, Washington, DC, annual.

1985–98 - Eno Transportation Foundation, *Transportation in America 1999*, Seventeenth edition, Lansdowne, VA, 2000, p. 47.

1990–98 *vehicle travel* - Estimated using passenger travel and an average load factor of 23.2.

School buses:

1970–80 - U.S. Department of Transportation, Federal Highway Administration, *Highway Statistics 1984*, Washington, DC, Table VM-1, p. 175, and annual.

1985 - U.S. Department of Transportation, Research and Special Programs Administration, *National Transportation Statistics*, 1989, Figure 2, p. 7, and annual.

1990–98 - National Safety Council, *Accident Facts*, 1999 Edition, Chicago, IL, pp. 94, and annual. Note: In the 1999 Edition the National Safety Council discontinued publishing the passenger-miles data. There is currently no other known source for these data.

Energy Use

Transit buses:

American Public Transit Association, *2000 Transit Fact Book*, Washington, DC, 2000, pp. 112–114. Gasoline consumption was assumed to be used by motor buses. For the years 1988–92, motor bus gasoline use was estimated as 5% of "other" fuels, based on personal communication with the APTA Research and Statistics Department.

Intercity buses:

1970–80 - American Bus Association, *Annual Report*, Washington, DC, annual.

1985–98 - Eno Transportation Foundation, *Transportation in America 1999*, Seventeenth edition, Lansdowne, VA, p. 56. For conversion purposes, fuel for all intercity buses was assumed to be diesel fuel.

School buses:

1970–80 - DOT, FHWA, *Highway Statistics 1984*, Washington, DC, Table VM-1, and annual.

1985–86 - DOT, Research and Special Programs Administration, *National Transportation Statistics*, Figure 2, p. 5, and annual.

1987–98 - Eno Transportation Foundation, *Transportation in America 1999*, Seventeenth edition, Lansdowne, VA, p. 56. For conversion purposes, fuel for school was assumed to be 90% diesel fuel and 10% gasoline based on estimates from the National Association of State Directors of Pupil Transportation Services.

APPENDIX B

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.1 may differ from values in other publications. The figures in this report are representative or average values, not absolute ones. The gross heating values used here agree with those used by the Energy Information Administration (EIA).

Heating values fall into two categories, gross and net. If the products of fuel combustion are cooled back to the initial fuel-air or fuel-oxidizer mixture temperature and the water formed during combustion is condensed, the energy released by the process is the higher (gross) heating value. If the products of combustion are cooled to the initial fuel-air temperature, but the water is considered to remain as a vapor, the energy released by the process is lower (net) heating value. Usually the difference between the gross and net heating values for fuels used in transportation is around 5 to 8 percent; however, it is important to be consistent in their use.

Table B.1
Approximate Heat Content for Various Fuels

| | |
|--------------------------------------|---|
| Automotive gasoline | 125,000 Btu/gal(gross) = 115,400 Btu/gal(net) |
| Diesel motor fuel | 138,700 Btu/gal (gross) = 128,700 Btu/gal (net) |
| Methanol | 64,600 Btu/gal (gross) = 56,560 Btu/gal (net) |
| Ethanol | 84,600 Btu/gal (gross) = 75,670 Btu/gal (net) |
| Gasohol | 120,900 Btu/gal (gross) = 112,417 Btu/gal (net) |
| Aviation gasoline | 120,200 Btu/gal (gross) = 112,000 Btu/gal (net) |
| Propane | 91,300 Btu/gal (gross) = 83,500 Btu/gal (net) |
| Butane | 103,000 Btu/gal (gross) = 93,000 Btu/gal (net) |
| Jet fuel (naphtha) | 127,500 Btu/gal (gross) = 118,700 Btu/gal (net) |
| Jet fuel (kerosene) | 135,000 Btu/gal (gross) = 128,100 Btu/gal (net) |
| Lubricants | 144,400 Btu/gal (gross) = 130,900 Btu/gal (net) |
| Waxes | 131,800 Btu/gal (gross) = 120,200 Btu/gal (net) |
| Asphalt and road oil | 158,000 Btu/gal (gross) = 157,700 Btu/gal (net) |
| Petroleum coke | 143,400 Btu/gal (gross) = 168,300 Btu/gal (net) |
| Natural gas | |
| Wet | 1,109 Btu/ft ³ |
| Dry | 1,027 Btu/ft ³ |
| Compressed | 20,551 Btu/pound |
| | 960 Btu/cubic foot |
| Liquid | 90,800 Btu/gal (gross) = 87,600 Btu/gal (net) |
| Crude petroleum | 138,100 Btu/gal (gross) = 131,800 Btu/gal (net) |
| Fuel Oils | |
| Residual | 149,700 Btu/gal (gross) = 138,400 Btu/gal (net) |
| Distillate | 138,700 Btu/gal (gross) = 131,800 Btu/gal (net) |
| Coal | |
| Anthracite - Consumption | 21.711 x 10 ⁶ Btu/short ton |
| Bituminous and lignite - Consumption | 21.012 x 10 ⁶ Btu/short ton |
| Production average | 21.352 x 10 ⁶ Btu/short ton |
| Consumption average | 21.015 x 10 ⁶ Btu/short ton |

Table B.2
Fuel Equivalents

| | |
|---|---|
| 1 million bbl crude oil/day | = 0.3650 billion bbl crude oil/year = 2.117 quadrillion Btu/year = 99.45 million short tons coal/year = 90.22 million metric tons coal/year = 2.061 trillion ft ³ natural gas/year = 2.233 exajoule/year |
| 1 billion bbl crude oil/year | = 2.740 million bbl crude oil/day = 5.800 quadrillion Btu/year = 272.5 million short tons coal/year = 247.2 million metric tons coal/year = 5.648 trillion ft ³ natural gas/year = 6.119 exajoule/year |
| 1 quadrillion Btu/year | = 0.4724 million bbl crude oil/day = 172.4 million bbl crude oil/year = 46.98 million short tons coal/year = 42.62 million metric tons coal/year = 973.7 billion ft ³ natural gas/year = 1.055×10^{-3} exajoule/year |
| 1 billion short tons coal/year | = 0.9072 billion metric tons coal/year = 10.06 million bbl crude oil/day = 3.670 billion bbl crude oil/year = 21.29 quadrillion Btu/year = 20.73 trillion ft ³ natural gas/year = 22.46 exajoule/year |
| 1 billion metric tons coal/year | = 1.102 billion short tons coal/year = 9.122 million bbl crude oil/day = 3.330 billion bbl crude oil/year = 19.31 quadrillion Btu/year = 18.80 trillion ft ³ natural gas/year = 20.37 exajoules/year |
| 1 trillion ft ³ natural gas/year | = 0.4851 million bbl crude oil/day = 0.1771 billion bbl crude oil/year = 1.027 quadrillion Btu/year = 48.25 million short tons coal/year = 43.77 million metric tons coal/year = 1.083×10^{-3} exajoules/year |
| 1 exajoule/year | = 0.4477 million bbl crude oil/day = 0.1634 billion bbl crude oil/year = 947.9 trillion Btu/year = 44.53 million short tons coal/year = 40.40 million metric tons coal/year = 0.9229 trillion ft ³ natural gas/year |

Table B.3
Energy Unit Conversions

| | | | |
|--------|--|---------------|---|
| 1 Btu | = 778.2 ft-lb = 107.6 kg-m = 1055 J = 39.30 x 10 ⁻⁵ hp-h = 39.85 x 10 ⁻⁵ metric hp-h = 29.31 x 10 ⁻⁵ kWhr | 1 kWhr | = 3412 Btu ^a = 2.655 x 10 ⁶ ft-lb = 3.671 x 10 ⁵ kg-m = 3.600 x 10 ⁶ J = 1.341 hp-h = 1.360 metric hp-h |
| 1 kg-m | = 92.95 x 10 ⁻⁴ Btu = 7.233 ft-lb = 9.806 J = 36.53 x 10 ⁻⁷ hp-h = 37.04 x 10 ⁻⁷ metric hp-h = 27.24 x 10 ⁻⁷ kWhr | 1 Joule | = 94.78 x 10 ⁻⁵ Btu = 0.7376 ft-lb = 0.1020 kg-m = 37.25 x 10 ⁻⁸ hp-h = 37.77 x 10 ⁻⁸ metric hp-h = 27.78 x 10 ⁻⁸ kWhr |
| 1 hp-h | = 2544 Btu = 1.98 x 10 ⁶ ft-lb = 2.738 x 10 ⁶ kgm = 2.685 x 10 ⁶ J = 1.014 metric hp-h = 0.7475 kWhr | 1 metric hp-h | = 2510 Btu = 1.953 x 10 ⁶ ft-lb = 27.00 x 10 ⁴ kg-m = 2.648 x 10 ⁶ J = 0.9863 hp-h = 0.7355 kWhr |

^aThis figure does not take into account the fact that electricity generation and distribution efficiency is approximately 29%. If generation and distribution efficiency are taken into account, 1 kWhr = 11,765 Btu.

Table B.4
International Energy Conversions

| To: | TJ | Gcal | Mtoe | Mbtu | GWh |
|--------------|---------------------------|-----------------|--------------------------|-------------------------|--------------------------|
| From: | <i>multiply by:</i> | | | | |
| TJ | 1 | 238.8 | 2.388 x 10 ⁻⁵ | 947.8 | 0.2778 |
| Gcal | 4.1868 x 10 ⁻³ | 1 | 10 ⁻⁷ | 3.968 | 1.163 x 10 ⁻³ |
| Mtoe | 4.1868 x 10 ⁴ | 10 ⁷ | 1 | 3.968 x 10 ⁷ | 11,630 |
| Mbtu | 1.0551 x 10 ⁻³ | 0.252 | 2.52 X 10 ⁻⁸ | 1 | 2.931 x 10 ⁻⁴ |
| Gwh | 3.6 | 860 | 8.6 x 10 ⁻⁵ | 3412 | 1 |

Table B.5
Distance and Velocity Conversions

| | | | |
|--|---------------------------------|------|---------------------------------|
| 1 in. | = 83.33 x 10 ⁻³ ft | 1 ft | = 12.0 in. |
| | = 27.78 x 10 ⁻³ yd | | = 0.33 yd |
| | = 15.78 x 10 ⁻⁶ mile | | = 189.4 x 10 ⁻³ mile |
| | = 25.40 x 10 ⁻³ m | | = 0.3048 m |
| | = 0.2540 x 10 ⁻⁶ km | | = 0.3048 x 10 ⁻³ km |
| 1 mile | = 63360 in. | 1 km | = 39370 in. |
| | = 5280 ft | | = 3281 ft |
| | = 1760 yd | | = 1093.6 yd |
| | = 1609 m | | = 0.6214 mile |
| | = 1.609 km | | = 1000 m |
| 1 ft/sec = 0.3048 m/s = 0.6818 mph = 1.0972 km/h | | | |
| 1 m/sec = 3.281 ft/s = 2.237 mph = 3.600 km/h | | | |
| 1 km/h = 0.9114 ft/s = 0.2778 m/s = 0.6214 mph | | | |
| 1 mph = 1.467 ft/s = 0.4469 m/s = 1.609 km/h | | | |

Table B.6
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 ₂ O-N) | = | 1.571 pounds nitrous oxide, measured at full molecular weight (N ₂ O) |

Table B.7
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 |

^aThe conversions for flow rates are identical to those for volume measures, if the time units are identical.

Table B.8
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.9
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 | 2000 | 907.2 | 1 | 0.8929 | 0.9072 |
| Long ton | 2240 | 1016 | 1.12 | 1 | 1.016 |
| Metric ton | 2205 | 1000 | 1.102 | 0.9842 | 1 |

Table B.10
Fuel Efficiency Conversions^a

| MPG | Miles/liter | Kilometers/L | L/100 kilometers |
|-----|-------------|--------------|------------------|
| 10 | 2.64 | 4.25 | 23.52 |
| 15 | 3.96 | 6.38 | 15.68 |
| 20 | 5.28 | 8.50 | 11.76 |
| 25 | 6.60 | 10.63 | 9.41 |
| 30 | 7.92 | 12.75 | 7.84 |
| 35 | 9.25 | 14.88 | 6.72 |
| 40 | 10.57 | 17.00 | 5.88 |
| 45 | 11.89 | 19.13 | 5.23 |
| 50 | 13.21 | 21.25 | 4.70 |
| 55 | 14.53 | 23.38 | 4.28 |
| 60 | 15.85 | 25.51 | 3.92 |
| 65 | 17.17 | 27.63 | 3.62 |
| 70 | 18.49 | 29.76 | 3.36 |
| 75 | 19.81 | 31.88 | 3.14 |
| 80 | 21.13 | 34.01 | 2.94 |
| 85 | 22.45 | 36.13 | 2.77 |
| 90 | 23.77 | 38.26 | 2.61 |
| 95 | 25.09 | 40.38 | 2.48 |
| 100 | 26.42 | 42.51 | 2.35 |
| 105 | 27.74 | 44.64 | 2.24 |
| 110 | 29.06 | 46.76 | 2.14 |
| 115 | 30.38 | 48.89 | 2.05 |
| 120 | 31.70 | 51.01 | 1.96 |
| 125 | 33.02 | 53.14 | 1.88 |
| 130 | 34.34 | 55.26 | 1.81 |
| 135 | 35.66 | 57.39 | 1.74 |
| 140 | 36.98 | 59.51 | 1.68 |
| 145 | 38.30 | 61.64 | 1.62 |
| 150 | 39.62 | 63.76 | 1.57 |

^aTo convert fuel efficiency from miles per gallon (mpg) to liters per hundred kilometers, divide mpg into 235.24.

Table B.11
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 |

^aCare 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.12
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 |

Conversion of Constant Dollar Values

Many types of information in this data book are expressed in dollars. Generally, constant dollars are used--that is, dollars of a fixed value for a specific year, such as 1990 dollars. Converting current dollars to constant dollars, or converting constant dollars for one year to constant dollars for another year, requires conversion factors (Table B.13 and B.14). Table B.13 shows conversion factors for the Consumer Price Index inflation factors. Table B.14 shows conversion factors using the Gross National Product inflation factors.

Due to the size of the tables, the data in Tables B.13 and B.14 were changed to two decimal places starting with Edition 17. However, three decimal places were used to calculate all constant dollar values.

Table B.13
Consumer Price Inflation (CPI) Index

| From | To | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|
| | 1970 | 1971 | 1972 | 1973 | 1974 | 1975 | 1976 | 1977 | 1978 | 1979 | 1980 | 1981 | 1982 | 1983 | 1984 | 1985 | 1986 | 1987 | 1988 | 1989 | 1990 | 1991 | 1992 | 1993 | 1994 | 1995 | 1996 | 1997 | 1998 | 1999 |
| 1970 | 1.00 | 1.04 | 1.08 | 1.14 | 1.27 | 1.39 | 1.47 | 1.56 | 1.68 | 1.87 | 2.12 | 2.34 | 2.49 | 2.57 | 2.68 | 2.77 | 2.82 | 2.93 | 3.05 | 3.19 | 3.37 | 3.51 | 3.61 | 3.72 | 3.82 | 3.93 | 4.04 | 4.13 | 4.20 | 4.29 |
| 1971 | 0.96 | 1.00 | 1.03 | 1.10 | 1.22 | 1.33 | 1.41 | 1.50 | 1.61 | 1.79 | 2.04 | 2.25 | 2.38 | 2.46 | 2.56 | 2.65 | 2.71 | 2.81 | 2.92 | 3.06 | 3.23 | 3.36 | 3.47 | 3.57 | 3.66 | 3.76 | 3.87 | 3.96 | 4.03 | 4.11 |
| 1972 | 0.93 | 0.97 | 1.00 | 1.06 | 1.18 | 1.29 | 1.36 | 1.45 | 1.56 | 1.74 | 1.97 | 2.17 | 2.31 | 2.38 | 2.48 | 2.57 | 2.62 | 2.72 | 2.83 | 2.96 | 3.12 | 3.26 | 3.35 | 3.45 | 3.54 | 3.64 | 3.75 | 3.84 | 3.90 | 3.98 |
| 1973 | 0.87 | 0.91 | 0.94 | 1.00 | 1.11 | 1.21 | 1.28 | 1.36 | 1.47 | 1.63 | 1.86 | 2.05 | 2.17 | 2.24 | 2.34 | 2.42 | 2.47 | 2.56 | 2.66 | 2.79 | 2.94 | 3.07 | 3.16 | 3.25 | 3.34 | 3.43 | 3.53 | 3.61 | 3.67 | 3.75 |
| 1974 | 0.79 | 0.82 | 0.85 | 0.90 | 1.00 | 1.09 | 1.15 | 1.23 | 1.32 | 1.47 | 1.67 | 1.84 | 1.96 | 2.02 | 2.11 | 2.18 | 2.22 | 2.31 | 2.40 | 2.51 | 2.65 | 2.76 | 2.85 | 2.93 | 3.01 | 3.09 | 3.18 | 3.26 | 3.31 | 3.38 |
| 1975 | 0.72 | 0.75 | 0.78 | 0.83 | 0.92 | 1.00 | 1.06 | 1.13 | 1.21 | 1.35 | 1.53 | 1.69 | 1.79 | 1.85 | 1.93 | 2.00 | 2.04 | 2.11 | 2.20 | 2.30 | 2.43 | 2.53 | 2.61 | 2.68 | 2.75 | 2.83 | 2.92 | 2.98 | 3.03 | 3.10 |
| 1976 | 0.68 | 0.71 | 0.74 | 0.78 | 0.87 | 0.95 | 1.00 | 1.07 | 1.15 | 1.28 | 1.45 | 1.60 | 1.70 | 1.75 | 1.82 | 1.89 | 1.93 | 2.00 | 2.08 | 2.18 | 2.30 | 2.39 | 2.47 | 2.54 | 2.60 | 2.68 | 2.76 | 2.82 | 2.86 | 2.93 |
| 1977 | 0.64 | 0.67 | 0.69 | 0.73 | 0.81 | 0.89 | 0.94 | 1.00 | 1.08 | 1.20 | 1.36 | 1.50 | 1.59 | 1.65 | 1.72 | 1.78 | 1.81 | 1.88 | 1.95 | 2.05 | 2.16 | 2.25 | 2.32 | 2.38 | 2.45 | 2.52 | 2.59 | 2.65 | 2.69 | 2.75 |
| 1978 | 0.60 | 0.62 | 0.64 | 0.68 | 0.76 | 0.83 | 0.87 | 0.93 | 1.00 | 1.11 | 1.27 | 1.40 | 1.48 | 1.53 | 1.59 | 1.65 | 1.68 | 1.74 | 1.81 | 1.90 | 2.00 | 2.09 | 2.15 | 2.21 | 2.27 | 2.34 | 2.40 | 2.46 | 2.50 | 2.55 |
| 1979 | 0.54 | 0.56 | 0.58 | 0.61 | 0.68 | 0.74 | 0.78 | 0.84 | 0.90 | 1.00 | 1.14 | 1.25 | 1.33 | 1.37 | 1.43 | 1.48 | 1.51 | 1.57 | 1.63 | 1.71 | 1.80 | 1.88 | 1.93 | 1.99 | 2.04 | 2.10 | 2.16 | 2.21 | 2.25 | 2.30 |
| 1980 | 0.47 | 0.49 | 0.51 | 0.54 | 0.60 | 0.65 | 0.69 | 0.74 | 0.79 | 0.88 | 1.00 | 1.10 | 1.17 | 1.21 | 1.26 | 1.31 | 1.33 | 1.38 | 1.44 | 1.50 | 1.59 | 1.65 | 1.70 | 1.75 | 1.80 | 1.85 | 1.90 | 1.95 | 1.98 | 2.02 |
| 1981 | 0.43 | 0.45 | 0.46 | 0.49 | 0.54 | 0.59 | 0.63 | 0.67 | 0.72 | 0.80 | 0.91 | 1.00 | 1.06 | 1.10 | 1.14 | 1.18 | 1.21 | 1.25 | 1.30 | 1.36 | 1.44 | 1.50 | 1.54 | 1.59 | 1.63 | 1.68 | 1.73 | 1.77 | 1.79 | 1.83 |
| 1982 | 0.40 | 0.42 | 0.43 | 0.46 | 0.51 | 0.56 | 0.59 | 0.63 | 0.68 | 0.75 | 0.85 | 0.94 | 1.00 | 1.03 | 1.08 | 1.11 | 1.14 | 1.18 | 1.23 | 1.28 | 1.35 | 1.41 | 1.45 | 1.50 | 1.54 | 1.58 | 1.63 | 1.66 | 1.69 | 1.73 |
| 1983 | 0.39 | 0.41 | 0.42 | 0.45 | 0.50 | 0.54 | 0.57 | 0.61 | 0.66 | 0.73 | 0.83 | 0.91 | 0.97 | 1.00 | 1.04 | 1.08 | 1.10 | 1.14 | 1.19 | 1.24 | 1.31 | 1.37 | 1.41 | 1.45 | 1.49 | 1.53 | 1.57 | 1.61 | 1.64 | 1.67 |
| 1984 | 0.37 | 0.39 | 0.40 | 0.43 | 0.48 | 0.52 | 0.55 | 0.58 | 0.63 | 0.70 | 0.79 | 0.88 | 0.93 | 0.96 | 1.00 | 1.04 | 1.06 | 1.09 | 1.14 | 1.19 | 1.26 | 1.31 | 1.35 | 1.39 | 1.43 | 1.47 | 1.51 | 1.55 | 1.57 | 1.60 |
| 1985 | 0.36 | 0.38 | 0.39 | 0.41 | 0.46 | 0.50 | 0.53 | 0.56 | 0.61 | 0.68 | 0.77 | 0.85 | 0.90 | 0.93 | 0.97 | 1.00 | 1.02 | 1.06 | 1.10 | 1.15 | 1.22 | 1.27 | 1.30 | 1.34 | 1.38 | 1.42 | 1.46 | 1.49 | 1.52 | 1.55 |
| 1986 | 0.35 | 0.37 | 0.38 | 0.41 | 0.45 | 0.49 | 0.52 | 0.55 | 0.60 | 0.66 | 0.75 | 0.83 | 0.88 | 0.91 | 0.95 | 0.98 | 1.00 | 1.04 | 1.08 | 1.13 | 1.19 | 1.24 | 1.28 | 1.32 | 1.35 | 1.39 | 1.43 | 1.46 | 1.49 | 1.52 |
| 1987 | 0.34 | 0.36 | 0.37 | 0.39 | 0.43 | 0.47 | 0.50 | 0.53 | 0.57 | 0.64 | 0.73 | 0.80 | 0.85 | 0.88 | 0.91 | 0.95 | 0.96 | 1.00 | 1.04 | 1.09 | 1.15 | 1.20 | 1.24 | 1.27 | 1.30 | 1.34 | 1.38 | 1.41 | 1.43 | 1.47 |
| 1988 | 0.33 | 0.34 | 0.35 | 0.38 | 0.42 | 0.46 | 0.48 | 0.51 | 0.55 | 0.61 | 0.70 | 0.77 | 0.82 | 0.84 | 0.88 | 0.91 | 0.93 | 0.96 | 1.00 | 1.05 | 1.11 | 1.15 | 1.19 | 1.22 | 1.25 | 1.29 | 1.33 | 1.36 | 1.38 | 1.41 |
| 1989 | 0.31 | 0.33 | 0.34 | 0.36 | 0.40 | 0.43 | 0.46 | 0.49 | 0.53 | 0.59 | 0.67 | 0.73 | 0.78 | 0.80 | 0.84 | 0.87 | 0.88 | 0.92 | 0.95 | 1.00 | 1.05 | 1.10 | 1.13 | 1.17 | 1.20 | 1.23 | 1.27 | 1.29 | 1.32 | 1.34 |
| 1990 | 0.30 | 0.31 | 0.32 | 0.34 | 0.38 | 0.41 | 0.44 | 0.46 | 0.50 | 0.56 | 0.63 | 0.70 | 0.74 | 0.76 | 0.80 | 0.82 | 0.84 | 0.87 | 0.91 | 0.95 | 1.00 | 1.04 | 1.07 | 1.11 | 1.13 | 1.17 | 1.20 | 1.23 | 1.25 | 1.27 |
| 1991 | 0.29 | 0.30 | 0.31 | 0.33 | 0.36 | 0.40 | 0.42 | 0.45 | 0.48 | 0.53 | 0.61 | 0.67 | 0.71 | 0.73 | 0.76 | 0.79 | 0.81 | 0.83 | 0.87 | 0.91 | 0.96 | 1.00 | 1.03 | 1.06 | 1.09 | 1.12 | 1.15 | 1.18 | 1.20 | 1.22 |
| 1992 | 0.28 | 0.29 | 0.30 | 0.32 | 0.35 | 0.38 | 0.41 | 0.43 | 0.47 | 0.52 | 0.59 | 0.65 | 0.69 | 0.71 | 0.74 | 0.77 | 0.78 | 0.81 | 0.84 | 0.88 | 0.93 | 0.97 | 1.00 | 1.03 | 1.06 | 1.09 | 1.12 | 1.14 | 1.16 | 1.19 |
| 1993 | 0.27 | 0.28 | 0.29 | 0.31 | 0.34 | 0.37 | 0.39 | 0.42 | 0.45 | 0.50 | 0.57 | 0.63 | 0.67 | 0.69 | 0.72 | 0.75 | 0.76 | 0.79 | 0.82 | 0.86 | 0.91 | 0.94 | 0.97 | 1.00 | 1.03 | 1.06 | 1.09 | 1.11 | 1.13 | 1.15 |
| 1994 | 0.26 | 0.27 | 0.28 | 0.30 | 0.33 | 0.36 | 0.38 | 0.41 | 0.44 | 0.49 | 0.56 | 0.61 | 0.65 | 0.67 | 0.70 | 0.73 | 0.74 | 0.77 | 0.80 | 0.84 | 0.88 | 0.92 | 0.95 | 0.98 | 1.00 | 1.03 | 1.06 | 1.08 | 1.10 | 1.12 |
| 1995 | 0.26 | 0.27 | 0.27 | 0.29 | 0.32 | 0.35 | 0.37 | 0.40 | 0.43 | 0.48 | 0.54 | 0.60 | 0.63 | 0.65 | 0.68 | 0.71 | 0.72 | 0.75 | 0.78 | 0.81 | 0.86 | 0.89 | 0.92 | 0.95 | 0.97 | 1.00 | 1.03 | 1.05 | 1.07 | 1.09 |
| 1996 | 0.25 | 0.26 | 0.27 | 0.28 | 0.31 | 0.34 | 0.36 | 0.39 | 0.42 | 0.46 | 0.53 | 0.58 | 0.62 | 0.64 | 0.66 | 0.69 | 0.70 | 0.72 | 0.75 | 0.79 | 0.83 | 0.87 | 0.89 | 0.92 | 0.94 | 0.97 | 1.00 | 1.02 | 1.04 | 1.06 |
| 1997 | 0.24 | 0.25 | 0.26 | 0.28 | 0.31 | 0.34 | 0.35 | 0.38 | 0.41 | 0.45 | 0.51 | 0.57 | 0.60 | 0.62 | 0.65 | 0.67 | 0.68 | 0.71 | 0.74 | 0.77 | 0.81 | 0.85 | 0.87 | 0.90 | 0.92 | 0.95 | 0.98 | 1.00 | 1.02 | 1.04 |
| 1998 | 0.24 | 0.25 | 0.26 | 0.27 | 0.30 | 0.33 | 0.35 | 0.37 | 0.40 | 0.45 | 0.51 | 0.56 | 0.59 | 0.61 | 0.64 | 0.66 | 0.67 | 0.70 | 0.73 | 0.76 | 0.80 | 0.84 | 0.86 | 0.89 | 0.91 | 0.94 | 0.96 | 0.98 | 1.00 | 1.02 |
| 1999 | 0.23 | 0.24 | 0.25 | 0.27 | 0.30 | 0.32 | 0.34 | 0.36 | 0.39 | 0.44 | 0.49 | 0.55 | 0.58 | 0.60 | 0.62 | 0.65 | 0.66 | 0.68 | 0.71 | 0.74 | 0.78 | 0.82 | 0.84 | 0.87 | 0.89 | 0.92 | 0.94 | 0.96 | 0.98 | 1.00 |

Source:

Personal contact with the Bureau of Labor Statistics.

Table B.14
Gross National Product (GNP) Implicit Price Deflator

| From | To | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|
| | 1970 | 1971 | 1972 | 1973 | 1974 | 1975 | 1976 | 1977 | 1978 | 1979 | 1980 | 1981 | 1982 | 1983 | 1984 | 1985 | 1986 | 1987 | 1988 | 1989 | 1990 | 1991 | 1992 | 1993 | 1994 | 1995 | 1996 | 1997 | 1998 | 1999 |
| 1970 | 1.00 | 1.05 | 1.10 | 1.16 | 1.26 | 1.38 | 1.45 | 1.53 | 1.65 | 1.79 | 1.95 | 2.14 | 2.27 | 2.36 | 2.45 | 2.53 | 2.60 | 2.67 | 2.76 | 2.87 | 2.99 | 3.12 | 3.23 | 3.29 | 3.36 | 3.47 | 3.54 | 3.63 | 3.64 | 3.71 |
| 1971 | 0.95 | 1.00 | 1.04 | 1.10 | 1.20 | 1.31 | 1.38 | 1.46 | 1.57 | 1.70 | 1.86 | 2.04 | 2.16 | 2.24 | 2.33 | 2.41 | 2.48 | 2.54 | 2.63 | 2.72 | 2.84 | 2.97 | 3.07 | 3.13 | 3.19 | 3.30 | 3.37 | 3.45 | 3.46 | 3.53 |
| 1972 | 0.91 | 0.96 | 1.00 | 1.06 | 1.15 | 1.26 | 1.32 | 1.40 | 1.50 | 1.63 | 1.79 | 1.96 | 2.07 | 2.15 | 2.24 | 2.32 | 2.38 | 2.44 | 2.52 | 2.62 | 2.73 | 2.85 | 2.95 | 3.01 | 3.07 | 3.17 | 3.24 | 3.31 | 3.32 | 3.39 |
| 1973 | 0.86 | 0.91 | 0.95 | 1.00 | 1.09 | 1.19 | 1.25 | 1.32 | 1.42 | 1.54 | 1.69 | 1.85 | 1.96 | 2.03 | 2.12 | 2.19 | 2.24 | 2.30 | 2.38 | 2.47 | 2.58 | 2.69 | 2.79 | 2.84 | 2.90 | 3.00 | 3.06 | 3.13 | 3.14 | 3.20 |
| 1974 | 0.79 | 0.83 | 0.87 | 0.92 | 1.00 | 1.09 | 1.15 | 1.22 | 1.31 | 1.42 | 1.55 | 1.70 | 1.80 | 1.87 | 1.95 | 2.01 | 2.06 | 2.12 | 2.19 | 2.28 | 2.37 | 2.48 | 2.56 | 2.61 | 2.67 | 2.76 | 2.81 | 2.88 | 2.89 | 2.95 |
| 1975 | 0.73 | 0.76 | 0.80 | 0.84 | 0.92 | 1.00 | 1.05 | 1.11 | 1.20 | 1.30 | 1.42 | 1.55 | 1.65 | 1.71 | 1.78 | 1.84 | 1.89 | 1.94 | 2.01 | 2.08 | 2.17 | 2.27 | 2.34 | 2.39 | 2.44 | 2.52 | 2.57 | 2.63 | 2.64 | 2.69 |
| 1976 | 0.69 | 0.73 | 0.76 | 0.80 | 0.87 | 0.95 | 1.00 | 1.06 | 1.14 | 1.24 | 1.35 | 1.48 | 1.57 | 1.63 | 1.70 | 1.75 | 1.80 | 1.84 | 1.91 | 1.98 | 2.06 | 2.15 | 2.23 | 2.27 | 2.32 | 2.40 | 2.44 | 2.50 | 2.51 | 2.56 |
| 1977 | 0.65 | 0.69 | 0.71 | 0.76 | 0.82 | 0.90 | 0.95 | 1.00 | 1.07 | 1.17 | 1.27 | 1.40 | 1.48 | 1.54 | 1.60 | 1.65 | 1.70 | 1.74 | 1.80 | 1.87 | 1.95 | 2.03 | 2.11 | 2.15 | 2.19 | 2.26 | 2.31 | 2.37 | 2.37 | 2.42 |
| 1978 | 0.61 | 0.64 | 0.67 | 0.70 | 0.77 | 0.84 | 0.88 | 0.93 | 1.00 | 1.09 | 1.19 | 1.30 | 1.38 | 1.43 | 1.49 | 1.54 | 1.58 | 1.62 | 1.68 | 1.74 | 1.81 | 1.89 | 1.96 | 2.00 | 2.04 | 2.11 | 2.15 | 2.20 | 2.21 | 2.25 |
| 1979 | 0.56 | 0.59 | 0.61 | 0.65 | 0.70 | 0.77 | 0.81 | 0.86 | 0.92 | 1.00 | 1.09 | 1.20 | 1.27 | 1.32 | 1.37 | 1.42 | 1.45 | 1.49 | 1.54 | 1.60 | 1.67 | 1.74 | 1.80 | 1.84 | 1.88 | 1.94 | 1.98 | 2.03 | 2.03 | 2.07 |
| 1980 | 0.51 | 0.54 | 0.56 | 0.59 | 0.65 | 0.71 | 0.74 | 0.78 | 0.84 | 0.92 | 1.00 | 1.10 | 1.16 | 1.21 | 1.26 | 1.30 | 1.33 | 1.36 | 1.41 | 1.47 | 1.53 | 1.60 | 1.65 | 1.68 | 1.72 | 1.78 | 1.81 | 1.86 | 1.86 | 1.90 |
| 1981 | 0.47 | 0.49 | 0.51 | 0.54 | 0.59 | 0.64 | 0.68 | 0.72 | 0.77 | 0.84 | 0.91 | 1.00 | 1.06 | 1.10 | 1.15 | 1.18 | 1.21 | 1.25 | 1.29 | 1.34 | 1.40 | 1.46 | 1.51 | 1.54 | 1.57 | 1.62 | 1.66 | 1.70 | 1.70 | 1.74 |
| 1982 | 0.44 | 0.46 | 0.48 | 0.51 | 0.56 | 0.61 | 0.64 | 0.68 | 0.73 | 0.79 | 0.86 | 0.94 | 1.00 | 1.04 | 1.08 | 1.12 | 1.15 | 1.18 | 1.22 | 1.26 | 1.32 | 1.38 | 1.42 | 1.45 | 1.48 | 1.53 | 1.56 | 1.60 | 1.60 | 1.64 |
| 1983 | 0.42 | 0.45 | 0.46 | 0.49 | 0.53 | 0.58 | 0.61 | 0.65 | 0.70 | 0.76 | 0.83 | 0.91 | 0.96 | 1.00 | 1.04 | 1.08 | 1.10 | 1.13 | 1.17 | 1.22 | 1.27 | 1.32 | 1.37 | 1.40 | 1.42 | 1.47 | 1.50 | 1.54 | 1.54 | 1.57 |
| 1984 | 0.41 | 0.43 | 0.45 | 0.47 | 0.51 | 0.56 | 0.59 | 0.62 | 0.67 | 0.73 | 0.80 | 0.87 | 0.92 | 0.96 | 1.00 | 1.04 | 1.06 | 1.08 | 1.12 | 1.16 | 1.21 | 1.27 | 1.31 | 1.34 | 1.37 | 1.41 | 1.44 | 1.47 | 1.48 | 1.51 |
| 1985 | 0.40 | 0.42 | 0.43 | 0.46 | 0.50 | 0.54 | 0.57 | 0.61 | 0.65 | 0.71 | 0.77 | 0.85 | 0.90 | 0.93 | 0.94 | 1.00 | 1.03 | 1.05 | 1.09 | 1.13 | 1.18 | 1.23 | 1.28 | 1.30 | 1.33 | 1.37 | 1.40 | 1.43 | 1.44 | 1.47 |
| 1986 | 0.39 | 0.40 | 0.42 | 0.45 | 0.49 | 0.53 | 0.56 | 0.59 | 0.63 | 0.69 | 0.75 | 0.82 | 0.87 | 0.91 | 0.94 | 0.97 | 1.00 | 1.03 | 1.06 | 1.10 | 1.15 | 1.20 | 1.24 | 1.27 | 1.29 | 1.34 | 1.36 | 1.40 | 1.40 | 1.43 |
| 1987 | 0.38 | 0.40 | 0.41 | 0.44 | 0.47 | 0.52 | 0.54 | 0.58 | 0.62 | 0.67 | 0.73 | 0.80 | 0.85 | 0.89 | 0.92 | 0.95 | 0.98 | 1.00 | 1.04 | 1.08 | 1.12 | 1.17 | 1.21 | 1.24 | 1.26 | 1.30 | 1.33 | 1.36 | 1.36 | 1.39 |
| 1988 | 0.36 | 0.38 | 0.40 | 0.42 | 0.46 | 0.50 | 0.53 | 0.56 | 0.60 | 0.65 | 0.71 | 0.77 | 0.82 | 0.85 | 0.89 | 0.92 | 0.94 | 0.97 | 1.00 | 1.04 | 1.08 | 1.13 | 1.17 | 1.19 | 1.22 | 1.26 | 1.28 | 1.31 | 1.32 | 1.34 |
| 1989 | 0.35 | 0.37 | 0.38 | 0.40 | 0.44 | 0.48 | 0.51 | 0.54 | 0.58 | 0.62 | 0.68 | 0.75 | 0.79 | 0.82 | 0.86 | 0.88 | 0.91 | 0.93 | 0.96 | 1.00 | 1.04 | 1.09 | 1.13 | 1.15 | 1.17 | 1.21 | 1.24 | 1.27 | 1.27 | 1.29 |
| 1990 | 0.34 | 0.35 | 0.37 | 0.39 | 0.42 | 0.46 | 0.49 | 0.51 | 0.55 | 0.60 | 0.66 | 0.72 | 0.76 | 0.79 | 0.83 | 0.85 | 0.87 | 0.89 | 0.93 | 0.96 | 1.00 | 1.05 | 1.08 | 1.10 | 1.13 | 1.16 | 1.19 | 1.22 | 1.22 | 1.24 |
| 1991 | 0.32 | 0.34 | 0.35 | 0.37 | 0.40 | 0.44 | 0.47 | 0.49 | 0.53 | 0.57 | 0.63 | 0.69 | 0.73 | 0.76 | 0.79 | 0.81 | 0.83 | 0.86 | 0.89 | 0.92 | 0.96 | 1.00 | 1.04 | 1.06 | 1.08 | 1.11 | 1.14 | 1.16 | 1.17 | 1.19 |
| 1992 | 0.31 | 0.33 | 0.34 | 0.36 | 0.39 | 0.43 | 0.45 | 0.48 | 0.51 | 0.55 | 0.61 | 0.66 | 0.70 | 0.73 | 0.76 | 0.78 | 0.81 | 0.83 | 0.86 | 0.89 | 0.92 | 0.97 | 1.00 | 1.02 | 1.04 | 1.08 | 1.10 | 1.12 | 1.13 | 1.15 |
| 1993 | 0.30 | 0.32 | 0.33 | 0.35 | 0.38 | 0.42 | 0.44 | 0.47 | 0.50 | 0.54 | 0.59 | 0.65 | 0.69 | 0.72 | 0.75 | 0.77 | 0.79 | 0.81 | 0.84 | 0.87 | 0.91 | 0.95 | 0.98 | 1.00 | 1.02 | 1.05 | 1.08 | 1.10 | 1.10 | 1.13 |
| 1994 | 0.30 | 0.31 | 0.33 | 0.35 | 0.38 | 0.41 | 0.43 | 0.46 | 0.49 | 0.53 | 0.58 | 0.64 | 0.68 | 0.70 | 0.73 | 0.75 | 0.77 | 0.79 | 0.82 | 0.85 | 0.89 | 0.93 | 0.96 | 0.98 | 1.00 | 1.03 | 1.05 | 1.08 | 1.08 | 1.10 |
| 1995 | 0.29 | 0.30 | 0.32 | 0.33 | 0.36 | 0.40 | 0.42 | 0.44 | 0.47 | 0.52 | 0.56 | 0.62 | 0.65 | 0.68 | 0.71 | 0.73 | 0.75 | 0.77 | 0.80 | 0.83 | 0.86 | 0.90 | 0.93 | 0.95 | 0.97 | 1.00 | 1.02 | 1.05 | 1.05 | 1.07 |
| 1996 | 0.28 | 0.30 | 0.31 | 0.33 | 0.36 | 0.39 | 0.41 | 0.43 | 0.46 | 0.51 | 0.55 | 0.60 | 0.64 | 0.67 | 0.69 | 0.71 | 0.73 | 0.75 | 0.78 | 0.81 | 0.84 | 0.88 | 0.91 | 0.93 | 0.95 | 0.98 | 1.00 | 1.02 | 1.03 | 1.05 |
| 1997 | 0.26 | 0.29 | 0.30 | 0.32 | 0.35 | 0.38 | 0.40 | 0.42 | 0.45 | 0.49 | 0.54 | 0.59 | 0.63 | 0.65 | 0.68 | 0.70 | 0.72 | 0.74 | 0.76 | 0.79 | 0.82 | 0.86 | 0.89 | 0.91 | 0.93 | 0.96 | 0.98 | 1.00 | 1.00 | 1.02 |
| 1998 | 0.27 | 0.29 | 0.30 | 0.32 | 0.35 | 0.38 | 0.40 | 0.42 | 0.45 | 0.49 | 0.54 | 0.59 | 0.62 | 0.65 | 0.68 | 0.70 | 0.71 | 0.73 | 0.76 | 0.79 | 0.82 | 0.86 | 0.89 | 0.91 | 0.92 | 0.95 | 0.97 | 1.00 | 1.00 | 1.02 |
| 1999 | 0.27 | 0.28 | 0.30 | 0.31 | 0.34 | 0.37 | 0.39 | 0.41 | 0.44 | 0.48 | 0.53 | 0.58 | 0.61 | 0.64 | 0.66 | 0.68 | 0.70 | 0.72 | 0.74 | 0.77 | 0.80 | 0.84 | 0.87 | 0.89 | 0.91 | 0.94 | 0.96 | 0.98 | 0.98 | 1.00 |

Source:

U.S. Department of Commerce, Bureau of Economic Analysis, *Survey of Current Business*, Washington, DC, monthly.

APPENDIX C

CENSUS DIVISIONS AND REGIONS

Table C.1
Census Divisions and Regions

| Northeast Division | | | |
|--|---|--|---|
| Mid-Atlantic region | | New England region | |
| New Jersey New York | Pennsylvania | Connecticut Maine Massachusetts | New Hampshire Rhode Island Vermont |
| South Division | | | |
| West South Central region | East South Central region | South Atlantic region | |
| Arkansas Louisiana Oklahoma Texas | Alabama Kentucky Mississippi Tennessee | Delaware Florida Georgia Maryland North Carolina | South Carolina Virginia Washington, DC West Virginia |
| West Division | | | |
| Pacific region | | Mountain region | |
| Alaska California Hawaii | Oregon Washington | Arizona Colorado Idaho Montana | Nevada New Mexico Utah Wyoming |
| Midwest Division | | | |
| West North Central region | | East North Central region | |
| Iowa Kansas Minnesota Missouri | Nebraska North Dakota South Dakota | Illinois Indiana Michigan | Ohio Wisconsin |

Census Divisions and Regions



GLOSSARY

Acceleration power - Measured in kilowatts. Pulse power obtainable from a battery used to accelerate a vehicle. This is based on a constant current pulse for 30 seconds at no less than 2/3 of the maximum open-circuit-voltage, at 80% depth-of-discharge relative to the battery's rated capacity and at 20° C ambient temperature.

Air Carrier - The commercial system of air transportation consisting of certificated air carriers, air taxis (including commuters), supplemental air carriers, commercial operators of large aircraft, and air travel clubs.

Certificated route air carrier: An air carrier holding a Certificate of Public Convenience and Necessity issued by the Department of Transportation to conduct scheduled interstate services. Nonscheduled or charter operations may also be conducted by these carriers. These carriers operate large aircraft (30 seats or more, or a maximum payload capacity of 7,500 pounds or more) in accordance with Federal Aviation Regulation part 121.

Domestic air operator: Commercial air transportation within and between the 50 States and the District of Columbia. Includes operations of certificated route air carriers, Pan American, local service, helicopter, intra-Alaska, intra-Hawaii, all-cargo carriers and other carriers. Also included are transborder operations conducted on the domestic route segments of U.S. air carriers. Domestic operators are classified based on their operating revenue as follows:

- Majors - over \$1 billion
- Nationals - \$100-1,000 million
- Large Regionals - \$10-99.9 million
- Medium Regionals - \$0-9.99 million

International air operator: Commercial air transportation outside the territory of the United States, including operations between the U.S. and foreign countries and between the U.S. and its territories and possessions.

Supplemental air carrier: A class of air carriers which hold certificates authorizing them to perform passenger and cargo charter services supplementing the scheduled service of the certificated route air carriers. Supplemental air carriers are often referred to as nonscheduled air carriers or "nonskeds."

Alcohol - The family name of a group of organic chemical compounds composed of carbon, hydrogen, and oxygen. The molecules in the series vary in chain length and are composed of a hydrocarbon plus a hydroxyl group. Alcohol includes methanol and ethanol.

Amtrak - See *Rail*.

Anthropogenic - Human made. Usually used in the context of emissions that are produced as the result of human activities.

Automobile size classifications - Size classifications of automobiles are established by the Environmental Protection Agency (EPA) as follows:

Minicompact - less than 85 cubic feet of passenger and luggage volume.

Subcompact - between 85 to 100 cubic feet of passenger and luggage volume.

Compact - between 100 to 110 cubic feet of passenger and luggage volume.

Midsize - between 110 to 120 cubic feet of passenger and luggage volume.

Large - more than 120 cubic feet of passenger and luggage volume.

Two seater - automobiles designed primarily to seat only two adults.

Station wagons are included with the size class for the sedan of the same name.

Aviation - See *General aviation*.

Aviation gasoline - All special grades of gasoline for use in aviation reciprocating engines, as given in the American Society for Testing and Materials (ASTM) Specification D 910. Includes all refinery products within the gasoline range that are to be marketed straight or in blends as aviation gasoline without further processing (any refinery operation except mechanical blending). Also included are finished components in the gasoline range which will be used for blending or compounding into aviation gasoline.

Barges - Shallow, nonself-propelled vessels used to carry bulk commodities on the rivers and the Great Lakes.

Battery efficiency - Measured in percentage. Net DC energy delivered on discharge, as a percentage of the total DC energy required to restore the initial state-of-charge. The efficiency value must include energy losses resulting from self-discharge, cell equalization, thermal loss compensation, and all battery-specific auxiliary equipment.

Btu - The amount of energy required to raise the temperature of 1 pound of water 1 degree Fahrenheit at or near 39.2 degrees Fahrenheit. An average Btu content of fuel is the heat value per quantity of fuel as determined from tests of fuel samples.

Bunker - A storage tank.

Bunkering fuels - Fuels stored in ship bunkers.

Bus -

Intercity bus: A standard size bus equipped with front doors only, high backed seats, luggage compartments separate from the passenger compartment and usually with restroom facilities, for high-speed long distance service.

Motor bus: Rubber-tired, self-propelled, manually-steered bus with fuel supply on board the vehicle. Motor bus types include intercity, school, and transit.

School and other nonrevenue bus: Bus services for which passengers are not directly charged for transportation, either on a per passenger or per vehicle basis.

Transit bus: A bus designed for frequent stop service with front and center doors, normally with a rear-mounted diesel engine, low-back seating, and without luggage storage compartments or restroom facilities. Includes motor bus and trolley coach.

Trolley coach: Rubber-tired electric transit vehicle, manually-steered, propelled by a motor drawing current, normally through overhead wires, from a central power source not on board the vehicle.

Calendar year - The period of time between January 1 and December 31 of any given year.

Captive imports - Products produced overseas specifically for domestic manufacturers.

Carbon dioxide (CO₂) - 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 normal 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*.

Clean Fuel Vehicle - Vehicle meeting the clean fuel vehicle exhaust emissions standards with no restriction on fuel type.

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 - See *Residential and Commercial sector*.

Commuter railroad - See *Rail*.

Compact car - See *Automobile size classifications*.

Constant dollars - A series of figures is expressed in constant dollars when the effect of change in the purchasing power of the dollar has been removed. Usually the data are expressed in terms of dollars of a selected year or the average of a set of years.

Consumer Price Index (CPI) - An index issued by the U.S. Department of Labor, Bureau of Labor Statistics. The CPI is designed to measure changes in the prices of goods and services bought by wage earners and clerical workers in urban areas. It represents the cost of a typical consumption bundle at current prices as a ratio to its cost at a base year.

Continuous discharge capacity - Measured as percent of rated energy capacity. Energy delivered in a constant power discharge required by an electric vehicle for hill climbing and/or high-speed cruise, specified as the percent of its rated energy capacity delivered in a one hour constant-power discharge.

Corporate Average Fuel Economy (CAFE) standards - CAFE standards were originally established by Congress for new automobiles, and later for light trucks, in Title V of the Motor Vehicle Information and Cost Savings Act (15 U.S.C.1901, et seq.) with subsequent amendments. Under CAFE, automobile manufacturers are required by law to produce vehicle fleets with a composite sales-weighted fuel economy which cannot be lower than the CAFE standards in a given year, or for every vehicle which does not meet the standard, a fine of \$5.00 is paid for every one-tenth of a mpg below the standard.

Crude oil - A mixture of hydrocarbons that exists in the liquid phase in natural underground reservoirs and remains liquid at atmospheric pressure after passing through surface separating facilities. Crude oil production is measured at the wellhead and includes lease condensate.

Crude oil imports - The volume of crude oil imported into the 50 States and the District of Columbia, including imports from U.S. territories, but excluding imports of crude oil into the Hawaiian Foreign Trade Zone.

Curb weight - The weight of a vehicle including all standard equipment, spare tire and wheel, all fluids and lubricants to capacity, full tank of fuel, and the weight of major optional accessories normally found on the vehicle.

Current dollars - Represents dollars current at the time designated or at the time of the transaction. In most contexts, the same meaning would be conveyed by the use of the term "dollars".

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*.

Electric utilities sector - Consists of privately and publicly owned establishments which generate electricity primarily for resale.

Emission standards - Standards for the levels of pollutants emitted from automobiles and trucks. Congress established the first standards in the Clean Air Act of 1963. Currently, standards are set for four vehicle classes - automobiles, light trucks, heavy-duty gasoline trucks, and heavy-duty diesel trucks.

Energy capacity - Measured in kilowatt hours. The energy delivered by the battery, when tested at C/3 discharge rate, up to termination of discharge specified by the battery manufacturer. The required acceleration power must be delivered by the battery at any point up to 80% of the battery's energy capacity rating.

Energy efficiency - In reference to transportation, the inverse of energy intensiveness: the ratio of outputs from a process to the energy inputs; for example, miles traveled per gallon of fuel (mpg).

Energy intensity - In reference to transportation, the ratio of energy inputs to a process to the useful outputs from that process; for example, gallons of fuel per passenger-mile or Btu per ton-mile.

Ethanol (C₂H₅OH) - 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), blended with gasoline (E85), or as a gasoline octane enhancer and oxygenate (10% concentration).

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 (GSA), 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. There are other fuels that contain methanol and gasoline, but these fuels are not referred to as gasohol.

Gasoline - See *Motor gasoline*.

General aviation - That portion of civil aviation which encompasses all facets of aviation except air carriers. It includes any air taxis, commuter air carriers, and air travel clubs which do not hold Certificates of Public Convenience and Necessity.

Gross National Product - A measure of monetary value of the goods and services becoming available to the nation from economic activity. Total value at market prices of all goods and services produced by the nation's economy. Calculated quarterly by the Department of Commerce, the Gross National Product is the broadest available measure of the level of economic activity.

Gross vehicle weight (gvw) - The weight of the empty vehicle plus the maximum anticipated load weight.

Heavy-heavy truck - See *Truck size classifications*.

Household - Consists of all persons who occupy a housing unit, including the related family members and all unrelated persons, if any, who share the housing unit.

Housing unit - A house, apartment, a group of rooms, or a single room occupied or intended for occupancy as separate living quarters. Separate living quarters are those in which the occupants do not live and eat with any other persons in the structure and which have either (1) direct access from the outside of the building or through a common hallway intended to be used by the occupants of another unit or by the general public, or (2) complete kitchen facilities for the exclusive use of the occupants. The occupants may be a single family, one person living alone, two or more families living together, or any other group of related or unrelated persons who share living arrangements.

Hydrocarbon (HC) - A compound that contains only hydrogen and carbon. The simplest and lightest forms of hydrocarbon are gaseous. With greater molecular weights they are liquid, while the heaviest are solids.

Income -

Disposable personal income: Personal income less personal tax and non-tax payments.

National income - The aggregate earnings of labor and property which arise in the current production of goods and services by the nation's economy.

Personal income: The current income received by persons from all sources, net of contributions for social insurance.

Industrial sector - Construction, manufacturing, agricultural and mining establishments.

Inertia weight - The curb weight of a vehicle plus 300 pounds.

Intercity bus - See *Bus*.

Internal water transportation - Includes all local (intraport) traffic and traffic between ports or landings wherein the entire movement takes place on inland waterways. Also termed internal are movements involving carriage on both inland waterways and the water of the Great Lakes, and inland movements that cross short stretches of open water that link inland systems.

International air operator - See *Air carrier*.

International freight - See *Foreign freight*.

Jet fuel - Includes both naphtha-type and kerosene-type fuels meeting standards for use in aircraft turbine engines. Although most jet fuel is used in aircraft, some is used for other purposes such as generating electricity in gas turbines.

Kerosene-type jet fuel: A quality kerosene product with an average gravity of 40.7 degrees API and 10% to 90% distillation temperatures of 217 to 261 degrees centigrade. Used primarily as fuel for commercial turbojet and turboprop aircraft engines. It is a relatively low freezing point distillate of the kerosene type.

Naphtha-type jet fuel: A fuel in the heavy naphtha boiling range with an average gravity of 52.8 degrees API and 10% to 90% distillation temperatures of 117 to 233 degrees centigrade used for turbojet and turboprop aircraft engines, primarily by the military. Excludes ramjet and petroleum.

Kerosene - A petroleum distillate in the 300 to 500 degrees Fahrenheit boiling range and generally having a flash point higher than 100 degrees Fahrenheit by the American Society of Testing and Material (ASTM) Method D56, a gravity range from 40 to 46 degrees API, and a burning point in the range of 150 to 175 degrees Fahrenheit. It is a clean-burning product suitable for use as an illuminant when burned in wick lamps. Includes grades of kerosene called range oil having properties similar to Number 1 fuel oil, but with a gravity of about 43 degrees API and an end point of 625 degrees Fahrenheit. Used in space heaters, cooking stoves, and water heaters.

Kerosene-type jet fuel - See *Jet fuel*.

Large car - See *Automobile size classifications*.

Lease Condensate - A liquid recovered from natural gas at the well or at small gas/oil separators in the field. Consists primarily of pentanes and heavier hydrocarbons (also called field condensate).

Light duty vehicles - Automobiles and light trucks combined.

Light truck - Unless otherwise noted, light trucks are defined in this publication as two-axle, four-tire trucks. The U.S. Bureau of Census classifies all trucks with a gross vehicle weight less than 10,000 pounds as light trucks (See *Truck size classifications*).

Light-heavy truck - See *Truck size classifications*.

Liquefied 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 - A term relating the potential capacity of a system relative to its actual performance. Is often calculated as total passenger miles divided by total vehicle miles.

Low-emission vehicle - A clean fuel vehicle meeting the low-emission vehicle standards.

Medium truck - See *Truck size classifications*.

Methanol (CH_3OH) - A colorless poisonous liquid with essentially no odor and very little taste. It is the simplest alcohol and boils at 64.7 degrees Celsius. In transportation, methanol is used as a vehicle fuel by itself (M100), or blended with gasoline (M85).

Midsize car - See *Automobile size classifications*.

Minicompact car - See *Automobile size classifications*.

Model year - In this publication, model year is referring to the "sales" model year, the period from October 1 to the next September 31.

Motor bus - See *Bus*.

Motor Gasoline - A mixture of volatile hydrocarbons suitable for operation of an internal combustion engine whose major components are hydrocarbons with boiling points ranging from 78 to 217 degrees centigrade and whose source is distillation of petroleum and cracking, polymerization, and other chemical reactions by which the naturally occurring petroleum hydrocarbons are converted into those that have superior fuel properties.

Naphtha-type jet fuel - See *Jet fuel*.

National income - See *Income*.

Nationwide Personal Transportation Study (NPTS) - A nationwide home interview 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 and 1990 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 Plant Liquids - Products obtained from processing natural gas at natural gas processing plants, including natural gasoline plants, cycling plants, and fractionators. Products obtained include ethane, liquefied petroleum gases, (propanes, butane, propane-butane mixtures, and ethane-propane mixtures), isopentane, natural gasoline, unfractionated streams, plant condensate, and other minor quantities of finished products, such as motor gasoline, special naphthas, jet fuel, kerosene, and distillate fuel oil.

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.

Oil Stocks - Oil stocks include crude oil (including strategic reserves), unfinished oils, natural gas plant liquids, and refined petroleum products.

Operating cost -

Fixed operating cost: In reference to passenger car operating cost, refers to those expenditures that are independent of the amount of use of the car, such as insurance costs, fees for license and registration, depreciation and finance charges.

Variable operating cost: In reference to passenger car operating cost, expenditures which are dependent on the amount of use of the car, such as the cost of gas and oil, tires, and other maintenance.

Organization for Economic Cooperation and Development (OECD) - Consists of Australia, Austria, Belgium, Canada, Czech Republic, Denmark, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Japan, Luxembourg, Mexico, Netherlands, New Zealand, Norway, Poland, Portugal, South Korea, Spain, Sweden, Switzerland, Turkey, United Kingdom, and United States. Total OECD includes the United States Territories (Guam, Puerto Rico, and the U.S. Virgin Islands). Total OECD excludes data for Czech Republic, Hungary, Mexico, Poland, and South Korea which are not yet available.

OECD Europe: Consists of Austria, Belgium, Czech Republic, Denmark, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Luxembourg, Netherlands, Norway, Poland, Portugal, Spain, Sweden, Switzerland, Turkey, and United Kingdom. OECD Europe excludes data for Czech Republic, Hungary, and Poland which are not yet available.

OECD Pacific: Consists of Australia, Japan, and New Zealand.

Organization for Petroleum Exporting Countries (OPEC) - Includes Saudi Arabia, Iran, Venezuela, Libya, Indonesia, United Arab Emirates, Algeria, Nigeria, Ecuador, Gabon, Iraq, Kuwait, and Qatar. Data for Saudi Arabia and Kuwait include their shares from the Partitioned Zone (formerly the Neutral Zone).

Arab OPEC - Consists of Algeria, Iraq, Kuwait, Libya, Qatar, Saudi Arabia and the United Arab Emirates.

Other single-unit truck - See *Single-unit truck*.

Oxygenate - A substance which, when added to gasoline, increases the amount of oxygen in that gasoline blend. Includes fuel ethanol, methanol, and methyl tertiary butyl ether (MTBE).

Particulates - Carbon particles formed by partial oxidation and reduction of the hydrocarbon fuel. Also included are trace quantities of metal oxides and nitrides, originating from engine wear, component degradation, and inorganic fuel additives. In the transportation sector, particulates are emitted mainly from diesel engines.

Passenger-miles traveled (PMT) - One person traveling the distance of one mile. Total passenger-miles traveled, thus, give the total mileage traveled by all persons.

Passenger rail - See *Rail*, "*Amtrak*" and "*Transit Railroad*".

Persian Gulf countries: Consists of Bahrain, Iran, Iraq, Kuwait, Qatar, Saudi Arabia, and the United Emirates.

Personal Consumption Expenditures (PCE) - As used in the national accounts, the market value of purchases of goods and services by individuals and nonprofit institutions and the value of food, clothing, housing, and financial services received by them as income in kind. It includes the rental value of owner-occupied houses but excludes purchases of dwellings, which are classified as capital goods (investment).

Personal income - See *Income*.

Petroleum - A generic term applied to oil and oil products in all forms, such as crude oil, lease condensate, unfinished oil, refined petroleum products, natural gas plant liquids, and non-hydrocarbon compounds blended into finished petroleum products.

Petroleum consumption: A calculated demand for petroleum products obtained by summing domestic production, imports of crude petroleum and natural gas liquids, imports of petroleum products, and the primary stocks at the beginning of the period and then subtracting the exports and the primary stocks at the end of the period.

Petroleum exports: Shipments of petroleum products from the 50 States and the District of Columbia to foreign countries, Puerto Rico, the Virgin Islands, and other U.S. possessions and territories.

Petroleum imports: All imports of crude petroleum, natural gas liquids, and petroleum products from foreign countries and receipts from Guam, Puerto Rico, the Virgin Islands, and the Hawaiian Trade Zone. The commodities included are crude oil, unfinished oils, plant condensate, and refined petroleum products.

Petroleum inventories: The amounts of crude oil, unfinished oil, petroleum products, and natural gas liquids held at refineries, at natural gas processing plants, in pipelines, at bulk terminals operated by refining and pipeline companies, and at independent bulk terminals. Crude oil held in storage on leases is also included; these stocks are 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.

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.

Residential and Commercial sector - Consists of housing units, non-manufacturing business establishments (e.g., wholesale and retail businesses), health and educational institutions, and government offices.

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 known 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.

Scrapage rate - As applied to motor vehicles, it is usually expressed as the percentage of vehicles of a certain type in a given age class that are retired from use (lacking registration) in a given year.

School and other nonrevenue bus - See *Bus*.

Single unit truck - Includes two-axle, four-tire trucks and other single unit trucks.

Two-axle, four tire truck: A motor vehicle consisting primarily of a single motorized device with two axles and four tires.

Other single-unit truck: A motor vehicle consisting primarily of a single motorized device with more than two axles or more than four tires.

Special fuels - Consist primarily of diesel fuel with small amount of liquified petroleum gas, as defined by the Federal Highway Administration.

Specific acceleration power - Measured in watts per kilogram. Acceleration power divided by the battery system weight. Weight must include the total battery system.

Specific energy - Measured in watt hours per kilogram. The rated energy capacity of the battery divided by the total battery system weight.

Subcompact car - See *Automobile size classifications*.

Supplemental air carrier - See *Air carrier*.

Test weight - The weight setting at which a vehicle is tested on a dynamometer 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. The 1992 data have not yet been released.

Trolley coach - See *Bus*.

Truck size classifications - U.S. Bureau of the Census has categorized trucks by gross vehicle weight (gvw) as follows:

- Light - Less than 10,000 pounds gvw (Also see *Light Truck*.)
- Medium - 10,001 to 20,000 pounds gvw
- Light-heavy - 20,001 to 26,000 pounds gvw
- Heavy-heavy - 26,001 pounds gvw or more.

Two-axle, four-tire truck - See *Single-unit truck*.

Two seater car - See *Automobile size classifications*.

Ultra-low emission vehicle - A clean fuel vehicle meeting the more stringent Ultra-low emission standards.

Urban - Usually refers to areas with population of 5,000 or greater.

Variable operating cost - See *Operating cost*.

Vehicle-miles traveled (vmt) - One vehicle traveling the distance of one mile. Total vehicle miles, thus, is the total mileage traveled by all vehicles.

Zero-emission vehicle - A clean fuel vehicle meeting even more stringent zero-emission vehicle standards.

TITLE INDEX

Acquisitions

Federal Fleet Vehicle Acquisitions by Fuel Type, FY 1997 10-7

Act

Energy Policy Act Purchase Requirements of Light Alternative Fuel Vehicles 10-8

Activity

Growth of Freight Activity in the United States: Comparison of the 1997 and 1993

Commodity Flow Surveys 8-12

Commodity Flow Survey Freight Activity, 1997 8-13

Advanced

NEAR-TERM Technology: Fuel-Cycle Energy and Greenhouse Gas Emission Changes

of Alternative Transportation Fuels and Advanced Vehicle Technologies 3-11

LONG-TERM Technology: Fuel-Cycle Energy and Greenhouse Gas Emission Changes

of Alternative Transportation Fuels and Advanced Vehicle Technologies 3-12

NEAR-TERM Technology: Fuel-Cycle Energy and Criteria Pollutant Emission Changes

of Alternative Transportation Fuels and Advanced Vehicle Technologies 4-17

LONG-TERM Technology: Fuel-Cycle Energy and Greenhouse Gas Emission Changes

of Alternative Transportation Fuels and Advanced Vehicle Technologies 4-19

U.S. Advanced Battery Consortium Goals for Electric Vehicle Batteries 9-10

Age

Average Age of Vehicles by Household Vehicle Ownership, 1995 NPTS 11-12

Average Annual Miles per Household Vehicle by Vehicle Age 11-13

Average Age of Automobiles and Trucks in Use, 1970-98 6-10

Automobiles in Operation and Vehicle Travel by Age, 1970 and 1998 6-8

Trucks in Operation and Vehicle Travel by Age, 1970 and 1998 6-9

Agency

Federal Government Vehicles by Agency, Fiscal Year 1997 10-6

Air

Summary Statistics for U.S. Domestic and International Certificated Route Air Carriers,

1970-98 12-2

Total National Emissions of the Criteria Air Pollutants by Sector, 1998 4-2

California Air Resources Board Requirements for Meeting Emission Standards 4-42

Alternative

Energy Policy Act Purchase Requirements of Light Alternative Fuel Vehicles 10-8

Alternative Vehicle Fuel Consumption, 1992-2000 2-11

NEAR-TERM Technology: Fuel-Cycle Energy and Greenhouse Gas Emission Changes

of Alternative Transportation Fuels and Advanced Vehicle Technologies 3-11

LONG-TERM Technology: Fuel-Cycle Energy and Greenhouse Gas Emission Changes

of Alternative Transportation Fuels and Advanced Vehicle Technologies 3-12

Alternative (continued)

| | |
|--|------|
| NEAR-TERM Technology: Fuel-Cycle Energy and Criteria Pollutant Emission Changes of Alternative Transportation Fuels and Advanced Vehicle Technologies | 4-17 |
| LONG-TERM Technology: Fuel-Cycle Energy and Greenhouse Gas Emission Changes of Alternative Transportation Fuels and Advanced Vehicle Technologies | 4-19 |
| Conventional and Alternative Fuel Refueling Stations | 7-17 |
| Estimates of Alternative Fuel Vehicles in Use, 1992-2000 | 9-3 |
| Estimates of Light Alternative Fuel Vehicles, 1996, 1998, and 2000 | 9-4 |
| Estimates of Heavy Alternative Fuel Vehicles, 1996, 1998, and 2000 | 9-5 |
| Alternative Fuel Vehicles Available by Manufacturer, Model Year 2000 | 9-6 |
| Number of Alternative Refuel Sites by State and Fuel Type, 1999 | 9-7 |

Amtrak

| | |
|---|-------|
| Summary Statistics for the National Railroad Passenger Corporation (Amtrak), 1971-98 | 12-11 |
|---|-------|

Annual

| | |
|---|-------|
| Average Annual and Daily Vehicle-Miles of Travel for Fleet Vehicles, 1991 | 10-4 |
| Average Annual Miles per Vehicle by Household Vehicle Ownership, 1995 NPTS | 11-12 |
| Average Annual Miles per Household Vehicle by Vehicle Age | 11-13 |
| Average Annual Expenditures of Households by Income, 1998 | 11-3 |
| Average Annual Vehicle-Miles, Vehicle Trips and Trip Length per Household | 11-6 |
| Average Annual Person-Miles Traveled (PMT), Person Trips and Trip Length per Household by Selected Trip Purposes | 11-7 |

Area

| | |
|--|-------|
| National and Metropolitan Area Comparisons of Journey-to-Work Statistics, 1990 Census | 11-16 |
|--|-------|

Automobile

| | |
|--|------|
| Automobile Operating Cost per Mile, 1975-99 | 5-15 |
| Fixed Automobile Operating Costs per Year, 1975-99 | 5-16 |
| Automobile Scrappage and Survival Rates | 6-11 |
| Automobile Survival Rates | 6-12 |
| Automobile Registrations for Selected Countries, 1950-96 | 6-2 |
| Average Material Consumption for a Domestic Automobile, 1978, 1985, and 1999 | 7-15 |
| New Retail Automobile Sales in the United States, 1970-98 | 7-4 |

Automobiles

| | |
|---|------|
| Average Age of Automobiles and Trucks in Use, 1970-98 | 6-10 |
| Automobiles and Trucks in Use, 1970-98 | 6-5 |
| Automobiles in Operation and Vehicle Travel by Age, 1970 and 1998 | 6-8 |

Automobiles (continued)

| | |
|---|------|
| Sales-Weighted Curb Weight of New Domestic and Import Automobiles by Size Class, Sales Periods 1976-99 | 7-11 |
| Sales-Weighted Interior Space of New Domestic and Import Automobiles by Size Class, Sales Periods 1976-99 | 7-12 |
| Engine Size, Curb Weight, and Interior Space of New Domestic and Import Automobiles, 1976-99 | 7-13 |
| Sales-Weighted Wheelbase of New Automobiles and Light Trucks, Sales Period 1976-99 | 7-14 |
| Corporate Average Fuel Economy (CAFE) Standards versus Sales-Weighted Fuel Economy Estimates for Automobiles and Light Trucks, 1978-99 | 7-18 |
| Period Sales, Market Shares, and Sales-Weighted Fuel Economies of New Domestic and Import Automobiles, Selected Sales Periods 1976-99 | 7-6 |
| Sales-Weighted Engine Size of New Domestic and Import Automobiles by Size Class, Sales Periods 1976-99 | 7-9 |

Available

| | |
|--|-----|
| Alternative Fuel Vehicles Available by Manufacturer, Model Year 2000 | 9-6 |
|--|-----|

Average

| | |
|---|-------|
| Average Length of Time Fleet Vehicles are Kept Before Sold to Others, 1991 | 10-4 |
| Average Annual and Daily Vehicle-Miles of Travel for Fleet Vehicles, 1991 | 10-4 |
| Average Miles per Federal Vehicle by Vehicle Type, 1997 | 10-5 |
| Average Vehicle Occupancy by Trip Purpose, 1977, 1983, 1990, and 1995 NPTS | 11-10 |
| Average Annual Miles per Vehicle by Household Vehicle Ownership, 1995 NPTS | 11-12 |
| Average Age of Vehicles by Household Vehicle Ownership, 1995 NPTS | 11-12 |
| Average Annual Miles per Household Vehicle by Vehicle Age | 11-13 |
| Average Annual Expenditures of Households by Income, 1998 | 11-3 |
| Average Annual Vehicle-Miles, Vehicle Trips and Trip Length per Household | 11-6 |
| Average Annual Person-Miles Traveled (PMT), Person Trips and Trip Length per Household by Selected Trip Purposes | 11-7 |
| Average Number of Vehicles and Vehicle Travel per Household, 1990 and 1995 NPTS | 11-8 |
| Average Vehicle Occupancy by Vehicle Type, 1995 NPTS | 11-9 |
| Average Price of a New Car, 1970-99 | 5-13 |
| Average Price of a New Car by Sector, 1970-99 | 5-14 |
| Average Age of Automobiles and Trucks in Use, 1970-98 | 6-10 |
| Average Material Consumption for a Domestic Automobile, 1978, 1985, and 1999 | 7-15 |
| Corporate Average Fuel Economy (CAFE) Standards versus Sales-Weighted Fuel Economy Estimates for Automobiles and Light Trucks, 1978-99 | 7-18 |
| Corporate Average Fuel Economy (CAFE) Fines Collected, 1983-98 | 7-19 |

| | |
|--|------|
| Aviation | |
| Summary Statistics for General Aviation, 1970-98 | 12-3 |
| Axle | |
| Summary Statistics for Two-Axle, Four-Tire Trucks, 1970-98 | 7-3 |
| Barrel | |
| Refinery Yield of Petroleum Products from a Barrel of Crude Oil, 1978-98 | 1-11 |
| Prices for a Barrel of Crude Oil and a Gallon of Gasoline, 1978-99 | 5-6 |
| Batteries | |
| U.S. Advanced Battery Consortium Goals for Electric Vehicle Batteries | 9-10 |
| Battery | |
| U.S. Advanced Battery Consortium Goals for Electric Vehicle Batteries | 9-10 |
| Board | |
| California Air Resources Board Requirements for Meeting Emission Standards | 4-42 |
| Breakdown | |
| Breakdown of Domestic Marine Cargo by Commodity Class, 1998 | 12-6 |
| Bus | |
| Truck and Bus Registrations for Selected Countries, 1950-96 | 6-3 |
| Buses | |
| Summary Statistics on Buses by Type, 1970-98 | 8-14 |
| CAFE | |
| Corporate Average Fuel Economy (CAFE) Standards versus Sales-Weighted Fuel | |
| Economy Estimates for Automobiles and Light Trucks, 1978-99 | 7-18 |
| Corporate Average Fuel Economy (CAFE) Fines Collected, 1983-98 | 7-19 |
| Calendar | |
| Vehicle Stock and New Sales in United States, 1998 Calendar Year | 6-6 |
| California | |
| California Passenger Cars and Light Trucks Emission Certification Standards | 4-40 |
| California Vehicle Emission Reduction for Passenger Cars and Light Trucks | 4-41 |
| California Air Resources Board Requirements for Meeting Emission Standards | 4-42 |
| Car | |
| Pollution from a Typical New Car and Light Truck, 2000 Model Year | 4-32 |
| Average Price of a New Car, 1970-99 | 5-13 |
| Average Price of a New Car by Sector, 1970-99 | 5-14 |
| Carbon | |
| International Man-Made Emissions of Carbon Dioxide, 1990-97 | 3-3 |
| International Man-Made Emissions of Carbon Dioxide by Source Category, 1990 and 1997 | 3-4 |

Carbon (continued)

| | |
|--|-----|
| U.S. Carbon Dioxide Emissions from Fossil Energy Consumption by End-Use Sector, 1984-98 | 3-6 |
| U.S. Carbon Dioxide Emissions from Energy Use in the Transportation Sector, 1980-98 | 3-7 |
| Numerical Estimates of Global Warming Potentials Compared With Carbon Dioxide | 3-8 |
| Total National Emissions of Carbon Monoxide, 1970-98 | 4-3 |
| Emissions of Carbon Monoxide from Highway Vehicles, 1970-98 | 4-4 |

Cargo

| | |
|---|------|
| Breakdown of Domestic Marine Cargo by Commodity Class, 1998 | 12-6 |
|---|------|

Carloads

| | |
|---|------|
| Railroad Revenue Carloads by Commodity Group, 1974 and 1998 | 12-9 |
|---|------|

Carriers

| | |
|--|------|
| Summary Statistics for U.S. Domestic and International Certificated Route Air Carriers, 1970-98 | 12-2 |
|--|------|

Cars

| | |
|---|------|
| California Passenger Cars and Light Trucks Emission Certification Standards | 4-40 |
| California Vehicle Emission Reduction for Passenger Cars and Light Trucks | 4-41 |
| Summary Statistics for Passenger Cars, 1970-98 | 7-2 |
| The Gas Guzzler Tax on New Cars | 7-20 |

Category

| | |
|---|-----|
| International Man-Made Emissions of Carbon Dioxide by Source Category, 1990 and 1997 | 3-4 |
|---|-----|

Census

| | |
|--|-------|
| Means of Transportation to Work, 1980 and 1990 Census | 11-15 |
| National and Metropolitan Area Comparisons of Journey-to-Work Statistics, 1990 Census | 11-16 |
| Household Vehicle Ownership, 1960-90 Census | 11-4 |

Certificated

| | |
|--|------|
| Summary Statistics for U.S. Domestic and International Certificated Route Air Carriers, 1970-98 | 12-2 |
|--|------|

Certification

| | |
|---|------|
| Federal Exhaust Emission Certification Standards for Gasoline- and Diesel-Powered Light Vehicles | 4-33 |
| Federal Exhaust Emission Certification Standards for Gasoline- and Diesel-Powered Light Trucks | 4-34 |
| Federal Exhaust Emission Certification Standards for Gasoline- and Diesel-Powered Light Trucks | 4-35 |

Certification (continued)

| | |
|--|------|
| Federal Exhaust Emission Certification Standards for Gasoline- and Diesel-Powered Light Trucks | 4-36 |
| Federal Exhaust Emission Certification Standards for Gasoline- and Diesel-Powered Light Trucks | 4-37 |
| Federal Exhaust Emission Certification Standards for Gasoline- and Diesel-Powered Light Heavy Trucks | 4-38 |
| Federal Exhaust Emission Certification Standards for Gasoline- and Diesel-Powered Heavy Heavy Trucks | 4-39 |
| California Passenger Cars and Light Trucks Emission Certification Standards | 4-40 |

Cities

| | |
|---|-----|
| List of Clean Cities as of 12/1/99 by Designation | 9-8 |
| Map of Clean Cities as of 12/1/99 | 9-9 |

City

| | |
|-----------------------------------|------|
| New York City Driving Cycle | 7-27 |
|-----------------------------------|------|

Class

| | |
|---|------|
| Breakdown of Domestic Marine Cargo by Commodity Class, 1998 | 12-6 |
| Class I Railroad Freight Systems in the United States Ranked by Revenue Ton-Miles, 1998 | 12-7 |
| Summary Statistics for Class I Freight Railroads, 1970-98 | 12-8 |
| Sales-Weighted Engine Size of New Domestic and Import Light Trucks by Size Class, Sales Periods 1976-99 | 7-10 |
| Sales-Weighted Curb Weight of New Domestic and Import Automobiles by Size Class, Sales Periods 1976-99 | 7-11 |
| Sales-Weighted Interior Space of New Domestic and Import Automobiles by Size Class, Sales Periods 1976-99 | 7-12 |
| Light Vehicle Market Shares by Size Class, Sales Period 1976-99 | 7-8 |
| Sales-Weighted Engine Size of New Domestic and Import Automobiles by Size Class, Sales Periods 1976-99 | 7-9 |
| Truck Statistics by Gross Vehicle Weight Class, 1997 | 8-5 |
| Percentage of Trucks by Size Class, 1977, 1982, 1987, 1992, and 1997 | 8-5 |
| Truck Fuel Economy by Fuel Type and Size Class, 1997 | 8-6 |
| Truck Fuel Economy by Size Class, 1977, 1982, 1987, 1992, and 1997 | 8-6 |

Clean

| | |
|---|-----|
| List of Clean Cities as of 12/1/99 by Designation | 9-8 |
| Map of Clean Cities as of 12/1/99 | 9-9 |

Collected

| | |
|--|------|
| Corporate Average Fuel Economy (CAFE) Fines Collected, 1983-98 | 7-19 |
|--|------|

Commerce

| | |
|--|------|
| Tonnage Statistics for Domestic and International Waterborne Commerce, 1970-98 | 12-4 |
| Summary Statistics for Domestic Waterborne Commerce, 1970-98 | 12-5 |

Commodity

| | |
|--|------|
| Breakdown of Domestic Marine Cargo by Commodity Class, 1998 | 12-6 |
| Railroad Revenue Carloads by Commodity Group, 1974 and 1998 | 12-9 |
| Growth of Freight Activity in the United States: Comparison of the 1997 and 1993 Commodity Flow Surveys | 8-12 |
| Commodity Flow Survey Freight Activity, 1997 | 8-13 |

Composition

| | |
|---|------|
| Fleet Vehicle Composition by Vehicle Type, 1991 | 10-4 |
|---|------|

Compounds

| | |
|--|-----|
| Total National Emissions of Volatile Organic Compounds, 1970-98 | 4-7 |
| Emissions of Volatile Organic Compounds from Highway Vehicles, 1970-98 | 4-8 |

Consortium

| | |
|---|------|
| U.S. Advanced Battery Consortium Goals for Electric Vehicle Batteries | 9-10 |
|---|------|

Consumed

| | |
|---|------|
| Fuel Consumed by Federal Government Fleets, FY 1997 | 10-7 |
|---|------|

Consumer

| | |
|---|------|
| Consumer Price Indices, 1970-99 | 5-17 |
|---|------|

Consumption

| | |
|--|------|
| United States Petroleum Production and Consumption, 1973-99 | 1-12 |
| Consumption by Petroleum by End-Use Sector, 1973-99 | 1-14 |
| World Oil Consumption, 1960-97 | 1-4 |
| Alternative Vehicle Fuel Consumption, 1992-2000 | 2-11 |
| World Consumption of Primary Energy by Selected Country Groups, 1989-98 | 2-3 |
| U. S. Consumption of Total Energy by End-Use Sector, 1970-99 | 2-4 |
| Distribution of Energy Consumption by Source, 1973, 1980, and 1999 | 2-5 |
| Domestic Consumption of Transportation Energy by Mode and Fuel Type, 1998 | 2-6 |
| Transportation Energy Consumption by Mode, 1970-98 | 2-8 |
| U.S. Carbon Dioxide Emissions from Fossil Energy Consumption by End-Use Sector, 1984-98 | 3-6 |
| Average Material Consumption for a Domestic Automobile, 1978, 1985, and 1999 | 7-15 |

Conventional

| | |
|--|------|
| Conventional and Alternative Fuel Refueling Stations | 7-17 |
|--|------|

Corporate

| | |
|--|------|
| Corporate Average Fuel Economy (CAFE) Standards versus Sales-Weighted Fuel Economy Estimates for Automobiles and Light Trucks, 1978-99 | 7-18 |
| Corporate Average Fuel Economy (CAFE) Fines Collected, 1983-98 | 7-19 |

Corporation

| | |
|--|-------|
| Summary Statistics for the National Railroad Passenger Corporation (Amtrak), 1971-98 | 12-11 |
|--|-------|

Cost

| | |
|---|------|
| Automobile Operating Cost per Mile, 1975-99 | 5-15 |
|---|------|

Costs

| | |
|--|------|
| Fixed Automobile Operating Costs per Year, 1975-99 | 5-16 |
|--|------|

Countries

| | |
|---|-----|
| Petroleum Stocks in OECD Countries, End of Year 1973-98 | 1-5 |
| Gasoline Prices for Selected Countries, 1978-99 | 5-2 |
| Gasoline Prices for Selected Countries, 1990 and 1998 | 5-3 |
| Diesel Fuel Prices for Selected Countries, 1978-99 | 5-4 |
| Diesel Fuel Prices for Selected Countries, 1990 and 1998 | 5-5 |
| Automobile Registrations for Selected Countries, 1950-96 | 6-2 |
| Truck and Bus Registrations for Selected Countries, 1950-96 | 6-3 |

Country

| | |
|---|-----|
| World Production of Primary Energy by Selected Country Groups, 1989-98 | 2-2 |
| World Consumption of Primary Energy by Selected Country Groups, 1989-98 | 2-3 |

Crash

| | |
|--|------|
| Crashes by Crash Severity, Crash Type, and Vehicle Type, 1998 | 7-31 |
| Percent Rollover Occurrence by Vehicle Type and Crash Severity | 7-32 |

Crashes

| | |
|---|------|
| Crashes by Crash Severity, Crash Type, and Vehicle Type, 1998 | 7-31 |
|---|------|

Criteria

| | |
|---|------|
| State-level Emissions for Criteria Pollutants, 1998 | 4-14 |
| NEAR-TERM Technology: Fuel-Cycle Energy and Criteria Pollutant Emission Changes of Alternative Transportation Fuels and Advanced Vehicle Technologies | 4-17 |
| Total National Emissions of the Criteria Air Pollutants by Sector, 1998 | 4-2 |

Crude

| | |
|--|------|
| U.S. Refinery Input of Crude Oil and Petroleum Products, 1987-98 | 1-10 |
| Refinery Yield of Petroleum Products from a Barrel of Crude Oil, 1978-98 | 1-11 |
| World Crude Oil Production, 1960-98 | 1-3 |
| Crude Oil Prices, 1870-98 | 1-6 |
| Prices for a Barrel of Crude Oil and a Gallon of Gasoline, 1978-99 | 5-6 |

Curb

| | |
|---|------|
| Sales-Weighted Curb Weight of New Domestic and Import Automobiles by Size Class, Sales Periods 1976-99 | 7-11 |
| Engine Size, Curb Weight, and Interior Space of New Domestic and Import Automobiles, 1976-99 | 7-13 |

Daily

| | |
|---|------|
| Average Annual and Daily Vehicle-Miles of Travel for Fleet Vehicles, 1991 | 10-4 |
|---|------|

Dealerships

| | |
|--|------|
| New Light Vehicle Dealerships and Sales, 1970-98 | 7-16 |
|--|------|

Defending

| | |
|--|-----|
| Summary of 1996 Military Expenditures for Defending Oil Supplies from the Middle East | 1-8 |
|--|-----|

Demographic

| | |
|---|------|
| Demographic Statistics, 1969, 1977, 1983, 1990, and 1995 NPTS | 11-5 |
|---|------|

Designation

| | |
|---|-----|
| List of Clean Cities as of 12/1/99 by Designation | 9-8 |
|---|-----|

Destination

| | |
|--|-------|
| Long-Distance Trips by Destination, 1995 | 11-17 |
|--|-------|

Diesel

| | |
|---|------|
| Federal Exhaust Emission Certification Standards for Gasoline- and Diesel-Powered Light Vehicles | 4-33 |
| Federal Exhaust Emission Certification Standards for Gasoline- and Diesel-Powered Light Trucks | 4-34 |
| Federal Exhaust Emission Certification Standards for Gasoline- and Diesel-Powered Light Trucks | 4-35 |
| Federal Exhaust Emission Certification Standards for Gasoline- and Diesel-Powered Light Trucks | 4-36 |
| Federal Exhaust Emission Certification Standards for Gasoline- and Diesel-Powered Light Trucks | 4-37 |
| Federal Exhaust Emission Certification Standards for Gasoline- and Diesel-Powered Light Heavy Trucks | 4-38 |
| Federal Exhaust Emission Certification Standards for Gasoline- and Diesel-Powered Heavy Heavy Trucks | 4-39 |
| Diesel Fuel Prices for Selected Countries, 1978-99 | 5-4 |
| Diesel Fuel Prices for Selected Countries, 1990 and 1998 | 5-5 |

Dioxide

| | |
|--|-----|
| International Man-Made Emissions of Carbon Dioxide, 1990-97 | 3-3 |
| International Man-Made Emissions of Carbon Dioxide by Source Category, 1990 and 1997 | 3-4 |
| U.S. Carbon Dioxide Emissions from Fossil Energy Consumption by End-Use Sector, 1984-98 | 3-6 |
| U.S. Carbon Dioxide Emissions from Energy Use in the Transportation Sector, 1980-98 | 3-7 |
| Numerical Estimates of Global Warming Potentials Compared With Carbon Dioxide | 3-8 |

Distance

| | |
|---|-------|
| Long-Distance Trips by Destination, 1995 | 11-17 |
| Long-Distance Trips by Mode and Purpose, 1995 | 11-18 |
| Long-Distance Household Trips by Mode and Trip Distance, 1995 | 11-19 |
| Shares of Long-Distance Person Trips by Mode and Household Income, 1995 | 11-20 |

Distribution

| | |
|--|-----|
| Distribution of Energy Consumption by Source, 1973, 1980, and 1999 | 2-5 |
|--|-----|

Domestic

| | |
|--|------|
| Summary Statistics for U.S. Domestic and International Certificated Route Air Carriers, 1970-98 | 12-2 |
| Tonnage Statistics for Domestic and International Waterborne Commerce, 1970-98 | 12-4 |
| Summary Statistics for Domestic Waterborne Commerce, 1970-98 | 12-5 |
| Breakdown of Domestic Marine Cargo by Commodity Class, 1998 | 12-6 |
| Domestic Consumption of Transportation Energy by Mode and Fuel Type, 1998 | 2-6 |
| Sales-Weighted Engine Size of New Domestic and Import Light Trucks by Size Class, Sales Periods 1976-99 | 7-10 |
| Sales-Weighted Curb Weight of New Domestic and Import Automobiles by Size Class, Sales Periods 1976-99 | 7-11 |
| Sales-Weighted Interior Space of New Domestic and Import Automobiles by Size Class, Sales Periods 1976-99 | 7-12 |
| Engine Size, Curb Weight, and Interior Space of New Domestic and Import Automobiles, 1976-99 | 7-13 |
| Average Material Consumption for a Domestic Automobile, 1978, 1985, and 1999 | 7-15 |
| Period Sales, Market Shares, and Sales-Weighted Fuel Economies of New Domestic and Import Automobiles, Selected Sales Periods 1976-99 | 7-6 |
| Period Sales, Market Shares, and Sales-Weighted Fuel Economies of New Domestic and Import Light Trucks, Selected Sales Period 1976-99 | 7-7 |
| Sales-Weighted Engine Size of New Domestic and Import Automobiles by Size Class, Sales Periods 1976-99 | 7-9 |

Driving

| | |
|--|------|
| Urban Driving Cycle | 7-26 |
| Highway Driving Cycle | 7-26 |
| New York City Driving Cycle | 7-27 |
| Representative Number Five Driving Cycle | 7-27 |
| US06 Driving Cycle | 7-28 |

East

| | |
|--|-----|
| Summary of 1996 Military Expenditures for Defending Oil Supplies from the Middle East | 1-8 |
|--|-----|

Economic

| | |
|------------------------------------|------|
| Economic Indicators, 1970-99 | 5-17 |
|------------------------------------|------|

Economies

| | |
|--|-----|
| Period Sales, Market Shares, and Sales-Weighted Fuel Economies of New Domestic and Import Automobiles, Selected Sales Periods 1976-99 | 7-6 |
| Period Sales, Market Shares, and Sales-Weighted Fuel Economies of New Domestic and Import Light Trucks, Selected Sales Period 1976-99 | 7-7 |

Economy

| | |
|---|------|
| Corporate Average Fuel Economy (CAFE) Standards versus Sales-Weighted Fuel Economy Estimates for Automobiles and Light Trucks, 1978-99 | 7-18 |
| Corporate Average Fuel Economy (CAFE) Fines Collected, 1983-98 | 7-19 |
| Fuel Economy by Speed, 1973, 1984 and 1997 | 7-23 |
| Fuel Economy by Speed, 1973, 1984 and 1997 | 7-24 |
| Steady Speed Fuel Economy for Tested Vehicles | 7-25 |
| Truck Fuel Economy by Fuel Type and Size Class, 1997 | 8-6 |
| Truck Fuel Economy by Size Class, 1977, 1982, 1987, 1992, and 1997 | 8-6 |

Electric

| | |
|---|------|
| U.S. Advanced Battery Consortium Goals for Electric Vehicle Batteries | 9-10 |
| PNGV Goals and Specifications of Hybrid-Electric Vehicles | 9-11 |

Emission

| | |
|--|------|
| NEAR-TERM Technology: Fuel-Cycle Energy and Greenhouse Gas Emission Changes of Alternative Transportation Fuels and Advanced Vehicle Technologies | 3-11 |
| LONG-TERM Technology: Fuel-Cycle Energy and Greenhouse Gas Emission Changes of Alternative Transportation Fuels and Advanced Vehicle Technologies | 3-12 |
| National Lead Emission Estimates, 1970-98 | 4-13 |
| NEAR-TERM Technology: Fuel-Cycle Energy and Criteria Pollutant Emission Changes of Alternative Transportation Fuels and Advanced Vehicle Technologies | 4-17 |

Emission (continued)

| | |
|--|------|
| LONG-TERM Technology: Fuel-Cycle Energy and Greenhouse Gas Emission Changes of Alternative Transportation Fuels and Advanced Vehicle Technologies | 4-19 |
| Tier 2 Federal Emission Standards | 4-32 |
| Federal Exhaust Emission Certification Standards for Gasoline- and Diesel-Powered Light Vehicles | 4-33 |
| Federal Exhaust Emission Certification Standards for Gasoline- and Diesel-Powered Light Trucks | 4-34 |
| Federal Exhaust Emission Certification Standards for Gasoline- and Diesel-Powered Light Trucks | 4-35 |
| Federal Exhaust Emission Certification Standards for Gasoline- and Diesel-Powered Light Trucks | 4-36 |
| Federal Exhaust Emission Certification Standards for Gasoline- and Diesel-Powered Light Trucks | 4-37 |
| Federal Exhaust Emission Certification Standards for Gasoline- and Diesel-Powered Light Heavy Trucks | 4-38 |
| Federal Exhaust Emission Certification Standards for Gasoline- and Diesel-Powered Heavy Heavy Trucks | 4-39 |
| California Passenger Cars and Light Trucks Emission Certification Standards | 4-40 |
| California Vehicle Emission Reduction for Passenger Cars and Light Trucks | 4-41 |
| California Air Resources Board Requirements for Meeting Emission Standards | 4-42 |

Emissions

| | |
|--|------|
| International Man-Made Emissions of Greenhouse Gases, 1990-97 | 3-2 |
| International Man-Made Emissions of Carbon Dioxide, 1990-97 | 3-3 |
| International Man-Made Emissions of Carbon Dioxide by Source Category, 1990 and 1997 | 3-4 |
| Estimated U.S. Emissions of Greenhouse Gases, 1990-98 | 3-5 |
| U.S. Carbon Dioxide Emissions from Fossil Energy Consumption by End-Use Sector, 1984-98 | 3-6 |
| U.S. Carbon Dioxide Emissions from Energy Use in the Transportation Sector, 1980-98 | 3-7 |
| Emissions of Particulate Matter (PM-10) from Highway Vehicles, 1970-98 | 4-10 |
| Total National Emissions of Particulate Matter (PM-2.5), 1990-98 | 4-11 |
| Emissions of Particulate Matter (PM-2.5) from Highway Vehicles, 1990-98 | 4-12 |
| State-level Emissions for Criteria Pollutants, 1998 | 4-14 |
| Total National Emissions of the Criteria Air Pollutants by Sector, 1998 | 4-2 |
| Total National Emissions of Carbon Monoxide, 1970-98 | 4-3 |
| Emissions of Carbon Monoxide from Highway Vehicles, 1970-98 | 4-4 |

Emissions (continued)

| | |
|--|-----|
| Total National Emissions of Nitrogen Oxides, 1970-98 | 4-5 |
| Emissions of Nitrogen Oxides from Highway Vehicles, 1970-98 | 4-6 |
| Total National Emissions of Volatile Organic Compounds, 1970-98 | 4-7 |
| Emissions of Volatile Organic Compounds from Highway Vehicles, 1970-98 | 4-8 |
| Total National Emissions of Particulate Matter (PM-10), 1970-98 | 4-9 |

Employees

| | |
|--|------|
| Employees of Motor Vehicle and Related Industries, 1990 and 1997 | 5-19 |
|--|------|

Employment

| | |
|--|------|
| Motor Vehicle Manufacturing Employment Statistics, 1972-98 | 5-18 |
| Employment in Transportation and Related Industries, 1960-98 | 5-20 |

Energy

| | |
|--|------|
| Energy Policy Act Purchase Requirements of Light Alternative Fuel Vehicles | 10-8 |
| Passenger Travel and Energy Use in the United States, 1998 | 2-13 |
| Energy Intensities of Passenger Modes, 1970-98 | 2-14 |
| Energy Intensity for Transit in the U.S., 1998 | 2-15 |
| Intercity Freight Movement and Energy Use in the United States, 1998 | 2-16 |
| Energy Intensities of Freight Modes, 1970-98 | 2-17 |
| World Production of Primary Energy by Selected Country Groups, 1989-98 | 2-2 |
| World Consumption of Primary Energy by Selected Country Groups, 1989-98 | 2-3 |
| U. S. Consumption of Total Energy by End-Use Sector, 1970-99 | 2-4 |
| Distribution of Energy Consumption by Source, 1973, 1980, and 1999 | 2-5 |
| Domestic Consumption of Transportation Energy by Mode and Fuel Type, 1998 | 2-6 |
| Transportation Energy Use by Mode, 1997-98 | 2-7 |
| Transportation Energy Consumption by Mode, 1970-98 | 2-8 |
| NEAR-TERM Technology: Fuel-Cycle Energy and Greenhouse Gas Emission Changes of Alternative Transportation Fuels and Advanced Vehicle Technologies | 3-11 |
| LONG-TERM Technology: Fuel-Cycle Energy and Greenhouse Gas Emission Changes of Alternative Transportation Fuels and Advanced Vehicle Technologies | 3-12 |
| U.S. Carbon Dioxide Emissions from Fossil Energy Consumption by End-Use Sector, 1984-98 | 3-6 |
| U.S. Carbon Dioxide Emissions from Energy Use in the Transportation Sector, 1980-98 | 3-7 |
| NEAR-TERM Technology: Fuel-Cycle Energy and Criteria Pollutant Emission Changes of Alternative Transportation Fuels and Advanced Vehicle Technologies | 4-17 |
| LONG-TERM Technology: Fuel-Cycle Energy and Greenhouse Gas Emission Changes of Alternative Transportation Fuels and Advanced Vehicle Technologies | 4-19 |

Engine

| | |
|--|------|
| Sales-Weighted Engine Size of New Domestic and Import Light Trucks by Size Class, Sales Periods 1976-99 | 7-10 |
| Engine Size, Curb Weight, and Interior Space of New Domestic and Import Automobiles, 1976-99 | 7-13 |
| Sales-Weighted Engine Size of New Domestic and Import Automobiles by Size Class, Sales Periods 1976-99 | 7-9 |

Estimated

| | |
|---|-----|
| Estimated U.S. Emissions of Greenhouse Gases, 1990-98 | 3-5 |
|---|-----|

Estimates

| | |
|---|------|
| Numerical Estimates of Global Warming Potentials Compared With Carbon Dioxide | 3-8 |
| National Lead Emission Estimates, 1970-98 | 4-13 |
| Corporate Average Fuel Economy (CAFE) Standards versus Sales-Weighted Fuel Economy Estimates for Automobiles and Light Trucks, 1978-99 | 7-18 |
| Estimates of Alternative Fuel Vehicles in Use, 1992-2000 | 9-3 |
| Estimates of Light Alternative Fuel Vehicles, 1996, 1998, and 2000 | 9-4 |
| Estimates of Heavy Alternative Fuel Vehicles, 1996, 1998, and 2000 | 9-5 |

Ethanol

| | |
|---|------|
| U.S. Production and Imports of MTBE and Fuel Ethanol, 1978-99 | 2-12 |
| States With Ethanol Tax Incentives | 5-12 |

Excise

| | |
|---|------|
| Federal Excise Taxes on Motor Fuels | 5-11 |
|---|------|

Exemptions

| | |
|---|------|
| State Tax Exemptions for Gasohol, January 1, 2000 | 5-11 |
|---|------|

Exhaust

| | |
|---|------|
| Federal Exhaust Emission Certification Standards for Gasoline- and Diesel-Powered Light Vehicles | 4-33 |
| Federal Exhaust Emission Certification Standards for Gasoline- and Diesel-Powered Light Trucks | 4-34 |
| Federal Exhaust Emission Certification Standards for Gasoline- and Diesel-Powered Light Trucks | 4-35 |
| Federal Exhaust Emission Certification Standards for Gasoline- and Diesel-Powered Light Trucks | 4-36 |
| Federal Exhaust Emission Certification Standards for Gasoline- and Diesel-Powered Light Trucks | 4-37 |
| Federal Exhaust Emission Certification Standards for Gasoline- and Diesel-Powered Light Heavy Trucks | 4-38 |
| Federal Exhaust Emission Certification Standards for Gasoline- and Diesel-Powered Heavy Heavy Trucks | 4-39 |

Expenditures

| | |
|---|------|
| Summary of 1996 Military Expenditures for Defending Oil Supplies from the Middle East | 1-8 |
| Average Annual Expenditures of Households by Income, 1998 | 11-3 |

Facility

| | |
|---|------|
| Percentage of Trucks by Major Use and Primary Refueling Facility, 1997 | 8-10 |
| Percentage of Trucks by Fleet Size and Primary Refueling Facility, 1997 | 8-9 |

Fatalities

| | |
|---|------|
| Occupant Fatalities by Vehicle Type and Nonoccupant Fatalities, 1975-98 | 7-29 |
|---|------|

Federal

| | |
|--|------|
| Worldwide Federal Inventory, 1992-97 | 10-5 |
| Average Miles per Federal Vehicle by Vehicle Type, 1997 | 10-5 |
| Federal Government Vehicles by Agency, Fiscal Year 1997 | 10-6 |
| Federal Fleet Vehicle Acquisitions by Fuel Type, FY 1997 | 10-7 |
| Fuel Consumed by Federal Government Fleets, FY 1997 | 10-7 |
| Tier 2 Federal Emission Standards | 4-32 |
| Federal Exhaust Emission Certification Standards for Gasoline- and Diesel-Powered Light Vehicles | 4-33 |
| Federal Exhaust Emission Certification Standards for Gasoline- and Diesel-Powered Light Trucks | 4-34 |
| Federal Exhaust Emission Certification Standards for Gasoline- and Diesel-Powered Light Trucks | 4-35 |
| Federal Exhaust Emission Certification Standards for Gasoline- and Diesel-Powered Light Trucks | 4-36 |
| Federal Exhaust Emission Certification Standards for Gasoline- and Diesel-Powered Light Trucks | 4-37 |
| Federal Exhaust Emission Certification Standards for Gasoline- and Diesel-Powered Light Heavy Trucks | 4-38 |
| Federal Exhaust Emission Certification Standards for Gasoline- and Diesel-Powered Heavy Heavy Trucks | 4-39 |
| Federal Excise Taxes on Motor Fuels | 5-11 |

Fines

| | |
|--|------|
| Corporate Average Fuel Economy (CAFE) Fines Collected, 1983-98 | 7-19 |
|--|------|

Fiscal

| | |
|---|------|
| Federal Government Vehicles by Agency, Fiscal Year 1997 | 10-6 |
|---|------|

Fixed

| | |
|--|------|
| Fixed Automobile Operating Costs per Year, 1975-99 | 5-16 |
|--|------|

Fleet

| | |
|--|------|
| Fleet Vehicles in Service as of January 1, 1999 | 10-2 |
| Fleet Vehicle Composition by Vehicle Type, 1991 | 10-4 |
| Average Length of Time Fleet Vehicles are Kept Before Sold to Others, 1991 | 10-4 |
| Average Annual and Daily Vehicle-Miles of Travel for Fleet Vehicles, 1991 | 10-4 |
| Federal Fleet Vehicle Acquisitions by Fuel Type, FY 1997 | 10-7 |
| Percentage of Trucks by Fleet Size and Primary Refueling Facility, 1997 | 8-9 |

Fleets

| | |
|--|------|
| Top Ten States with Fleets of Ten Vehicles or More, 1999 | 10-3 |
| Fuel Consumed by Federal Government Fleets, FY 1997 | 10-7 |

Flow

| | |
|--|------|
| Growth of Freight Activity in the United States: Comparison of the 1997 and 1993 Commodity Flow Surveys | 8-12 |
| Commodity Flow Survey Freight Activity, 1997 | 8-13 |

Fossil

| | |
|--|-----|
| World Fossil Fuel Potential | 1-2 |
| U.S. Carbon Dioxide Emissions from Fossil Energy Consumption by End-Use Sector, 1984-98 | 3-6 |

Freight

| | |
|--|------|
| Class I Railroad Freight Systems in the United States Ranked by Revenue Ton-Miles, 1998 | 12-7 |
| Summary Statistics for Class I Freight Railroads, 1970-98 | 12-8 |
| Intercity Freight Movement and Energy Use in the United States, 1998 | 2-16 |
| Energy Intensities of Freight Modes, 1970-98 | 2-17 |
| Growth of Freight Activity in the United States: Comparison of the 1997 and 1993 Commodity Flow Surveys | 8-12 |
| Commodity Flow Survey Freight Activity, 1997 | 8-13 |

Fuel

| | |
|--|------|
| World Fossil Fuel Potential | 1-2 |
| Federal Fleet Vehicle Acquisitions by Fuel Type, FY 1997 | 10-7 |
| Fuel Consumed by Federal Government Fleets, FY 1997 | 10-7 |
| Energy Policy Act Purchase Requirements of Light Alternative Fuel Vehicles | 10-8 |
| Alternative Vehicle Fuel Consumption, 1992-2000 | 2-11 |
| U.S. Production and Imports of MTBE and Fuel Ethanol, 1978-99 | 2-12 |
| Domestic Consumption of Transportation Energy by Mode and Fuel Type, 1998 | 2-6 |
| NEAR-TERM Technology: Fuel-Cycle Energy and Greenhouse Gas Emission Changes of Alternative Transportation Fuels and Advanced Vehicle Technologies | 3-11 |

Fuel

| | |
|--|------|
| LONG-TERM Technology: Fuel-Cycle Energy and Greenhouse Gas Emission Changes of Alternative Transportation Fuels and Advanced Vehicle Technologies | 3-12 |
| NEAR-TERM Technology: Fuel-Cycle Energy and Criteria Pollutant Emission Changes of Alternative Transportation Fuels and Advanced Vehicle Technologies | 4-17 |
| LONG-TERM Technology: Fuel-Cycle Energy and Greenhouse Gas Emission Changes of Alternative Transportation Fuels and Advanced Vehicle Technologies | 4-19 |
| Diesel Fuel Prices for Selected Countries, 1978-99 | 5-4 |
| Diesel Fuel Prices for Selected Countries, 1990 and 1998 | 5-5 |
| Retail Prices for Motor Fuel, 1978-99 | 5-7 |
| Conventional and Alternative Fuel Refueling Stations | 7-17 |
| Corporate Average Fuel Economy (CAFE) Standards versus Sales-Weighted Fuel Economy Estimates for Automobiles and Light Trucks, 1978-99 | 7-18 |
| Corporate Average Fuel Economy (CAFE) Fines Collected, 1983-98 | 7-19 |
| Fuel Economy by Speed, 1973, 1984 and 1997 | 7-23 |
| Fuel Economy by Speed, 1973, 1984 and 1997 | 7-24 |
| Steady Speed Fuel Economy for Tested Vehicles | 7-25 |
| Period Sales, Market Shares, and Sales-Weighted Fuel Economies of New Domestic and Import Automobiles, Selected Sales Periods 1976-99 | 7-6 |
| Period Sales, Market Shares, and Sales-Weighted Fuel Economies of New Domestic and Import Light Trucks, Selected Sales Period 1976-99 | 7-7 |
| Truck Fuel Economy by Fuel Type and Size Class, 1997 | 8-6 |
| Truck Fuel Economy by Size Class, 1977, 1982, 1987, 1992, and 1997 | 8-6 |
| Estimates of Alternative Fuel Vehicles in Use, 1992-2000 | 9-3 |
| Estimates of Light Alternative Fuel Vehicles, 1996, 1998, and 2000 | 9-4 |
| Estimates of Heavy Alternative Fuel Vehicles, 1996, 1998, and 2000 | 9-5 |
| Alternative Fuel Vehicles Available by Manufacturer, Model Year 2000 | 9-6 |
| Number of Alternative Refuel Sites by State and Fuel Type, 1999 | 9-7 |

Fuels

| | |
|--|------|
| Highway Usage of Gasoline and Special Fuels, 1973-98 | 2-9 |
| NEAR-TERM Technology: Fuel-Cycle Energy and Greenhouse Gas Emission Changes of Alternative Transportation Fuels and Advanced Vehicle Technologies | 3-11 |
| LONG-TERM Technology: Fuel-Cycle Energy and Greenhouse Gas Emission Changes of Alternative Transportation Fuels and Advanced Vehicle Technologies | 3-12 |
| NEAR-TERM Technology: Fuel-Cycle Energy and Criteria Pollutant Emission Changes of Alternative Transportation Fuels and Advanced Vehicle Technologies | 4-17 |
| LONG-TERM Technology: Fuel-Cycle Energy and Greenhouse Gas Emission Changes of Alternative Transportation Fuels and Advanced Vehicle Technologies | 4-19 |

Fuels (continued)

| | |
|---|------|
| Federal Excise Taxes on Motor Fuels | 5-11 |
| Prices for Selected Transportation Fuels, 1978-99 | 5-8 |
| State Taxes on Motor Fuels, 1999 | 5-9 |

Gallon

| | |
|--|-----|
| Prices for a Barrel of Crude Oil and a Gallon of Gasoline, 1978-99 | 5-6 |
|--|-----|

Gas

| | |
|--|------|
| NEAR-TERM Technology: Fuel-Cycle Energy and Greenhouse Gas Emission Changes of Alternative Transportation Fuels and Advanced Vehicle Technologies | 3-11 |
| LONG-TERM Technology: Fuel-Cycle Energy and Greenhouse Gas Emission Changes of Alternative Transportation Fuels and Advanced Vehicle Technologies | 3-12 |
| LONG-TERM Technology: Fuel-Cycle Energy and Greenhouse Gas Emission Changes of Alternative Transportation Fuels and Advanced Vehicle Technologies | 4-19 |
| Tax Receipts from the Sale of Gas Guzzlers, 1980-98 | 7-19 |
| The Gas Guzzler Tax on New Cars | 7-20 |

Gases

| | |
|---|-----|
| International Man-Made Emissions of Greenhouse Gases, 1990-97 | 3-2 |
| Estimated U.S. Emissions of Greenhouse Gases, 1990-98 | 3-5 |

Gasohol

| | |
|---|------|
| State Tax Exemptions for Gasohol, January 1, 2000 | 5-11 |
|---|------|

Gasoline

| | |
|---|------|
| Motor Gasoline Quantities by Type, 1981 and 1998 | 2-10 |
| Highway Usage of Gasoline and Special Fuels, 1973-98 | 2-9 |
| Federal Exhaust Emission Certification Standards for Gasoline- and Diesel-Powered Light Vehicles | 4-33 |
| Federal Exhaust Emission Certification Standards for Gasoline- and Diesel-Powered Light Trucks | 4-34 |
| Federal Exhaust Emission Certification Standards for Gasoline- and Diesel-Powered Light Trucks | 4-35 |
| Federal Exhaust Emission Certification Standards for Gasoline- and Diesel-Powered Light Trucks | 4-36 |
| Federal Exhaust Emission Certification Standards for Gasoline- and Diesel-Powered Light Trucks | 4-37 |
| Federal Exhaust Emission Certification Standards for Gasoline- and Diesel-Powered Light Heavy Trucks | 4-38 |
| Federal Exhaust Emission Certification Standards for Gasoline- and Diesel-Powered Heavy Heavy Trucks | 4-39 |
| Gasoline Prices for Selected Countries, 1978-99 | 5-2 |

Gasoline (continued)

| | |
|--|-----|
| Gasoline Prices for Selected Countries, 1990 and 1998 | 5-3 |
| Prices for a Barrel of Crude Oil and a Gallon of Gasoline, 1978-99 | 5-6 |

Global

| | |
|---|-----|
| Numerical Estimates of Global Warming Potentials Compared With Carbon Dioxide | 3-8 |
|---|-----|

Goals

| | |
|---|------|
| U.S. Advanced Battery Consortium Goals for Electric Vehicle Batteries | 9-10 |
| PNGV Goals and Specifications of Hybrid-Electric Vehicles | 9-11 |

Government

| | |
|---|------|
| Federal Government Vehicles by Agency, Fiscal Year 1997 | 10-6 |
| Fuel Consumed by Federal Government Fleets, FY 1997 | 10-7 |

Greenhouse

| | |
|--|------|
| NEAR-TERM Technology: Fuel-Cycle Energy and Greenhouse Gas Emission Changes of Alternative Transportation Fuels and Advanced Vehicle Technologies | 3-11 |
| LONG-TERM Technology: Fuel-Cycle Energy and Greenhouse Gas Emission Changes of Alternative Transportation Fuels and Advanced Vehicle Technologies | 3-12 |
| International Man-Made Emissions of Greenhouse Gases, 1990-97 | 3-2 |
| Estimated U.S. Emissions of Greenhouse Gases, 1990-98 | 3-5 |
| LONG-TERM Technology: Fuel-Cycle Energy and Greenhouse Gas Emission Changes of Alternative Transportation Fuels and Advanced Vehicle Technologies | 4-19 |

Gross

| | |
|---|-----|
| Refinery Gross Output by World Region, 1999 | 1-9 |
| New Retail Truck Sales by Gross Vehicle Weight, 1970-98 | 8-3 |
| Truck Statistics by Gross Vehicle Weight Class, 1997 | 8-5 |

Growth

| | |
|--|------|
| Growth of Freight Activity in the United States: Comparison of the 1997 and 1993 Commodity Flow Surveys | 8-12 |
|--|------|

Guzzler

| | |
|---------------------------------------|------|
| The Gas Guzzler Tax on New Cars | 7-20 |
|---------------------------------------|------|

Guzzlers

| | |
|---|------|
| Tax Receipts from the Sale of Gas Guzzlers, 1980-98 | 7-19 |
|---|------|

GVW

| | |
|--|-----|
| New Retail Sales of Trucks 10,000 pounds GVW and Less in the United States, 1970-98 | 7-5 |
|--|-----|

Heavy

| | |
|---|------|
| Federal Exhaust Emission Certification Standards for Gasoline- and Diesel-Powered Light Heavy Trucks | 4-38 |
|---|------|

Heavy (continued)

Federal Exhaust Emission Certification Standards for Gasoline- and Diesel-Powered

Heavy Heavy Trucks 4-39

Estimates of Heavy Alternative Fuel Vehicles, 1996, 1998, and 2000 9-5

Highway

Highway Usage of Gasoline and Special Fuels, 1973-98 2-9

Emissions of Particulate Matter (PM-10) from Highway Vehicles, 1970-98 4-10

Emissions of Particulate Matter (PM-2.5) from Highway Vehicles, 1990-98 4-12

Emissions of Carbon Monoxide from Highway Vehicles, 1970-98 4-4

Emissions of Nitrogen Oxides from Highway Vehicles, 1970-98 4-6

Emissions of Volatile Organic Compounds from Highway Vehicles, 1970-98 4-8

Highway Vehicle Miles Traveled by Vehicle Type, 1970-98 6-7

Highway Driving Cycle 7-26

Household

Average Annual Miles per Vehicle by Household Vehicle Ownership, 1995 NPTS 11-12

Average Age of Vehicles by Household Vehicle Ownership, 1995 NPTS 11-12

Average Annual Miles per Household Vehicle by Vehicle Age 11-13

Long-Distance Household Trips by Mode and Trip Distance, 1995 11-19

Shares of Long-Distance Person Trips by Mode and Household Income, 1995 11-20

Household Vehicle Ownership, 1960-90 Census 11-4

Average Annual Vehicle-Miles, Vehicle Trips and Trip Length per Household 11-6

Average Annual Person-Miles Traveled (PMT), Person Trips and Trip Length per

Household by Selected Trip Purposes 11-7

Average Number of Vehicles and Vehicle Travel per Household, 1990 and

1995 NPTS 11-8

Households

Average Annual Expenditures of Households by Income, 1998 11-3

Hybrid

PNGV Goals and Specifications of Hybrid-Electric Vehicles 9-11

Import

Sales-Weighted Engine Size of New Domestic and Import Light Trucks by Size Class,

Sales Periods 1976-99 7-10

Sales-Weighted Curb Weight of New Domestic and Import Automobiles by Size Class,

Sales Periods 1976-99 7-11

Sales-Weighted Interior Space of New Domestic and Import Automobiles by Size Class,

Sales Periods 1976-99 7-12

Engine Size, Curb Weight, and Interior Space of New Domestic and Import

Automobiles, 1976-99 7-13

Import (continued)

Period Sales, Market Shares, and Sales-Weighted Fuel Economies of New Domestic and
Import Automobiles, Selected Sales Periods 1976-99 7-6

Period Sales, Market Shares, and Sales-Weighted Fuel Economies of New Domestic and
Import Light Trucks, Selected Sales Period 1976-99 7-7

Sales-Weighted Engine Size of New Domestic and Import Automobiles by Size Class,
Sales Periods 1976-99 7-9

Imports

U.S. Petroleum Net Imports by World Region of Origin, 1960-98 1-7

U.S. Production and Imports of MTBE and Fuel Ethanol, 1978-99 2-12

Incentives

States With Ethanol Tax Incentives 5-12

Income

Shares of Long-Distance Person Trips by Mode and Household Income, 1995 11-20

Average Annual Expenditures of Households by Income, 1998 11-3

Indicators

Economic Indicators, 1970-99 5-17

Indices

Consumer Price Indices, 1970-99 5-17

Industries

Employees of Motor Vehicle and Related Industries, 1990 and 1997 5-19

Employment in Transportation and Related Industries, 1960-98 5-20

Input

U.S. Refinery Input of Crude Oil and Petroleum Products, 1987-98 1-10

Intensities

Energy Intensities of Passenger Modes, 1970-98 2-14

Energy Intensities of Freight Modes, 1970-98 2-17

Intensity

Energy Intensity for Transit in the U.S., 1998 2-15

Intercity

Intercity Freight Movement and Energy Use in the United States, 1998 2-16

Interior

Sales-Weighted Interior Space of New Domestic and Import Automobiles by Size Class,
Sales Periods 1976-99 7-12

Engine Size, Curb Weight, and Interior Space of New Domestic and Import
Automobiles, 1976-99 7-13

Intermodal

Intermodal Rail Traffic, 1965-98 12-10

International

| | |
|--|------|
| Summary Statistics for U.S. Domestic and International Certificated Route Air Carriers, 1970-98 | 12-2 |
| Tonnage Statistics for Domestic and International Waterborne Commerce, 1970-98 | 12-4 |
| International Man-Made Emissions of Greenhouse Gases, 1990-97 | 3-2 |
| International Man-Made Emissions of Carbon Dioxide, 1990-97 | 3-3 |
| International Man-Made Emissions of Carbon Dioxide by Source Category, 1990 and 1997 | 3-4 |

Inventory

| | |
|--|------|
| Worldwide Federal Inventory, 1992-97 | 10-5 |
|--|------|

January

| | |
|---|------|
| Fleet Vehicles in Service as of January 1, 1999 | 10-2 |
| State Tax Exemptions for Gasohol, January 1, 2000 | 5-11 |

Journey

| | |
|--|-------|
| Journey-to-Work Statistics, 1983, 1990, and 1995 NPTS | 11-14 |
| National and Metropolitan Area Comparisons of Journey-to-Work Statistics, 1990 Census | 11-16 |

Lead

| | |
|---|------|
| National Lead Emission Estimates, 1970-98 | 4-13 |
|---|------|

Length

| | |
|---|------|
| Average Length of Time Fleet Vehicles are Kept Before Sold to Others, 1991 | 10-4 |
| Average Annual Vehicle-Miles, Vehicle Trips and Trip Length per Household | 11-6 |
| Average Annual Person-Miles Traveled (PMT), Person Trips and Trip Length per Household by Selected Trip Purposes | 11-7 |

Light

| | |
|---|------|
| Energy Policy Act Purchase Requirements of Light Alternative Fuel Vehicles | 10-8 |
| Pollution from a Typical New Car and Light Truck, 2000 Model Year | 4-32 |
| Federal Exhaust Emission Certification Standards for Gasoline- and Diesel-Powered Light Vehicles | 4-33 |
| Federal Exhaust Emission Certification Standards for Gasoline- and Diesel-Powered Light Trucks | 4-34 |
| Federal Exhaust Emission Certification Standards for Gasoline- and Diesel-Powered Light Trucks | 4-35 |
| Federal Exhaust Emission Certification Standards for Gasoline- and Diesel-Powered Light Trucks | 4-36 |
| Federal Exhaust Emission Certification Standards for Gasoline- and Diesel-Powered Light Trucks | 4-37 |

Light (continued)

| | |
|--|------|
| Federal Exhaust Emission Certification Standards for Gasoline- and Diesel-Powered Light Heavy Trucks | 4-38 |
| California Passenger Cars and Light Trucks Emission Certification Standards | 4-40 |
| California Vehicle Emission Reduction for Passenger Cars and Light Trucks | 4-41 |
| Light Truck Scrappage and Survival Rates | 6-13 |
| Light Truck Survival Rates | 6-14 |
| Sales-Weighted Engine Size of New Domestic and Import Light Trucks by Size Class, Sales Periods 1976-99 | 7-10 |
| Sales-Weighted Wheelbase of New Automobiles and Light Trucks, Sales Period 1976-99 | 7-14 |
| New Light Vehicle Dealerships and Sales, 1970-98 | 7-16 |
| Corporate Average Fuel Economy (CAFE) Standards versus Sales-Weighted Fuel Economy Estimates for Automobiles and Light Trucks, 1978-99 | 7-18 |
| Light Vehicle Occupant Safety Data, 1975-98 | 7-30 |
| Period Sales, Market Shares, and Sales-Weighted Fuel Economies of New Domestic and Import Light Trucks, Selected Sales Period 1976-99 | 7-7 |
| Light Vehicle Market Shares by Size Class, Sales Period 1976-99 | 7-8 |
| Estimates of Light Alternative Fuel Vehicles, 1996, 1998, and 2000 | 9-4 |

Man

| | |
|--|-----|
| International Man-Made Emissions of Greenhouse Gases, 1990-97 | 3-2 |
| International Man-Made Emissions of Carbon Dioxide, 1990-97 | 3-3 |
| International Man-Made Emissions of Carbon Dioxide by Source Category, 1990 and 1997 | 3-4 |

Manufacturer

| | |
|--|-----|
| Alternative Fuel Vehicles Available by Manufacturer, Model Year 2000 | 9-6 |
|--|-----|

Manufacturing

| | |
|--|------|
| Motor Vehicle Manufacturing Employment Statistics, 1972-98 | 5-18 |
|--|------|

Map

| | |
|---|-----|
| Map of Clean Cities as of 12/1/99 | 9-9 |
|---|-----|

Marine

| | |
|---|------|
| Breakdown of Domestic Marine Cargo by Commodity Class, 1998 | 12-6 |
|---|------|

Market

| | |
|---|-----|
| Period Sales, Market Shares, and Sales-Weighted Fuel Economies of New Domestic and Import Automobiles, Selected Sales Periods 1976-99 | 7-6 |
| Period Sales, Market Shares, and Sales-Weighted Fuel Economies of New Domestic and Import Light Trucks, Selected Sales Period 1976-99 | 7-7 |
| Light Vehicle Market Shares by Size Class, Sales Period 1976-99 | 7-8 |

Material

Average Material Consumption for a Domestic Automobile, 1978, 1985, and 1999 7-15

Matter

Emissions of Particulate Matter (PM-10) from Highway Vehicles, 1970-98 4-10

Total National Emissions of Particulate Matter (PM-2.5), 1990-98 4-11

Emissions of Particulate Matter (PM-2.5) from Highway Vehicles, 1990-98 4-12

Total National Emissions of Particulate Matter (PM-10), 1970-98 4-9

Meeting

California Air Resources Board Requirements for Meeting Emission Standards 4-42

Metropolitan

National and Metropolitan Area Comparisons of Journey-to-Work Statistics,
1990 Census 11-16

Middle

Summary of 1996 Military Expenditures for Defending Oil Supplies from the
Middle East 1-8

Mile

Automobile Operating Cost per Mile, 1975-99 5-15

Miles

Average Annual and Daily Vehicle-Miles of Travel for Fleet Vehicles, 1991 10-4

Average Miles per Federal Vehicle by Vehicle Type, 1997 10-5

Vehicle-Miles by Trip Purpose, 1995 NPTS 11-11

Average Annual Miles per Vehicle by Household Vehicle Ownership, 1995 NPTS 11-12

Average Annual Miles per Household Vehicle by Vehicle Age 11-13

Average Annual Vehicle-Miles, Vehicle Trips and Trip Length per Household 11-6

Average Annual Person-Miles Traveled (PMT), Person Trips and Trip Length per

Household by Selected Trip Purposes 11-7

Class I Railroad Freight Systems in the United States Ranked by Revenue Ton-Miles,
1998 12-7

Highway Vehicle Miles Traveled by Vehicle Type, 1970-98 6-7

Military

Summary of 1996 Military Expenditures for Defending Oil Supplies from the
Middle East 1-8

Mode

Transportation of Petroleum and Petroleum Products in the U.S. by Mode, 1975-98 1-15

Long-Distance Trips by Mode and Purpose, 1995 11-18

Long-Distance Household Trips by Mode and Trip Distance, 1995 11-19

Shares of Long-Distance Person Trips by Mode and Household Income, 1995 11-20

Domestic Consumption of Transportation Energy by Mode and Fuel Type, 1998 2-6

Mode (continued)

| | |
|--|-----|
| Transportation Energy Use by Mode, 1997-98 | 2-7 |
| Transportation Energy Consumption by Mode, 1970-98 | 2-8 |

Model

| | |
|--|------|
| Pollution from a Typical New Car and Light Truck, 2000 Model Year | 4-32 |
| Alternative Fuel Vehicles Available by Manufacturer, Model Year 2000 | 9-6 |

Modes

| | |
|--|------|
| Energy Intensities of Passenger Modes, 1970-98 | 2-14 |
| Energy Intensities of Freight Modes, 1970-98 | 2-17 |

Monoxide

| | |
|---|-----|
| Total National Emissions of Carbon Monoxide, 1970-98 | 4-3 |
| Emissions of Carbon Monoxide from Highway Vehicles, 1970-98 | 4-4 |

Motor

| | |
|--|------|
| Motor Gasoline Quantities by Type, 1981 and 1998 | 2-10 |
| Federal Excise Taxes on Motor Fuels | 5-11 |
| Motor Vehicle Manufacturing Employment Statistics, 1972-98 | 5-18 |
| Employees of Motor Vehicle and Related Industries, 1990 and 1997 | 5-19 |
| Retail Prices for Motor Fuel, 1978-99 | 5-7 |
| State Taxes on Motor Fuels, 1999 | 5-9 |

Movement

| | |
|--|------|
| Intercity Freight Movement and Energy Use in the United States, 1998 | 2-16 |
|--|------|

MTBE

| | |
|---|------|
| U.S. Production and Imports of MTBE and Fuel Ethanol, 1978-99 | 2-12 |
|---|------|

National

| | |
|--|-------|
| National and Metropolitan Area Comparisons of Journey-to-Work Statistics, 1990 Census | 11-16 |
| Summary Statistics for the National Railroad Passenger Corporation (Amtrak), 1971-98 | 12-11 |
| Total National Emissions of Particulate Matter (PM-2.5), 1990-98 | 4-11 |
| National Lead Emission Estimates, 1970-98 | 4-13 |
| Total National Emissions of the Criteria Air Pollutants by Sector, 1998 | 4-2 |
| Total National Emissions of Carbon Monoxide, 1970-98 | 4-3 |
| Total National Emissions of Nitrogen Oxides, 1970-98 | 4-5 |
| Total National Emissions of Volatile Organic Compounds, 1970-98 | 4-7 |
| Total National Emissions of Particulate Matter (PM-10), 1970-98 | 4-9 |

Net

| | |
|---|-----|
| U.S. Petroleum Net Imports by World Region of Origin, 1960-98 | 1-7 |
|---|-----|

Nitrogen

| | |
|---|-----|
| Total National Emissions of Nitrogen Oxides, 1970-98 | 4-5 |
| Emissions of Nitrogen Oxides from Highway Vehicles, 1970-98 | 4-6 |

Nonoccupant

Occupant Fatalities by Vehicle Type and Nonoccupant Fatalities, 1975-98 7-29

NPTS

Average Vehicle Occupancy by Trip Purpose, 1977, 1983, 1990, and 1995 NPTS 11-10

Vehicle-Miles by Trip Purpose, 1995 NPTS 11-11

Average Annual Miles per Vehicle by Household Vehicle Ownership, 1995 NPTS 11-12

Average Age of Vehicles by Household Vehicle Ownership, 1995 NPTS 11-12

Journey-to-Work Statistics, 1983, 1990, and 1995 NPTS 11-14

Demographic Statistics, 1969, 1977, 1983, 1990, and 1995 NPTS 11-5

Average Number of Vehicles and Vehicle Travel per Household, 1990 and
1995 NPTS 11-8

Average Vehicle Occupancy by Vehicle Type, 1995 NPTS 11-9

Numerical

Numerical Estimates of Global Warming Potentials Compared With Carbon Dioxide 3-8

Occupancy

Average Vehicle Occupancy by Trip Purpose, 1977, 1983, 1990, and 1995 NPTS 11-10

Average Vehicle Occupancy by Vehicle Type, 1995 NPTS 11-9

Occupant

Occupant Fatalities by Vehicle Type and Nonoccupant Fatalities, 1975-98 7-29

Light Vehicle Occupant Safety Data, 1975-98 7-30

OECD

Petroleum Stocks in OECD Countries, End of Year 1973-98 1-5

Oil

U.S. Refinery Input of Crude Oil and Petroleum Products, 1987-98 1-10

Refinery Yield of Petroleum Products from a Barrel of Crude Oil, 1978-98 1-11

World Crude Oil Production, 1960-98 1-3

World Oil Consumption, 1960-97 1-4

Crude Oil Prices, 1870-98 1-6

Summary of 1996 Military Expenditures for Defending Oil Supplies from the
Middle East 1-8

Prices for a Barrel of Crude Oil and a Gallon of Gasoline, 1978-99 5-6

Operating

Automobile Operating Cost per Mile, 1975-99 5-15

Fixed Automobile Operating Costs per Year, 1975-99 5-16

Operation

Automobiles in Operation and Vehicle Travel by Age, 1970 and 1998 6-8

Trucks in Operation and Vehicle Travel by Age, 1970 and 1998 6-9

Operations

Summary Statistics for Rail Transit Operations, 1970-98 12-12

Organic

| | |
|--|-----|
| Total National Emissions of Volatile Organic Compounds, 1970-98 | 4-7 |
| Emissions of Volatile Organic Compounds from Highway Vehicles, 1970-98 | 4-8 |

Origin

| | |
|---|-----|
| U.S. Petroleum Net Imports by World Region of Origin, 1960-98 | 1-7 |
|---|-----|

Others

| | |
|--|------|
| Average Length of Time Fleet Vehicles are Kept Before Sold to Others, 1991 | 10-4 |
|--|------|

Output

| | |
|---|-----|
| Refinery Gross Output by World Region, 1999 | 1-9 |
|---|-----|

Ownership

| | |
|---|-------|
| Average Annual Miles per Vehicle by Household Vehicle Ownership, 1995 NPTS | 11-12 |
| Average Age of Vehicles by Household Vehicle Ownership, 1995 NPTS | 11-12 |
| Household Vehicle Ownership, 1960-90 Census | 11-4 |

Oxides

| | |
|---|-----|
| Total National Emissions of Nitrogen Oxides, 1970-98 | 4-5 |
| Emissions of Nitrogen Oxides from Highway Vehicles, 1970-98 | 4-6 |

Particulate

| | |
|---|------|
| Emissions of Particulate Matter (PM-10) from Highway Vehicles, 1970-98 | 4-10 |
| Total National Emissions of Particulate Matter (PM-2.5), 1990-98 | 4-11 |
| Emissions of Particulate Matter (PM-2.5) from Highway Vehicles, 1990-98 | 4-12 |
| Total National Emissions of Particulate Matter (PM-10), 1970-98 | 4-9 |

Passenger

| | |
|---|-------|
| Summary Statistics for the National Railroad Passenger Corporation (Amtrak), 1971-98 | 12-11 |
| Passenger Travel and Energy Use in the United States, 1998 | 2-13 |
| Energy Intensities of Passenger Modes, 1970-98 | 2-14 |
| California Passenger Cars and Light Trucks Emission Certification Standards | 4-40 |
| California Vehicle Emission Reduction for Passenger Cars and Light Trucks | 4-41 |
| Summary Statistics for Passenger Cars, 1970-98 | 7-2 |

Percentage

| | |
|--|------|
| Percentage of Trucks by Major Use and Primary Refueling Facility, 1997 | 8-10 |
| Percentage of Trucks by Size Class, 1977, 1982, 1987, 1992, and 1997 | 8-5 |

Percentage (continued)

| | |
|---|-----|
| Percentage of Trucks by Size Ranked by Major Use, 1997 | 8-8 |
| Percentage of Trucks by Fleet Size and Primary Refueling Facility, 1997 | 8-9 |

Periods

| | |
|--|------|
| Sales-Weighted Engine Size of New Domestic and Import Light Trucks by Size Class, Sales Periods 1976-99 | 7-10 |
| Sales-Weighted Curb Weight of New Domestic and Import Automobiles by Size Class, Sales Periods 1976-99 | 7-11 |
| Sales-Weighted Interior Space of New Domestic and Import Automobiles by Size Class, Sales Periods 1976-99 | 7-12 |
| Period Sales, Market Shares, and Sales-Weighted Fuel Economies of New Domestic and Import Automobiles, Selected Sales Periods 1976-99 | 7-6 |
| Sales-Weighted Engine Size of New Domestic and Import Automobiles by Size Class, Sales Periods 1976-99 | 7-9 |

Person

| | |
|---|-------|
| Shares of Long-Distance Person Trips by Mode and Household Income, 1995 | 11-20 |
| Average Annual Person-Miles Traveled (PMT), Person Trips and Trip Length per Household by Selected Trip Purposes | 11-7 |

Petroleum

| | |
|---|------|
| U.S. Refinery Input of Crude Oil and Petroleum Products, 1987-98 | 1-10 |
| Refinery Yield of Petroleum Products from a Barrel of Crude Oil, 1978-98 | 1-11 |
| United States Petroleum Production and Consumption, 1973-99 | 1-12 |
| Consumption by Petroleum by End-Use Sector, 1973-99 | 1-14 |
| Transportation of Petroleum and Petroleum Products in the U.S. by Mode, 1975-98 | 1-15 |
| Petroleum Stocks in OECD Countries, End of Year 1973-98 | 1-5 |
| U.S. Petroleum Net Imports by World Region of Origin, 1960-98 | 1-7 |

PM

| | |
|---|------|
| Emissions of Particulate Matter (PM-10) from Highway Vehicles, 1970-98 | 4-10 |
| Total National Emissions of Particulate Matter (PM-2.5), 1990-98 | 4-11 |
| Emissions of Particulate Matter (PM-2.5) from Highway Vehicles, 1990-98 | 4-12 |
| Total National Emissions of Particulate Matter (PM-10), 1970-98 | 4-9 |

PMT

| | |
|---|------|
| Average Annual Person-Miles Traveled (PMT), Person Trips and Trip Length per Household by Selected Trip Purposes | 11-7 |
|---|------|

PNGV

| | |
|---|------|
| PNGV Goals and Specifications of Hybrid-Electric Vehicles | 9-11 |
|---|------|

Policy

| | |
|--|------|
| Energy Policy Act Purchase Requirements of Light Alternative Fuel Vehicles | 10-8 |
|--|------|

Pollutant

| | |
|--|------|
| NEAR-TERM Technology: Fuel-Cycle Energy and Criteria Pollutant Emission Changes of Alternative Transportation Fuels and Advanced Vehicle Technologies | 4-17 |
|--|------|

Pollutants

| | |
|---|------|
| State-level Emissions for Criteria Pollutants, 1998 | 4-14 |
| Total National Emissions of the Criteria Air Pollutants by Sector, 1998 | 4-2 |

Pollution

| | |
|---|------|
| Pollution from a Typical New Car and Light Truck, 2000 Model Year | 4-32 |
|---|------|

Population

| | |
|---|------|
| Population and Vehicle Profile, 1950-98 | 11-2 |
|---|------|

Potential

| | |
|-----------------------------------|-----|
| World Fossil Fuel Potential | 1-2 |
|-----------------------------------|-----|

Potentials

| | |
|--|-----|
| Numerical Estimates of Global Warming Potentials Compared With Carbon Dioxide | 3-8 |
|--|-----|

Pounds

| | |
|--|-----|
| New Retail Sales of Trucks 10,000 pounds GVW and Less in the United States, 1970-98 | 7-5 |
|--|-----|

Powered

| | |
|---|------|
| Federal Exhaust Emission Certification Standards for Gasoline- and Diesel-Powered Light Vehicles | 4-33 |
| Federal Exhaust Emission Certification Standards for Gasoline- and Diesel-Powered Light Trucks | 4-34 |
| Federal Exhaust Emission Certification Standards for Gasoline- and Diesel-Powered Light Trucks | 4-35 |
| Federal Exhaust Emission Certification Standards for Gasoline- and Diesel-Powered Light Trucks | 4-36 |
| Federal Exhaust Emission Certification Standards for Gasoline- and Diesel-Powered Light Trucks | 4-37 |
| Federal Exhaust Emission Certification Standards for Gasoline- and Diesel-Powered Light Heavy Trucks | 4-38 |
| Federal Exhaust Emission Certification Standards for Gasoline- and Diesel-Powered Heavy Heavy Trucks | 4-39 |

Price

| | |
|---|------|
| Average Price of a New Car, 1970-99 | 5-13 |
| Average Price of a New Car by Sector, 1970-99 | 5-14 |
| Consumer Price Indices, 1970-99 | 5-17 |

Prices

| | |
|--|-----|
| Crude Oil Prices, 1870-98 | 1-6 |
| Gasoline Prices for Selected Countries, 1978-99 | 5-2 |
| Gasoline Prices for Selected Countries, 1990 and 1998 | 5-3 |
| Diesel Fuel Prices for Selected Countries, 1978-99 | 5-4 |
| Diesel Fuel Prices for Selected Countries, 1990 and 1998 | 5-5 |
| Prices for a Barrel of Crude Oil and a Gallon of Gasoline, 1978-99 | 5-6 |
| Retail Prices for Motor Fuel, 1978-99 | 5-7 |
| Prices for Selected Transportation Fuels, 1978-99 | 5-8 |

Primary

| | |
|---|------|
| World Production of Primary Energy by Selected Country Groups, 1989-98 | 2-2 |
| World Consumption of Primary Energy by Selected Country Groups, 1989-98 | 2-3 |
| Percentage of Trucks by Major Use and Primary Refueling Facility, 1997 | 8-10 |
| Percentage of Trucks by Fleet Size and Primary Refueling Facility, 1997 | 8-9 |

Products

| | |
|---|------|
| U.S. Refinery Input of Crude Oil and Petroleum Products, 1987-98 | 1-10 |
| Refinery Yield of Petroleum Products from a Barrel of Crude Oil, 1978-98 | 1-11 |
| Transportation of Petroleum and Petroleum Products in the U.S. by Mode, 1975-98 | 1-15 |

Profile

| | |
|---|------|
| Population and Vehicle Profile, 1950-98 | 11-2 |
|---|------|

Purchase

| | |
|--|------|
| Energy Policy Act Purchase Requirements of Light Alternative Fuel Vehicles | 10-8 |
|--|------|

Purpose

| | |
|--|-------|
| Average Vehicle Occupancy by Trip Purpose, 1977, 1983, 1990, and 1995 NPTS | 11-10 |
| Vehicle-Miles by Trip Purpose, 1995 NPTS | 11-11 |
| Long-Distance Trips by Mode and Purpose, 1995 | 11-18 |

Purposes

| | |
|---|------|
| Average Annual Person-Miles Traveled (PMT), Person Trips and Trip Length per Household by Selected Trip Purposes | 11-7 |
|---|------|

Rail

| | |
|---|-------|
| Intermodal Rail Traffic, 1965-98 | 12-10 |
| Summary Statistics for Rail Transit Operations, 1970-98 | 12-12 |

Railroad

| | |
|--|-------|
| Summary Statistics for the National Railroad Passenger Corporation (Amtrak), 1971-98 | 12-11 |
| Class I Railroad Freight Systems in the United States Ranked by Revenue Ton-Miles, 1998 | 12-7 |
| Railroad Revenue Carloads by Commodity Group, 1974 and 1998 | 12-9 |

Railroads

| | |
|---|------|
| Summary Statistics for Class I Freight Railroads, 1970-98 | 12-8 |
|---|------|

Ranked

| | |
|--|------|
| Class I Railroad Freight Systems in the United States Ranked by Revenue Ton-Miles, 1998 | 12-7 |
| Percentage of Trucks by Size Ranked by Major Use, 1997 | 8-8 |

Rates

| | |
|--|------|
| Automobile Scrappage and Survival Rates | 6-11 |
| Automobile Survival Rates | 6-12 |
| Light Truck Scrappage and Survival Rates | 6-13 |
| Light Truck Survival Rates | 6-14 |

Receipts

| | |
|---|------|
| Tax Receipts from the Sale of Gas Guzzlers, 1980-98 | 7-19 |
|---|------|

Reduction

| | |
|---|------|
| California Vehicle Emission Reduction for Passenger Cars and Light Trucks | 4-41 |
|---|------|

Refinery

| | |
|--|------|
| U.S. Refinery Input of Crude Oil and Petroleum Products, 1987-98 | 1-10 |
| Refinery Yield of Petroleum Products from a Barrel of Crude Oil, 1978-98 | 1-11 |
| Refinery Gross Output by World Region, 1999 | 1-9 |

Refuel

| | |
|---|-----|
| Number of Alternative Refuel Sites by State and Fuel Type, 1999 | 9-7 |
|---|-----|

Refueling

| | |
|---|------|
| Conventional and Alternative Fuel Refueling Stations | 7-17 |
| Percentage of Trucks by Major Use and Primary Refueling Facility, 1997 | 8-10 |
| Percentage of Trucks by Fleet Size and Primary Refueling Facility, 1997 | 8-9 |

Region

| | |
|---|-----|
| U.S. Petroleum Net Imports by World Region of Origin, 1960-98 | 1-7 |
| Refinery Gross Output by World Region, 1999 | 1-9 |

Registrations

| | |
|---|-----|
| Automobile Registrations for Selected Countries, 1950-96 | 6-2 |
| Truck and Bus Registrations for Selected Countries, 1950-96 | 6-3 |

Representative

| | |
|--|------|
| Representative Number Five Driving Cycle | 7-27 |
|--|------|

Resources

| | |
|--|------|
| California Air Resources Board Requirements for Meeting Emission Standards | 4-42 |
|--|------|

Retail

| | |
|---|-----|
| Retail Prices for Motor Fuel, 1978-99 | 5-7 |
| New Retail Automobile Sales in the United States, 1970-98 | 7-4 |

Retail (continued)

| | |
|--|-----|
| New Retail Sales of Trucks 10,000 pounds GVW and Less in the United States, 1970-98 | 7-5 |
|--|-----|

| | |
|---|-----|
| New Retail Truck Sales by Gross Vehicle Weight, 1970-98 | 8-3 |
|---|-----|

Revenue

| | |
|--|------|
| Class I Railroad Freight Systems in the United States Ranked by Revenue Ton-Miles, 1998 | 12-7 |
|--|------|

| | |
|---|------|
| Railroad Revenue Carloads by Commodity Group, 1974 and 1998 | 12-9 |
|---|------|

Rollover

| | |
|--|------|
| Percent Rollover Occurrence by Vehicle Type and Crash Severity | 7-32 |
|--|------|

Route

| | |
|--|------|
| Summary Statistics for U.S. Domestic and International Certificated Route Air Carriers, 1970-98 | 12-2 |
|--|------|

Safety

| | |
|---|------|
| Light Vehicle Occupant Safety Data, 1975-98 | 7-30 |
|---|------|

Sale

| | |
|---|------|
| Tax Receipts from the Sale of Gas Guzzlers, 1980-98 | 7-19 |
|---|------|

Sales

| | |
|--|-----|
| Vehicle Stock and New Sales in United States, 1998 Calendar Year | 6-6 |
|--|-----|

| | |
|--|------|
| Sales-Weighted Engine Size of New Domestic and Import Light Trucks by Size Class, Sales Periods 1976-99 | 7-10 |
|--|------|

| | |
|---|------|
| Sales-Weighted Curb Weight of New Domestic and Import Automobiles by Size Class, Sales Periods 1976-99 | 7-11 |
|---|------|

| | |
|--|------|
| Sales-Weighted Interior Space of New Domestic and Import Automobiles by Size Class, Sales Periods 1976-99 | 7-12 |
|--|------|

| | |
|---|------|
| Sales-Weighted Wheelbase of New Automobiles and Light Trucks, Sales Period 1976-99 | 7-14 |
|---|------|

| | |
|--|------|
| New Light Vehicle Dealerships and Sales, 1970-98 | 7-16 |
|--|------|

| | |
|---|------|
| Corporate Average Fuel Economy (CAFE) Standards versus Sales-Weighted Fuel Economy Estimates for Automobiles and Light Trucks, 1978-99 | 7-18 |
|---|------|

| | |
|---|-----|
| New Retail Automobile Sales in the United States, 1970-98 | 7-4 |
|---|-----|

| | |
|--|-----|
| New Retail Sales of Trucks 10,000 pounds GVW and Less in the United States, 1970-98 | 7-5 |
|--|-----|

| | |
|--|-----|
| Period Sales, Market Shares, and Sales-Weighted Fuel Economies of New Domestic and Import Automobiles, Selected Sales Periods 1976-99 | 7-6 |
|--|-----|

| | |
|--|-----|
| Period Sales, Market Shares, and Sales-Weighted Fuel Economies of New Domestic and Import Light Trucks, Selected Sales Period 1976-99 | 7-7 |
|--|-----|

| | |
|---|-----|
| Light Vehicle Market Shares by Size Class, Sales Period 1976-99 | 7-8 |
|---|-----|

Sales (continued)

| | |
|---|-----|
| Sales-Weighted Engine Size of New Domestic and Import Automobiles by Size Class, Sales Periods 1976-99 | 7-9 |
| New Retail Truck Sales by Gross Vehicle Weight, 1970-98 | 8-3 |

Scrappage

| | |
|--|------|
| Automobile Scrappage and Survival Rates | 6-11 |
| Light Truck Scrappage and Survival Rates | 6-13 |

Sector

| | |
|--|------|
| Consumption by Petroleum by End-Use Sector, 1973-99 | 1-14 |
| U. S. Consumption of Total Energy by End-Use Sector, 1970-99 | 2-4 |
| U.S. Carbon Dioxide Emissions from Fossil Energy Consumption by End-Use Sector, 1984-98 | 3-6 |
| U.S. Carbon Dioxide Emissions from Energy Use in the Transportation Sector, 1980-98 | 3-7 |
| Total National Emissions of the Criteria Air Pollutants by Sector, 1998 | 4-2 |
| Average Price of a New Car by Sector, 1970-99 | 5-14 |

Selected

| | |
|--|------|
| Average Annual Person-Miles Traveled (PMT), Person Trips and Trip Length per Household by Selected Trip Purposes | 11-7 |
| World Production of Primary Energy by Selected Country Groups, 1989-98 | 2-2 |
| World Consumption of Primary Energy by Selected Country Groups, 1989-98 | 2-3 |
| Gasoline Prices for Selected Countries, 1978-99 | 5-2 |
| Gasoline Prices for Selected Countries, 1990 and 1998 | 5-3 |
| Diesel Fuel Prices for Selected Countries, 1978-99 | 5-4 |
| Diesel Fuel Prices for Selected Countries, 1990 and 1998 | 5-5 |
| Prices for Selected Transportation Fuels, 1978-99 | 5-8 |
| Automobile Registrations for Selected Countries, 1950-96 | 6-2 |
| Truck and Bus Registrations for Selected Countries, 1950-96 | 6-3 |
| Period Sales, Market Shares, and Sales-Weighted Fuel Economies of New Domestic and Import Automobiles, Selected Sales Periods 1976-99 | 7-6 |
| Period Sales, Market Shares, and Sales-Weighted Fuel Economies of New Domestic and Import Light Trucks, Selected Sales Period 1976-99 | 7-7 |

Service

| | |
|---|------|
| Fleet Vehicles in Service as of January 1, 1999 | 10-2 |
|---|------|

Severity

| | |
|--|------|
| Crashes by Crash Severity, Crash Type, and Vehicle Type, 1998 | 7-31 |
| Percent Rollover Occurrence by Vehicle Type and Crash Severity | 7-32 |

Shares

Shares of Long-Distance Person Trips by Mode and Household Income, 1995 11-20

Period Sales, Market Shares, and Sales-Weighted Fuel Economies of New Domestic and

Import Automobiles, Selected Sales Periods 1976-99 7-6

Period Sales, Market Shares, and Sales-Weighted Fuel Economies of New Domestic and

Import Light Trucks, Selected Sales Period 1976-99 7-7

Light Vehicle Market Shares by Size Class, Sales Period 1976-99 7-8

Single

Summary Statistics for Other Single-Unit and Combination Trucks, 1970-98 8-2

Sites

Number of Alternative Refuel Sites by State and Fuel Type, 1999 9-7

Sold

Average Length of Time Fleet Vehicles are Kept Before Sold to Others, 1991 10-4

Source

Distribution of Energy Consumption by Source, 1973, 1980, and 1999 2-5

International Man-Made Emissions of Carbon Dioxide by Source Category, 1990

and 1997 3-4

Space

Sales-Weighted Interior Space of New Domestic and Import Automobiles by Size Class,

Sales Periods 1976-99 7-12

Engine Size, Curb Weight, and Interior Space of New Domestic and Import

Automobiles, 1976-99 7-13

Specifications

Vehicle Specifications for Tested Vehicles 7-22

PNGV Goals and Specifications of Hybrid-Electric Vehicles 9-11

Speed

Fuel Economy by Speed, 1973, 1984 and 1997 7-23

Fuel Economy by Speed, 1973, 1984 and 1997 7-24

Steady Speed Fuel Economy for Tested Vehicles 7-25

Standards

Tier 2 Federal Emission Standards 4-32

Federal Exhaust Emission Certification Standards for Gasoline- and Diesel-Powered

Light Vehicles 4-33

Federal Exhaust Emission Certification Standards for Gasoline- and Diesel-Powered

Light Trucks 4-34

Federal Exhaust Emission Certification Standards for Gasoline- and Diesel-Powered

Light Trucks 4-35

Standards (continued)

| | |
|--|------|
| Federal Exhaust Emission Certification Standards for Gasoline- and Diesel-Powered Light Trucks | 4-36 |
| Federal Exhaust Emission Certification Standards for Gasoline- and Diesel-Powered Light Trucks | 4-37 |
| Federal Exhaust Emission Certification Standards for Gasoline- and Diesel-Powered Light Heavy Trucks | 4-38 |
| Federal Exhaust Emission Certification Standards for Gasoline- and Diesel-Powered Heavy Heavy Trucks | 4-39 |
| California Passenger Cars and Light Trucks Emission Certification Standards | 4-40 |
| California Air Resources Board Requirements for Meeting Emission Standards | 4-42 |
| Corporate Average Fuel Economy (CAFE) Standards versus Sales-Weighted Fuel Economy Estimates for Automobiles and Light Trucks, 1978-99 | 7-18 |

Stations

| | |
|--|------|
| Conventional and Alternative Fuel Refueling Stations | 7-17 |
|--|------|

Statistics

| | |
|---|-------|
| Journey-to-Work Statistics, 1983, 1990, and 1995 NPTS | 11-14 |
| National and Metropolitan Area Comparisons of Journey-to-Work Statistics, 1990 Census | 11-16 |
| Demographic Statistics, 1969, 1977, 1983, 1990, and 1995 NPTS | 11-5 |
| Summary Statistics for the National Railroad Passenger Corporation (Amtrak), 1971-98 | 12-11 |
| Summary Statistics for Rail Transit Operations, 1970-98 | 12-12 |
| Summary Statistics for U.S. Domestic and International Certificated Route Air Carriers, 1970-98 | 12-2 |
| Summary Statistics for General Aviation, 1970-98 | 12-3 |
| Tonnage Statistics for Domestic and International Waterborne Commerce, 1970-98 | 12-4 |
| Summary Statistics for Domestic Waterborne Commerce, 1970-98 | 12-5 |
| Summary Statistics for Class I Freight Railroads, 1970-98 | 12-8 |
| Motor Vehicle Manufacturing Employment Statistics, 1972-98 | 5-18 |
| Summary Statistics for Passenger Cars, 1970-98 | 7-2 |
| Summary Statistics for Two-Axle, Four-Tire Trucks, 1970-98 | 7-3 |
| Summary Statistics on Buses by Type, 1970-98 | 8-14 |
| Summary Statistics for Other Single-Unit and Combination Trucks, 1970-98 | 8-2 |
| Truck Statistics by Gross Vehicle Weight Class, 1997 | 8-5 |
| Truck Statistics by Size, 1997 | 8-7 |

Steady

| | |
|---|------|
| Steady Speed Fuel Economy for Tested Vehicles | 7-25 |
|---|------|

Stock

| | |
|--|-----|
| Vehicle Stock and New Sales in United States, 1998 Calendar Year | 6-6 |
|--|-----|

Stocks

Petroleum Stocks in OECD Countries, End of Year 1973-98 1-5

Summary

Summary of 1996 Military Expenditures for Defending Oil Supplies from the
Middle East 1-8

Summary Statistics for the National Railroad Passenger Corporation (Amtrak),
1971-98 12-11

Summary Statistics for Rail Transit Operations, 1970-98 12-12

Summary Statistics for U.S. Domestic and International Certificated Route Air Carriers,
1970-98 12-2

Summary Statistics for General Aviation, 1970-98 12-3

Summary Statistics for Domestic Waterborne Commerce, 1970-98 12-5

Summary Statistics for Class I Freight Railroads, 1970-98 12-8

Summary Statistics for Passenger Cars, 1970-98 7-2

Summary Statistics for Two-Axle, Four-Tire Trucks, 1970-98 7-3

Summary Statistics on Buses by Type, 1970-98 8-14

Summary Statistics for Other Single-Unit and Combination Trucks, 1970-98 8-2

Supplies

Summary of 1996 Military Expenditures for Defending Oil Supplies from the
Middle East 1-8

Survey

Commodity Flow Survey Freight Activity, 1997 8-13

Surveys

Growth of Freight Activity in the United States: Comparison of the 1997 and 1993
Commodity Flow Surveys 8-12

Survival

Automobile Scrappage and Survival Rates 6-11

Automobile Survival Rates 6-12

Light Truck Scrappage and Survival Rates 6-13

Light Truck Survival Rates 6-14

Systems

Class I Railroad Freight Systems in the United States Ranked by Revenue Ton-Miles,
1998 12-7

Tax

State Tax Exemptions for Gasohol, January 1, 2000 5-11

States With Ethanol Tax Incentives 5-12

Tax (continued)

Tax Receipts from the Sale of Gas Guzzlers, 1980-98 7-19

The Gas Guzzler Tax on New Cars 7-20

Taxes

| | |
|---|------|
| Federal Excise Taxes on Motor Fuels | 5-11 |
| State Taxes on Motor Fuels, 1999 | 5-9 |

Technologies

| | |
|--|------|
| NEAR-TERM Technology: Fuel-Cycle Energy and Greenhouse Gas Emission Changes of Alternative Transportation Fuels and Advanced Vehicle Technologies | 3-11 |
| LONG-TERM Technology: Fuel-Cycle Energy and Greenhouse Gas Emission Changes of Alternative Transportation Fuels and Advanced Vehicle Technologies | 3-12 |
| NEAR-TERM Technology: Fuel-Cycle Energy and Criteria Pollutant Emission Changes of Alternative Transportation Fuels and Advanced Vehicle Technologies | 4-17 |
| LONG-TERM Technology: Fuel-Cycle Energy and Greenhouse Gas Emission Changes of Alternative Transportation Fuels and Advanced Vehicle Technologies | 4-19 |

Technology

| | |
|--|------|
| NEAR-TERM Technology: Fuel-Cycle Energy and Greenhouse Gas Emission Changes of Alternative Transportation Fuels and Advanced Vehicle Technologies | 3-11 |
| LONG-TERM Technology: Fuel-Cycle Energy and Greenhouse Gas Emission Changes of Alternative Transportation Fuels and Advanced Vehicle Technologies | 3-12 |
| NEAR-TERM Technology: Fuel-Cycle Energy and Criteria Pollutant Emission Changes of Alternative Transportation Fuels and Advanced Vehicle Technologies | 4-17 |
| LONG-TERM Technology: Fuel-Cycle Energy and Greenhouse Gas Emission Changes of Alternative Transportation Fuels and Advanced Vehicle Technologies | 4-19 |

TERM

| | |
|--|------|
| NEAR-TERM Technology: Fuel-Cycle Energy and Greenhouse Gas Emission Changes of Alternative Transportation Fuels and Advanced Vehicle Technologies | 3-11 |
| LONG-TERM Technology: Fuel-Cycle Energy and Greenhouse Gas Emission Changes of Alternative Transportation Fuels and Advanced Vehicle Technologies | 3-12 |
| NEAR-TERM Technology: Fuel-Cycle Energy and Criteria Pollutant Emission Changes of Alternative Transportation Fuels and Advanced Vehicle Technologies | 4-17 |
| LONG-TERM Technology: Fuel-Cycle Energy and Greenhouse Gas Emission Changes of Alternative Transportation Fuels and Advanced Vehicle Technologies | 4-19 |

Tested

| | |
|---|------|
| Vehicle Specifications for Tested Vehicles | 7-22 |
| Steady Speed Fuel Economy for Tested Vehicles | 7-25 |

Tier

| | |
|---|------|
| Tier 2 Federal Emission Standards | 4-32 |
|---|------|

Time

| | |
|--|------|
| Average Length of Time Fleet Vehicles are Kept Before Sold to Others, 1991 | 10-4 |
|--|------|

Tire

| | |
|--|-----|
| Summary Statistics for Two-Axle, Four-Tire Trucks, 1970-98 | 7-3 |
|--|-----|

| | |
|--|-------|
| Ton | |
| Class I Railroad Freight Systems in the United States Ranked by Revenue Ton-Miles, 1998 | 12-7 |
| Tonnage | |
| Tonnage Statistics for Domestic and International Waterborne Commerce, 1970-98 | 12-4 |
| Top | |
| Top Ten States with Fleets of Ten Vehicles or More, 1999 | 10-3 |
| Traffic | |
| Intermodal Rail Traffic, 1965-98 | 12-10 |
| Transit | |
| Summary Statistics for Rail Transit Operations, 1970-98 | 12-12 |
| Energy Intensity for Transit in the U.S., 1998 | 2-15 |
| Transportation | |
| Transportation of Petroleum and Petroleum Products in the U.S. by Mode, 1975-98 | 1-15 |
| Means of Transportation to Work, 1980 and 1990 Census | 11-15 |
| Domestic Consumption of Transportation Energy by Mode and Fuel Type, 1998 | 2-6 |
| Transportation Energy Use by Mode, 1997-98 | 2-7 |
| Transportation Energy Consumption by Mode, 1970-98 | 2-8 |
| NEAR-TERM Technology: Fuel-Cycle Energy and Greenhouse Gas Emission Changes of Alternative Transportation Fuels and Advanced Vehicle Technologies | 3-11 |
| LONG-TERM Technology: Fuel-Cycle Energy and Greenhouse Gas Emission Changes of Alternative Transportation Fuels and Advanced Vehicle Technologies | 3-12 |
| U.S. Carbon Dioxide Emissions from Energy Use in the Transportation Sector, 1980-98 | 3-7 |
| NEAR-TERM Technology: Fuel-Cycle Energy and Criteria Pollutant Emission Changes of Alternative Transportation Fuels and Advanced Vehicle Technologies | 4-17 |
| LONG-TERM Technology: Fuel-Cycle Energy and Greenhouse Gas Emission Changes of Alternative Transportation Fuels and Advanced Vehicle Technologies | 4-19 |
| Employment in Transportation and Related Industries, 1960-98 | 5-20 |
| Prices for Selected Transportation Fuels, 1978-99 | 5-8 |
| Travel | |
| Average Annual and Daily Vehicle-Miles of Travel for Fleet Vehicles, 1991 | 10-4 |
| Average Number of Vehicles and Vehicle Travel per Household, 1990 and 1995 NPTS | 11-8 |
| Travel (continued) | |
| Passenger Travel and Energy Use in the United States, 1998 | 2-13 |
| Automobiles in Operation and Vehicle Travel by Age, 1970 and 1998 | 6-8 |
| Trucks in Operation and Vehicle Travel by Age, 1970 and 1998 | 6-9 |

Traveled

| | |
|--|------|
| Average Annual Person-Miles Traveled (PMT), Person Trips and Trip Length per Household by Selected Trip Purposes | 11-7 |
| Highway Vehicle Miles Traveled by Vehicle Type, 1970-98 | 6-7 |

Trip

| | |
|--|-------|
| Average Vehicle Occupancy by Trip Purpose, 1977, 1983, 1990, and 1995 NPTS | 11-10 |
| Vehicle-Miles by Trip Purpose, 1995 NPTS | 11-11 |
| Long-Distance Household Trips by Mode and Trip Distance, 1995 | 11-19 |
| Average Annual Vehicle-Miles, Vehicle Trips and Trip Length per Household | 11-6 |
| Average Annual Person-Miles Traveled (PMT), Person Trips and Trip Length per Household by Selected Trip Purposes | 11-7 |

Trips

| | |
|--|-------|
| Long-Distance Trips by Destination, 1995 | 11-17 |
| Long-Distance Trips by Mode and Purpose, 1995 | 11-18 |
| Long-Distance Household Trips by Mode and Trip Distance, 1995 | 11-19 |
| Shares of Long-Distance Person Trips by Mode and Household Income, 1995 | 11-20 |
| Average Annual Vehicle-Miles, Vehicle Trips and Trip Length per Household | 11-6 |
| Average Annual Person-Miles Traveled (PMT), Person Trips and Trip Length per Household by Selected Trip Purposes | 11-7 |

Truck

| | |
|--|------|
| Pollution from a Typical New Car and Light Truck, 2000 Model Year | 4-32 |
| Light Truck Scrappage and Survival Rates | 6-13 |
| Light Truck Survival Rates | 6-14 |
| Truck and Bus Registrations for Selected Countries, 1950-96 | 6-3 |
| New Retail Truck Sales by Gross Vehicle Weight, 1970-98 | 8-3 |
| Truck Statistics by Gross Vehicle Weight Class, 1997 | 8-5 |
| Truck Fuel Economy by Fuel Type and Size Class, 1997 | 8-6 |
| Truck Fuel Economy by Size Class, 1977, 1982, 1987, 1992, and 1997 | 8-6 |
| Truck Statistics by Size, 1997 | 8-7 |

Trucks

| | |
|--|------|
| Federal Exhaust Emission Certification Standards for Gasoline- and Diesel-Powered Light Trucks | 4-34 |
| Federal Exhaust Emission Certification Standards for Gasoline- and Diesel-Powered Light Trucks | 4-35 |

Trucks (continued)

| | |
|--|------|
| Federal Exhaust Emission Certification Standards for Gasoline- and Diesel-Powered Light Trucks | 4-36 |
| Federal Exhaust Emission Certification Standards for Gasoline- and Diesel-Powered Light Trucks | 4-37 |
| Federal Exhaust Emission Certification Standards for Gasoline- and Diesel-Powered Light Heavy Trucks | 4-38 |
| Federal Exhaust Emission Certification Standards for Gasoline- and Diesel-Powered Heavy Heavy Trucks | 4-39 |
| California Passenger Cars and Light Trucks Emission Certification Standards | 4-40 |
| California Vehicle Emission Reduction for Passenger Cars and Light Trucks | 4-41 |
| Average Age of Automobiles and Trucks in Use, 1970-98 | 6-10 |
| Automobiles and Trucks in Use, 1970-98 | 6-5 |
| Trucks in Operation and Vehicle Travel by Age, 1970 and 1998 | 6-9 |
| Sales-Weighted Engine Size of New Domestic and Import Light Trucks by Size Class, Sales Periods 1976-99 | 7-10 |
| Sales-Weighted Wheelbase of New Automobiles and Light Trucks, Sales Period 1976-99 | 7-14 |
| Corporate Average Fuel Economy (CAFE) Standards versus Sales-Weighted Fuel Economy Estimates for Automobiles and Light Trucks, 1978-99 | 7-18 |
| Summary Statistics for Two-Axle, Four-Tire Trucks, 1970-98 | 7-3 |
| New Retail Sales of Trucks 10,000 pounds GVW and Less in the United States, 1970-98 | 7-5 |
| Period Sales, Market Shares, and Sales-Weighted Fuel Economies of New Domestic and Import Light Trucks, Selected Sales Period 1976-99 | 7-7 |
| Percentage of Trucks by Major Use and Primary Refueling Facility, 1997 | 8-10 |
| Summary Statistics for Other Single-Unit and Combination Trucks, 1970-98 | 8-2 |
| Percentage of Trucks by Size Class, 1977, 1982, 1987, 1992, and 1997 | 8-5 |
| Percentage of Trucks by Size Ranked by Major Use, 1997 | 8-8 |
| Percentage of Trucks by Fleet Size and Primary Refueling Facility, 1997 | 8-9 |

Unit

| | |
|--|-----|
| Summary Statistics for Other Single-Unit and Combination Trucks, 1970-98 | 8-2 |
|--|-----|

United

| | |
|---|------|
| United States Petroleum Production and Consumption, 1973-99 | 1-12 |
| Class I Railroad Freight Systems in the United States Ranked by Revenue Ton-Miles, 1998 | 12-7 |
| Passenger Travel and Energy Use in the United States, 1998 | 2-13 |
| Intercity Freight Movement and Energy Use in the United States, 1998 | 2-16 |

United (continued)

| | |
|--|------|
| Vehicle Stock and New Sales in United States, 1998 Calendar Year | 6-6 |
| New Retail Automobile Sales in the United States, 1970-98 | 7-4 |
| New Retail Sales of Trucks 10,000 pounds GVW and Less in the United States, 1970-98 | 7-5 |
| Growth of Freight Activity in the United States: Comparison of the 1997 and 1993 Commodity Flow Surveys | 8-12 |

Urban

| | |
|---------------------------|------|
| Urban Driving Cycle | 7-26 |
|---------------------------|------|

US06

| | |
|--------------------------|------|
| US06 Driving Cycle | 7-28 |
|--------------------------|------|

Vehicle

| | |
|--|-------|
| Fleet Vehicle Composition by Vehicle Type, 1991 | 10-4 |
| Average Annual and Daily Vehicle-Miles of Travel for Fleet Vehicles, 1991 | 10-4 |
| Average Miles per Federal Vehicle by Vehicle Type, 1997 | 10-5 |
| Federal Fleet Vehicle Acquisitions by Fuel Type, FY 1997 | 10-7 |
| Average Vehicle Occupancy by Trip Purpose, 1977, 1983, 1990, and 1995 NPTS | 11-10 |
| Vehicle-Miles by Trip Purpose, 1995 NPTS | 11-11 |
| Average Annual Miles per Vehicle by Household Vehicle Ownership, 1995 NPTS | 11-12 |
| Average Age of Vehicles by Household Vehicle Ownership, 1995 NPTS | 11-12 |
| Average Annual Miles per Household Vehicle by Vehicle Age | 11-13 |
| Population and Vehicle Profile, 1950-98 | 11-2 |
| Household Vehicle Ownership, 1960-90 Census | 11-4 |
| Average Annual Vehicle-Miles, Vehicle Trips and Trip Length per Household | 11-6 |
| Average Number of Vehicles and Vehicle Travel per Household, 1990 and 1995 NPTS | 11-8 |
| Average Vehicle Occupancy by Vehicle Type, 1995 NPTS | 11-9 |
| Alternative Vehicle Fuel Consumption, 1992-2000 | 2-11 |
| NEAR-TERM Technology: Fuel-Cycle Energy and Greenhouse Gas Emission Changes of Alternative Transportation Fuels and Advanced Vehicle Technologies | 3-11 |
| LONG-TERM Technology: Fuel-Cycle Energy and Greenhouse Gas Emission Changes of Alternative Transportation Fuels and Advanced Vehicle Technologies | 3-12 |
| NEAR-TERM Technology: Fuel-Cycle Energy and Criteria Pollutant Emission Changes of Alternative Transportation Fuels and Advanced Vehicle Technologies | 4-17 |
| LONG-TERM Technology: Fuel-Cycle Energy and Greenhouse Gas Emission Changes of Alternative Transportation Fuels and Advanced Vehicle Technologies | 4-19 |
| California Vehicle Emission Reduction for Passenger Cars and Light Trucks | 4-41 |
| Motor Vehicle Manufacturing Employment Statistics, 1972-98 | 5-18 |

Vehicle (continued)

| | |
|---|------|
| Employees of Motor Vehicle and Related Industries, 1990 and 1997 | 5-19 |
| Vehicle Stock and New Sales in United States, 1998 Calendar Year | 6-6 |
| Highway Vehicle Miles Traveled by Vehicle Type, 1970-98 | 6-7 |
| Automobiles in Operation and Vehicle Travel by Age, 1970 and 1998 | 6-8 |
| Trucks in Operation and Vehicle Travel by Age, 1970 and 1998 | 6-9 |
| New Light Vehicle Dealerships and Sales, 1970-98 | 7-16 |
| Vehicle Specifications for Tested Vehicles | 7-22 |
| Occupant Fatalities by Vehicle Type and Nonoccupant Fatalities, 1975-98 | 7-29 |
| Light Vehicle Occupant Safety Data, 1975-98 | 7-30 |
| Crashes by Crash Severity, Crash Type, and Vehicle Type, 1998 | 7-31 |
| Percent Rollover Occurrence by Vehicle Type and Crash Severity | 7-32 |
| Light Vehicle Market Shares by Size Class, Sales Period 1976-99 | 7-8 |
| New Retail Truck Sales by Gross Vehicle Weight, 1970-98 | 8-3 |
| Truck Statistics by Gross Vehicle Weight Class, 1997 | 8-5 |
| U.S. Advanced Battery Consortium Goals for Electric Vehicle Batteries | 9-10 |

Vehicles

| | |
|---|-------|
| Fleet Vehicles in Service as of January 1, 1999 | 10-2 |
| Top Ten States with Fleets of Ten Vehicles or More, 1999 | 10-3 |
| Average Length of Time Fleet Vehicles are Kept Before Sold to Others, 1991 | 10-4 |
| Average Annual and Daily Vehicle-Miles of Travel for Fleet Vehicles, 1991 | 10-4 |
| Federal Government Vehicles by Agency, Fiscal Year 1997 | 10-6 |
| Energy Policy Act Purchase Requirements of Light Alternative Fuel Vehicles | 10-8 |
| Average Age of Vehicles by Household Vehicle Ownership, 1995 NPTS | 11-12 |
| Average Number of Vehicles and Vehicle Travel per Household, 1990 and 1995 NPTS | 11-8 |
| Emissions of Particulate Matter (PM-10) from Highway Vehicles, 1970-98 | 4-10 |
| Emissions of Particulate Matter (PM-2.5) from Highway Vehicles, 1990-98 | 4-12 |
| Federal Exhaust Emission Certification Standards for Gasoline- and Diesel-Powered Light Vehicles | 4-33 |
| Emissions of Carbon Monoxide from Highway Vehicles, 1970-98 | 4-4 |
| Emissions of Nitrogen Oxides from Highway Vehicles, 1970-98 | 4-6 |
| Emissions of Volatile Organic Compounds from Highway Vehicles, 1970-98 | 4-8 |
| Vehicle Specifications for Tested Vehicles | 7-22 |
| Steady Speed Fuel Economy for Tested Vehicles | 7-25 |
| PNGV Goals and Specifications of Hybrid-Electric Vehicles | 9-11 |
| Estimates of Alternative Fuel Vehicles in Use, 1992-2000 | 9-3 |
| Estimates of Light Alternative Fuel Vehicles, 1996, 1998, and 2000 | 9-4 |

Vehicle (continued)

| | |
|--|-----|
| Estimates of Heavy Alternative Fuel Vehicles, 1996, 1998, and 2000 | 9-5 |
| Alternative Fuel Vehicles Available by Manufacturer, Model Year 2000 | 9-6 |

Volatile

| | |
|--|-----|
| Total National Emissions of Volatile Organic Compounds, 1970-98 | 4-7 |
| Emissions of Volatile Organic Compounds from Highway Vehicles, 1970-98 | 4-8 |

Warming

| | |
|--|-----|
| Numerical Estimates of Global Warming Potentials Compared With Carbon Dioxide | 3-8 |
|--|-----|

Waterborne

| | |
|--|------|
| Tonnage Statistics for Domestic and International Waterborne Commerce, 1970-98 | 12-4 |
| Summary Statistics for Domestic Waterborne Commerce, 1970-98 | 12-5 |

Weight

| | |
|---|------|
| Sales-Weighted Curb Weight of New Domestic and Import Automobiles by Size Class, Sales Periods 1976-99 | 7-11 |
| Engine Size, Curb Weight, and Interior Space of New Domestic and Import Automobiles, 1976-99 | 7-13 |
| New Retail Truck Sales by Gross Vehicle Weight, 1970-98 | 8-3 |
| Truck Statistics by Gross Vehicle Weight Class, 1997 | 8-5 |

Weighted

| | |
|---|------|
| Sales-Weighted Engine Size of New Domestic and Import Light Trucks by Size Class, Sales Periods 1976-99 | 7-10 |
| Sales-Weighted Curb Weight of New Domestic and Import Automobiles by Size Class, Sales Periods 1976-99 | 7-11 |
| Sales-Weighted Interior Space of New Domestic and Import Automobiles by Size Class, Sales Periods 1976-99 | 7-12 |
| Sales-Weighted Wheelbase of New Automobiles and Light Trucks, Sales Period 1976-99 | 7-14 |
| Corporate Average Fuel Economy (CAFE) Standards versus Sales-Weighted Fuel Economy Estimates for Automobiles and Light Trucks, 1978-99 | 7-18 |
| Period Sales, Market Shares, and Sales-Weighted Fuel Economies of New Domestic and Import Automobiles, Selected Sales Periods 1976-99 | 7-6 |
| Period Sales, Market Shares, and Sales-Weighted Fuel Economies of New Domestic and Import Light Trucks, Selected Sales Period 1976-99 | 7-7 |
| Sales-Weighted Engine Size of New Domestic and Import Automobiles by Size Class, Sales Periods 1976-99 | 7-9 |

Wheelbase

| | |
|---|------|
| Sales-Weighted Wheelbase of New Automobiles and Light Trucks, Sales Period 1976-99 | 7-14 |
|---|------|

Work

| | |
|--|-------|
| Journey-to-Work Statistics, 1983, 1990, and 1995 NPTS | 11-14 |
| Means of Transportation to Work, 1980 and 1990 Census | 11-15 |
| National and Metropolitan Area Comparisons of Journey-to-Work Statistics, 1990 Census | 11-16 |

World

| | |
|---|-----|
| World Fossil Fuel Potential | 1-2 |
| World Crude Oil Production, 1960-98 | 1-3 |
| World Oil Consumption, 1960-97 | 1-4 |
| U.S. Petroleum Net Imports by World Region of Origin, 1960-98 | 1-7 |
| Refinery Gross Output by World Region, 1999 | 1-9 |
| World Production of Primary Energy by Selected Country Groups, 1989-98 | 2-2 |
| World Consumption of Primary Energy by Selected Country Groups, 1989-98 | 2-3 |

Worldwide

| | |
|--|------|
| Worldwide Federal Inventory, 1992-97 | 10-5 |
|--|------|

Yield

| | |
|--|------|
| Refinery Yield of Petroleum Products from a Barrel of Crude Oil, 1978-98 | 1-11 |
|--|------|

York

| | |
|-----------------------------------|------|
| New York City Driving Cycle | 7-27 |
|-----------------------------------|------|