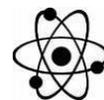


Chapter 2 Energy

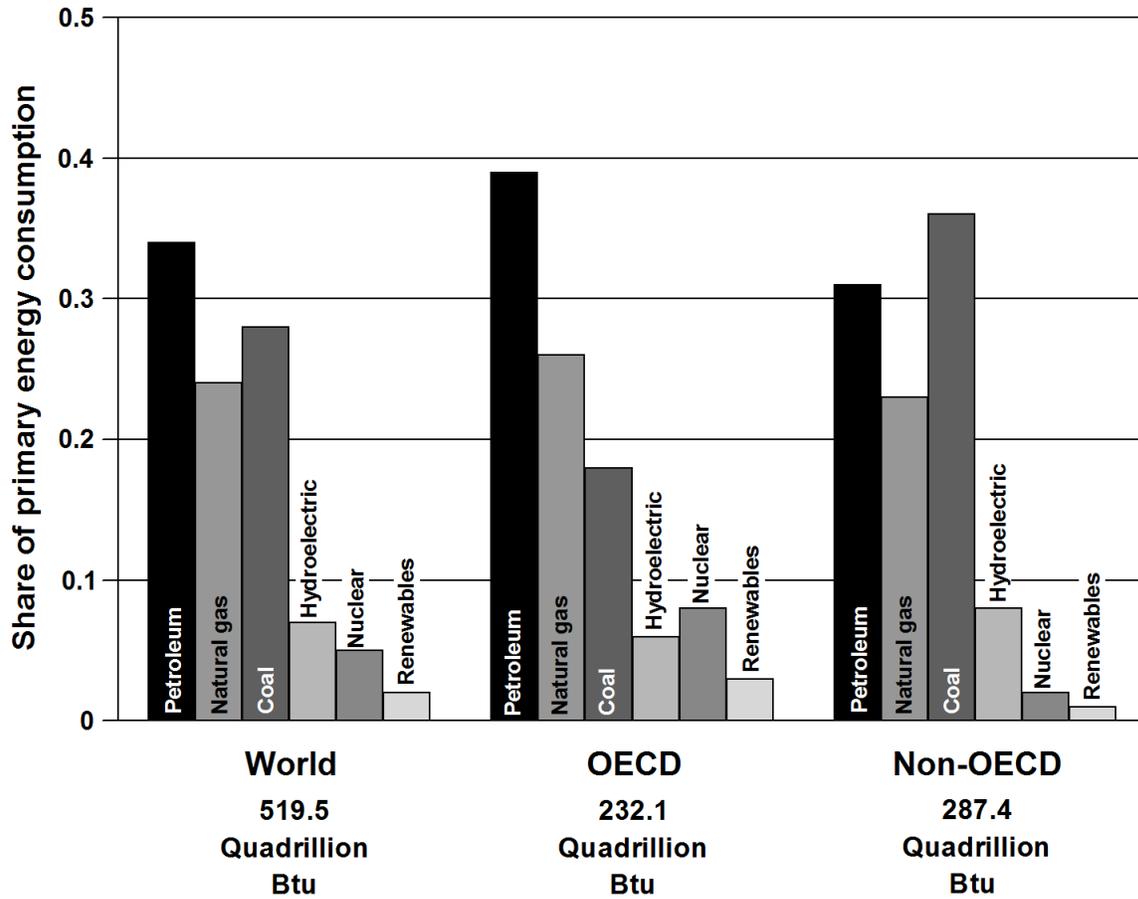
Summary Statistics from Tables in this Chapter

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



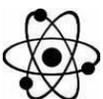
Petroleum accounted for 34% of the world's energy use in 2012. Though petroleum is the dominant energy source for OECD countries, the non-OECD countries rely on coal and petroleum.

Figure 2.1. World Consumption of Primary Energy, 2012



Source:

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



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

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

Year	Transportation	Percentage transportation of				Total ^a
		total	Industrial	Commercial	Residential	
1973	18.6	24.6%	32.6	9.5	14.9	75.7
1975	18.2	25.4%	29.4	9.5	14.8	72.0
1976	19.1	25.1%	31.4	10.1	15.4	76.0
1977	19.8	25.4%	32.3	10.2	15.7	78.0
1978	20.6	25.8%	32.7	10.5	16.1	80.0
1979	20.5	25.3%	33.9	10.6	15.8	80.9
1980	19.7	25.2%	32.0	10.6	15.8	78.1
1981	19.5	25.6%	30.7	10.6	15.3	76.1
1982	19.1	26.1%	27.6	10.9	15.5	73.1
1983	19.2	26.3%	27.4	10.9	15.4	73.0
1984	19.7	25.7%	29.6	11.4	16.0	76.7
1985	20.1	26.3%	28.8	11.5	16.0	76.4
1986	20.8	27.1%	28.3	11.6	16.0	76.7
1987	21.5	27.2%	28.4	11.9	16.3	79.1
1988	22.3	27.0%	30.7	12.6	17.1	82.7
1989	22.5	26.5%	31.3	13.2	17.8	84.8
1990	22.4	26.5%	31.8	13.3	16.9	84.5
1991	22.1	26.2%	31.4	13.4	17.4	84.4
1992	22.4	26.1%	32.6	13.4	17.4	85.8
1993	22.8	26.1%	32.6	13.8	18.2	87.4
1994	23.4	26.3%	33.5	14.1	18.1	89.1
1995	23.8	26.2%	34.0	14.7	18.5	91.0
1996	24.4	26.0%	34.9	15.2	19.5	94.0
1997	24.8	26.2%	35.2	15.7	19.0	94.6
1998	25.3	26.8%	34.8	16.0	19.0	95.0
1999	25.9	26.8%	34.8	16.4	19.6	96.7
2000	26.6	26.9%	34.7	17.2	20.4	98.8
2001	26.3	27.3%	32.7	17.1	20.0	96.2
2002	26.8	27.5%	32.7	17.3	20.8	97.6
2003	26.9	27.5%	32.6	17.3	21.1	97.9
2004	27.8	27.8%	33.5	17.7	21.1	100.1
2005	28.3	28.2%	32.4	17.9	21.6	100.2
2006	28.7	28.9%	32.4	17.7	20.7	99.5
2007	28.9	28.6%	32.4	18.2	21.5	101.0
2008	27.5	27.8%	31.3	18.4	21.7	98.9
2009	26.7	28.3%	28.5	17.9	21.1	94.1
2010	27.1	27.8%	30.5	18.0	21.8	97.5
2011	27.7	27.6%	30.8	18.0	21.4	96.9
2012	26.2	27.7%	30.9	17.4	20.0	94.5
2013	26.8	27.5%	31.4	17.9	21.2	97.2
2014	27.1	27.6%	31.4	18.4	21.6	98.4
		<i>Average annual percentage change</i>				
1973–2014	0.9%		-0.1%	1.6%	0.9%	0.6%
2004–2014	-0.3%		-0.6%	0.4%	0.2%	-0.2%

Source:

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

^a Electrical energy losses have been distributed among the sectors.



In transportation, the alcohol fuels blended into gasoline to make gasohol (10% ethanol or less) are counted under “renewables” and are not in with petroleum. The petroleum category, however, still contains other blending agents that are not actually petroleum, but are not broken out into a separate category.

Table 2.2
Distribution of Energy Consumption by Source, 1973 and 2014
(percentage)

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

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

Source:

U.S. Department of Energy, Energy Information Administration, *Monthly Energy Review*, April 2015, Washington, DC, Tables 2.2, 2.3, 2.4, 2.5, and 2.6. (Additional resources: www.eia.doe.gov)

^a In transportation, the petroleum category contains some blending agents which are not petroleum.

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

^c Includes electrical system energy losses.

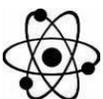


Table 2.3. Distribution of Transportation Energy Consumption by Source, 1950–2014

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

Source:

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

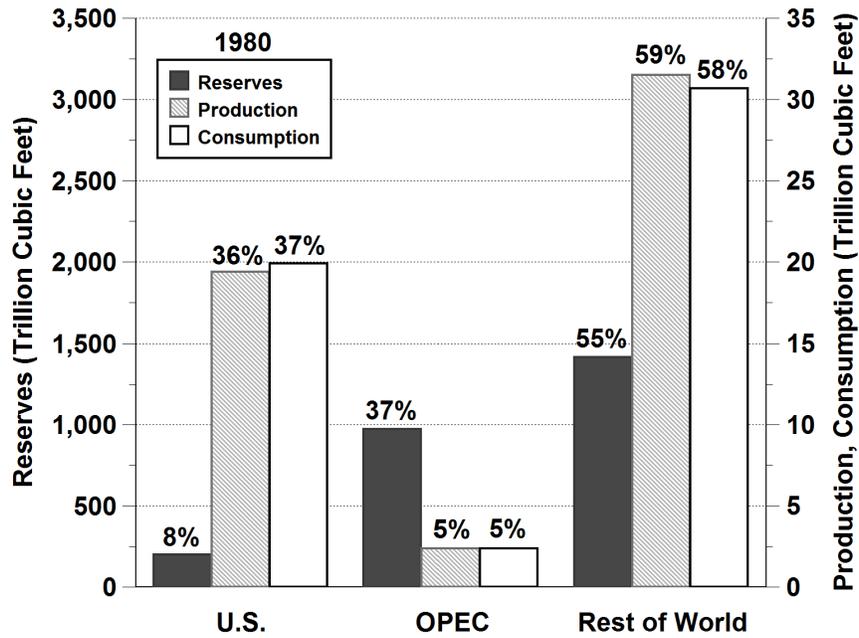
^a In transportation, the petroleum category contains some blending agents which are not petroleum.

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

^c Includes electrical system energy losses.

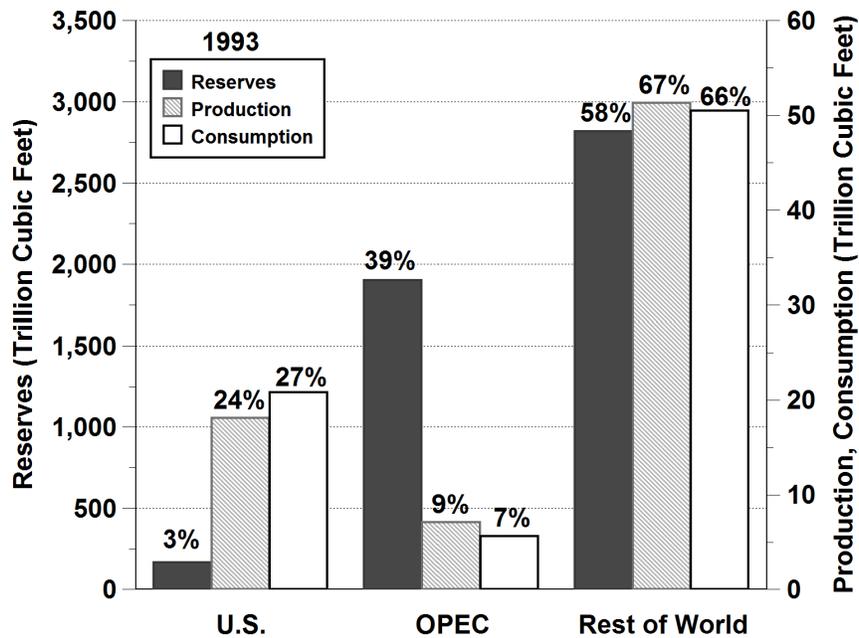


Figure 2.2. World Natural Gas Reserves, Production, and Consumption, 1980



Source:
See Table 2.4.

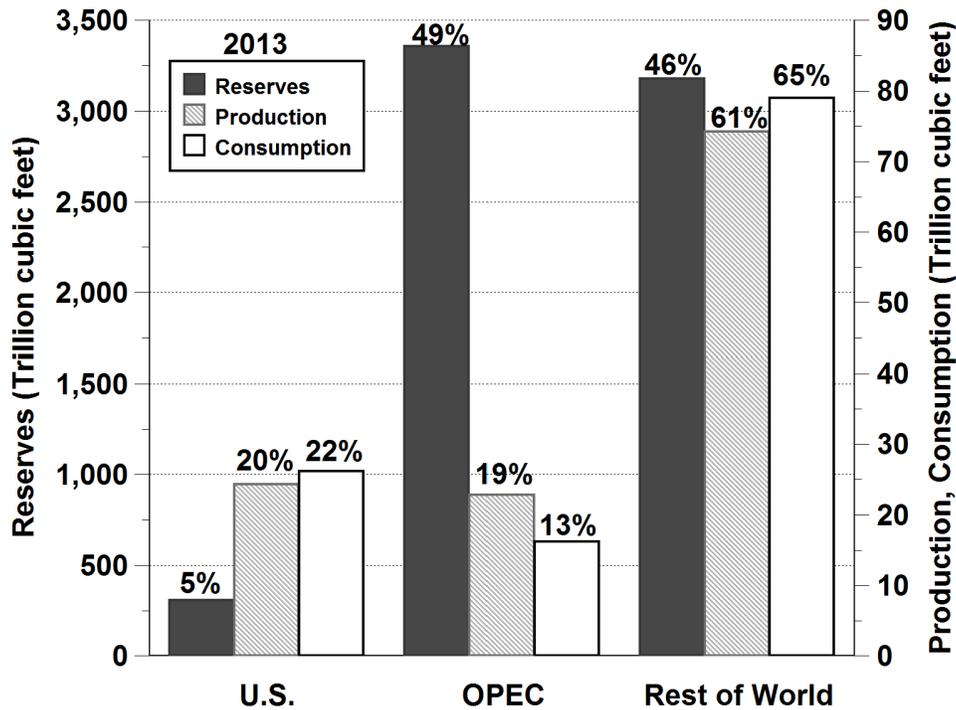
Figure 2.3. World Natural Gas Reserves, Production, and Consumption, 1993



Source:
See Table 2.4.



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



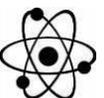
Source:
See Table 2.4.

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

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

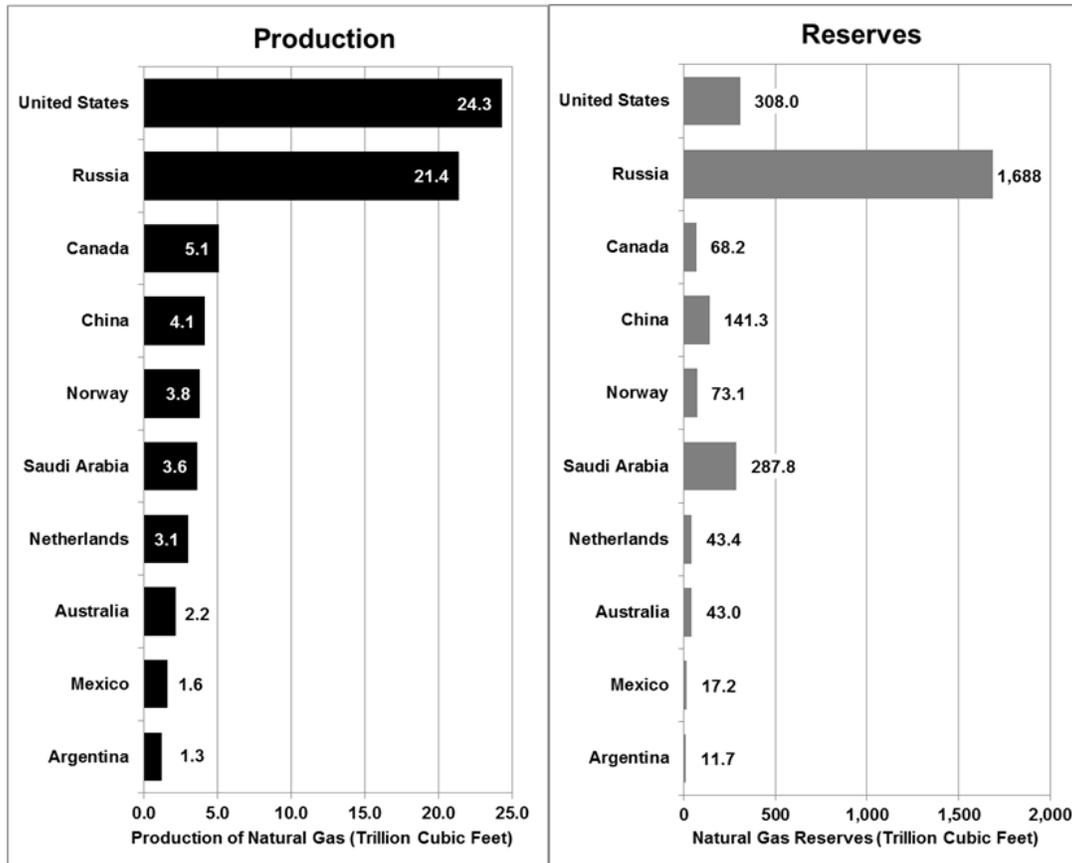
Note: Production data are dry gas production.

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



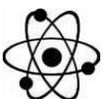
In 2013, the United States and Russia were by far the top natural gas producing countries with more than double that of any other country. Although the United States produced more than Russia, Russia has five times more reserves.

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



Source:

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



Oxygenates are blended with gasoline to be used in conventional vehicles. The amount of oxygenate use dwarfs the alternative fuel use. Gasoline-equivalent gallons are used in this table to allow comparisons of different fuel types. The Energy Information Administration has not released data for any year past 2011.

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

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

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

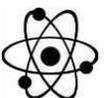
Source:

U.S. Department of Energy, Energy Information Administration, Alternative Fuel Vehicle Data website, May 2013, www.eia.doe.gov/renewable. (Additional resources: www.eia.doe.gov)

^a Consumption includes gasoline portion of the mixture.

^b Vehicle consumption only; does not include power plant inputs.

^c Methyl Tertiary Butyl Ether. This category includes a very small amount of other ethers, primarily Tertiary Amyl Methyl Ether (TAME) and Ethyl Tertiary Butyl Ether (ETBE).



Ethanol is used as an oxygenate blended with gasoline to be used as gasohol in conventional vehicles. The amount of ethanol used in gasohol dwarfs the amount used in E85. Production of E95 ended in 2000. The Energy Information Administration has not released data for any year past 2011.

Table 2.6
Ethanol Consumption, 1995–2011
(thousand gallons)

	Ethanol blends		Ethanol in gasohol	Total
	E85	E95		
1995	166	970	934,615	935,751
2000	10,530	12	1,114,313	1,124,855
2001	12,756	0	1,173,323	1,186,079
2002	15,513	0	1,450,721	1,466,234
2003	26,376	0	1,919,572	1,945,948
2004	31,581	0	2,414,167	2,445,748
2005	38,074	0	2,756,663	2,794,737
2006	44,041	0	3,729,168	3,773,209
2007	54,091	0	4,694,304	4,748,395
2008	62,464	0	6,442,781	6,505,245
2009	71,213	0	7,343,133	7,414,346
2010	90,323	0	8,527,431	8,617,754
2011	137,165	0	8,563,841	8,701,006
2011 Percentage	1.6%	0.0%	98.4%	100.0%

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

Source:

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



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

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

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

Source:

See Appendix A for Energy Use Sources.

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

^b Totals may not sum due to rounding.

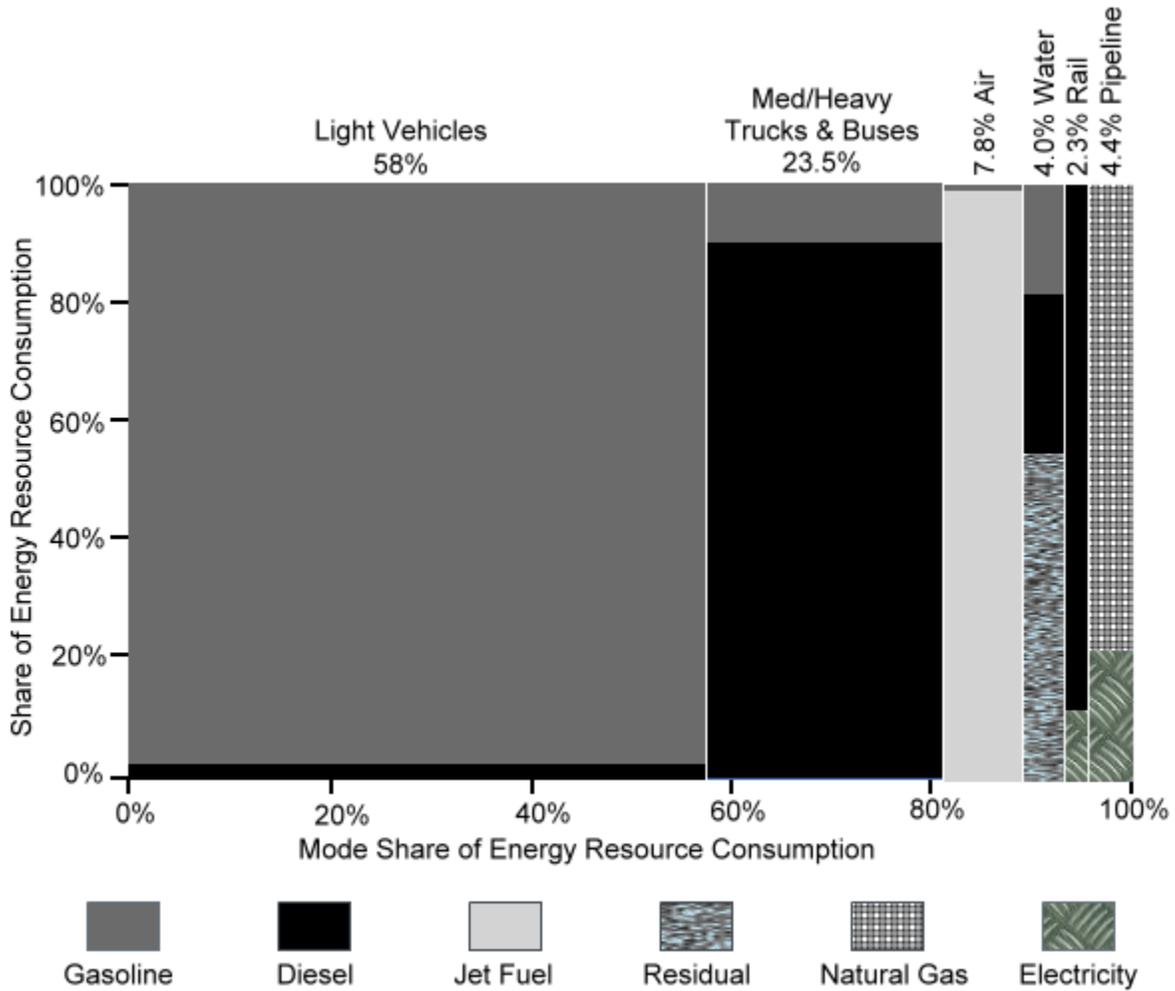
^c Two-axle, four-tire trucks.

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



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

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



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

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

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



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

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

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

Source:

See Appendix A for Energy Use Sources.

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

^b Two-axle, four-tire trucks.



Light trucks include pick-ups, minivans, sport-utility vehicles, and vans. See Table 1.14 for highway petroleum use in thousand barrels per day.

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

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

Note: Totals may not add due to rounding.

Source:

See Appendix A for Highway Energy Use.

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

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



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

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

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

Note: Totals may not add due to rounding.

Source:

See Appendix A for Nonhighway Energy Use.

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



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

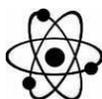
Table 2.11
Off-Highway Transportation-Related Fuel Consumption from the Nonroad Model, 2013
(trillion Btus)

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

Source:

Environmental Protection Agency, NONROAD2008a model, www.epa.gov/oms/nonrdmdl.htm.

^a There is no equipment listed for this fuel type.



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

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

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

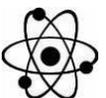
Source:

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

^a Numbers may not sum due to rounding.

^b Includes equipment such as aerators, dethatchers, sod cutters, hydro-seeders, turf utility vehicles, golf course greens mowers, and sand trap groomers.

^c Includes equipment not otherwise classified such as augers, sickle-bar mowers, and wood splitters.



The Federal Highway Administration (FHWA) cautions that data from 1993 on may not be directly comparable to earlier years. Some states have improved reporting procedures in recent years, and the estimation procedures were revised in 1994. The FHWA no longer publishes separate estimates of gasohol or ethanol used in gasohol. See Table 2.5 for details on oxygenate usage.

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

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

Source:

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

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



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

Table 2.14
Passenger Travel and Energy Use, 2013

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

Source:

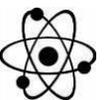
See Appendix A for Passenger Travel and Energy Use.

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

^b Data are not available.

^c Energy use is estimated.

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



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

Table 2.15
Energy Intensities of Highway Passenger Modes, 1970–2013

Year	Cars		Light truck ^a	Transit Buses ^b	
	(Btu per vehicle-mile)	(Btu per passenger-mile)	(Btu per vehicle-mile)	(Btu per vehicle-mile)	(Btu per passenger-mile)
1970	9,250	4,868	12,480	31,796	2,472
1975	8,993	4,733	11,879	33,748	2,814
1980	7,916	4,279	10,224	36,553	2,813
1981	7,670	4,184	9,997	37,745	3,027
1982	7,465	4,109	9,268	38,766	3,237
1983	7,365	4,092	9,124	37,962	3,177
1984	7,202	4,066	8,931	38,705	3,307
1985	7,164	4,110	8,730	38,876	3,423
1986	7,194	4,197	8,560	37,889	3,545
1987	6,959	4,128	8,359	36,247	3,594
1988	6,683	4,033	8,119	36,673	3,706
1989	6,589	4,046	7,746	36,754	3,732
1990	6,169	3,856	7,746	37,374	3,794
1991	5,912	3,695	7,351	37,732	3,877
1992	5,956	3,723	7,239	40,243	4,310
1993	6,087	3,804	7,182	39,043	4,262
1994	6,024	3,765	7,212	37,259	4,262
1995	5,902	3,689	7,208	37,251	4,307
1996	5,874	3,683	7,247	37,452	4,340
1997	5,797	3,646	7,251	38,861	4,434
1998	5,767	3,638	7,260	41,296	4,399
1999	5,821	3,684	7,327	40,578	4,344
2000	5,687	3,611	7,158	41,695	4,531
2001	5,626	3,583	7,080	38,535	4,146
2002	5,662	3,607	7,125	37,548	4,133
2003	5,535	3,525	7,673	37,096	4,213
2004	5,489	3,496	7,653	37,855	4,364
2005	5,607	3,571	7,009	37,430	4,250
2006	5,511	3,510	6,974	39,568	4,316
2007	5,513	3,512	6,904	39,931	4,372
2008	5,466	3,526	6,830	39,906	4,348
2009	5,239	3,380	7,158	39,160	4,242
2010	5,117	3,301	6,919	35,953	4,118
2011	5,032	3,246	6,795	37,718	4,240
2012	4,949	3,193	6,674	37,105	4,030
2013	4,873	3,144	6,557	37,442	4,071
		<i>Average annual percentage change</i>			
1970–2013	-1.5%	-1.0%	-1.5%	0.4%	1.2%
2003–2013	-1.3%	-1.1%	-1.6%	0.1%	-0.3%

Source:

See Appendix A for Highway Passenger Mode Energy Intensities.

^a All two-axle, four-tire trucks.

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



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

Table 2.16
Energy Intensities of Nonhighway Passenger Modes, 1970–2013

Year	Air	Intercity Amtrak (Btu per passenger-mile)	Rail	Commuter rail (Btu per passenger-mile)
	Certificated air carriers ^a (Btu per passenger-mile)		Rail transit (Btu per passenger-mile)	
1970	10,115	^b	2,157	^b
1975	7,625	3,548	2,625	^b
1976	7,282	3,278	2,633	^b
1977	6,990	3,443	2,364	^b
1978	6,144	3,554	2,144	^b
1979	5,607	3,351	2,290	^b
1980	5,561	3,065	2,312	^b
1981	5,774	2,883	2,592	^b
1982	5,412	3,052	2,699	^b
1983	5,133	2,875	2,820	^b
1984	5,298	2,923	3,037	2,804
1985	5,053	2,703	2,809	2,826
1986	5,011	2,481	3,042	2,926
1987	4,827	2,450	3,039	2,801
1988	4,861	2,379	3,072	2,872
1989	4,844	2,614	2,909	2,864
1990	4,797	2,505	3,024	2,822
1991	4,602	2,417	3,254	2,770
1992	4,455	2,534	3,155	2,629
1993	4,490	2,565	3,373	2,976
1994	4,407	2,282	3,338	2,682
1995	4,349	2,501	3,340	2,632
1996	4,199	2,690	3,017	2,582
1997	4,173	2,811	2,856	2,724
1998	3,987	2,788	2,823	2,646
1999	4,108	2,943	2,785	2,714
2000	3,960	3,235	2,797	2,551
2001	3,943	3,257	2,803	2,515
2002	3,718	3,212	2,872	2,514
2003	3,614	2,800	2,837	2,545
2004	3,505	2,760	2,750	2,569
2005	3,346	2,709	2,783	2,743
2006	3,250	2,650	2,707	2,527
2007	3,153	2,516	2,577	2,638
2008	3,055	2,398	2,521	2,656
2009	2,901	2,435	2,516	2,811
2010	2,825	2,271	2,520	2,897
2011	2,772	2,214	2,459	2,780
2012	2,633	2,120	2,398	2,823
2013	2,568	2,118	2,404	2,737
		<i>Average annual percentage change^c</i>		
1970–2013	-3.1%	-1.3%	0.3%	-0.1%
2003–2013	-3.4%	-2.8%	-1.6%	0.7%

Source:

See Appendix A for Nonhighway Passenger Mode Energy Intensities.

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

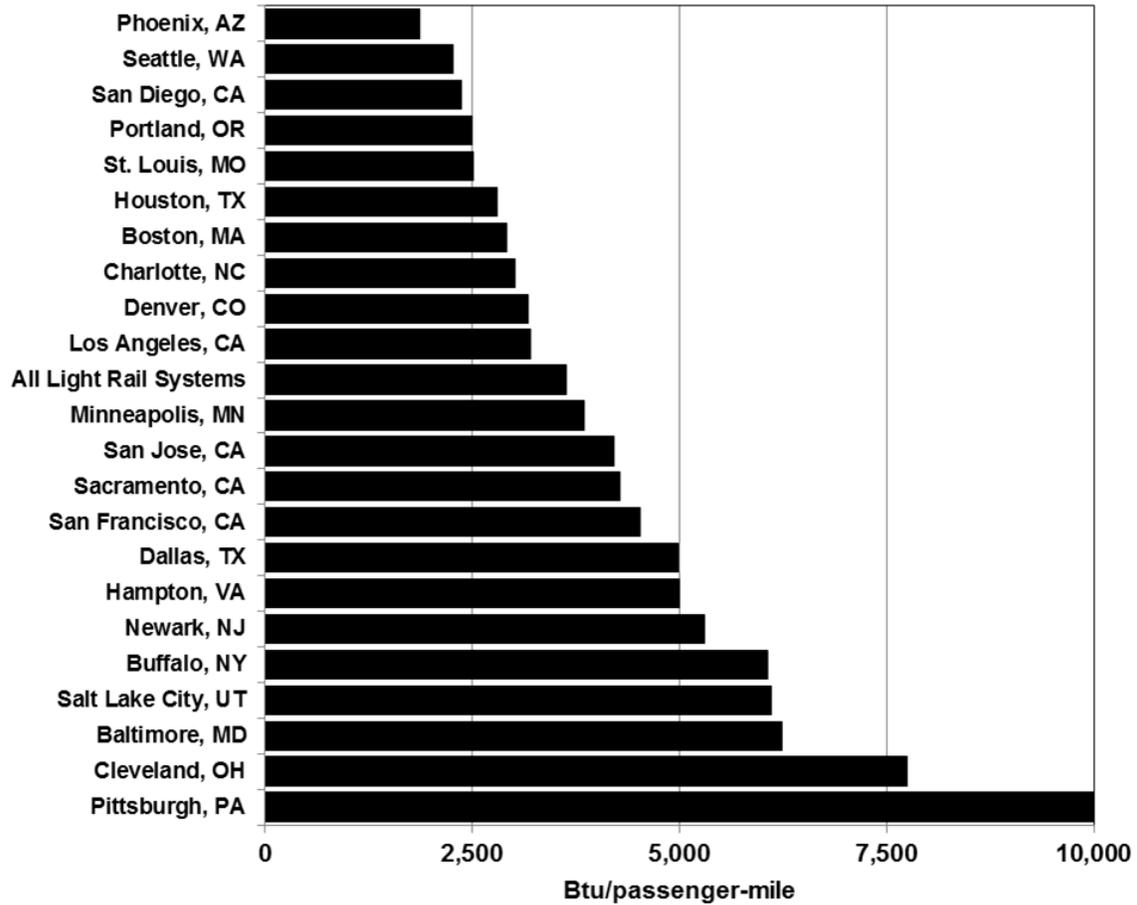
^b Data are not available.

^c Average annual percentage calculated to earliest year possible.



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

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



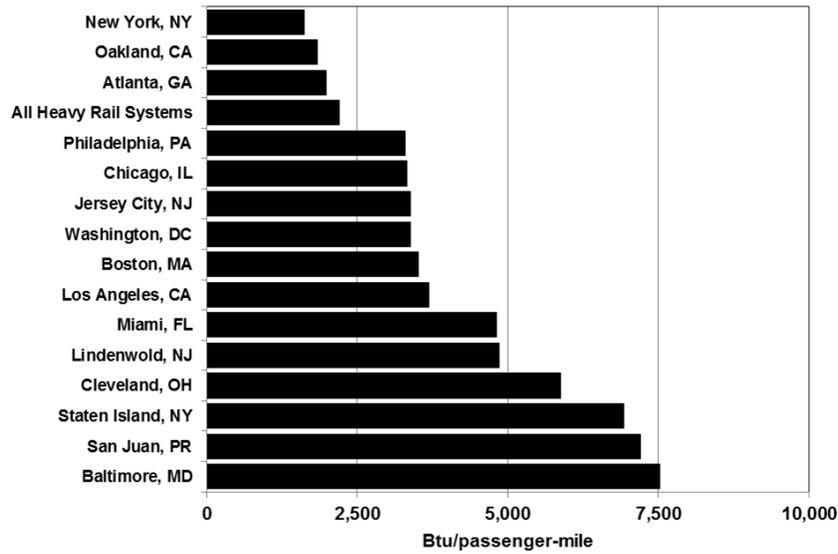
Source:

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

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



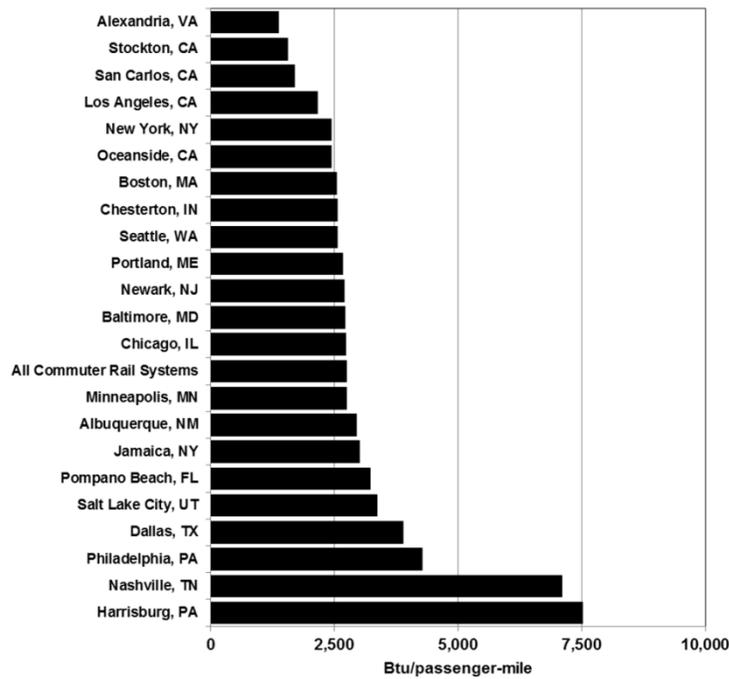
Figure 2.8. Energy Intensity of Heavy Rail Systems^a, 2013



Source:

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

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

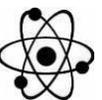


Source:

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

^a An electric railway with the capacity for a heavy volume of traffic.

^b Electric car or diesel-propelled railway for urban passenger train service between a central city and adjacent suburbs.



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

Table 2.17
Energy Intensities of Freight Modes, 1970–2013

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

Source:

See Appendix A for Freight Mode Energy Intensities.

^a Data are not available.

^b Due to changes in the FHWA fuel use methodology, truck data are not comparable with data before the year 2007.

