Chapter 6
Alternative Fuel and Advanced Technology Vehicles and Characteristics

Summary Statistics from Tables in this Chapter

Source		
Table 6.1	Alternative fuel vehicles in use, 2011 (latest available)	1,191,786
	E85	862,837
	LPG	139,477
	CNG	118,214
	Electric	67,295
	LNG	3,436
	M85	0
Table 6.8	Number of alternative fuel refuel sites, 2015	48,177
	Electric outlets	28,275
	LPG	3,146
	CNG	1,549
	Biodiesel	753
	Hydrogen	45

Fuel type abbreviations are used throughout this chapter.

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

Alternative Fuels

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

- methanol, ethanol, and other alcohols,
- blends of 85% or more of alcohol with gasoline,
- natural gas and liquid fuels domestically produced from natural gas,
- liquefied petroleum gas (propane),
- coal-derived liquid fuels,
- hydrogen,
- electricity,
- biodiesel (B100),
- fuels (other than alcohol) derived from biological materials,
- P-series.

Alternative Fuels Data Center

DOE established the Alternative Fuels Data Center (AFDC) in 1991 to support its work aimed at fulfilling the Alternative Motor Fuels Act directives. Since then, the AFDC has expanded its focus to include all advanced transportation fuels, vehicles, and technologies. The AFDC is operated and managed by the National Renewable Energy Laboratory (NREL) in Golden, Colorado.

The purposes of the AFDC are:

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

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

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

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

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

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

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

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

Tools – www.afdc.energylgov/tools

There are almost 1.2 million alternative fuel vehicles in the United States, not including flex-fuel E85 vehicles which operate mainly on gasoline. The E85 vehicles in this table are those believed to be regularly fueled with E85 and represent only fleet vehicles covered under the Energy Policy Act. The Energy Information Administration has not updated these data since the 2011 data were released.

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

Year	LPG	CNG	LNG	M85	M100	E85[b]	E95	Electricity[c]	Hydrogen	**Total**
1995	172,806	50,218	603	18,319	386	1,527	136	2,860	0	**246,855**
1996	175,585	60,144	663	20,265	172	4,536	361	3,280	0	**265,006**
1997	175,679	68,571	813	21,040	172	9,130	347	4,453	0	**280,205**
1998	177,183	78,782	1,172	19,648	200	12,788	14	5,243	0	**295,030**
1999	178,610	91,267	1,681	18,964	198	24,604	14	6,964	0	**322,302**
2000	181,994	100,750	2,090	10,426	0	87,570	4	11,830	0	**394,664**
2001	185,053	111,851	2,576	7,827	0	100,303	0	17,847	0	**425,457**
2002	187,680	120,839	2,708	5,873	0	120,951	0	33,047	0	**471,098**
2003	190,369	114,406	2,640	0	0	176,799	0	47,485	9	**531,708**
2004	182,864	118,532	2,717	0	0	211,800	0	49,536	43	**565,492**
2005	173,795	117,699	2,748	0	0	246,363	0	51,398	119	**592,122**
2006	164,846	116,131	2,798	0	0	297,099	0	53,526	159	**634,559**
2007	158,254	114,391	2,781	0	0	364,384	0	55,730	223	**695,763**
2008	151,049	113,973	3,101	0	0	450,327	0	56,901	313	**775,664**
2009	147,030	114,270	3,176	0	0	504,297	0	57,185	357	**826,315**
2010	143,037	115,863	3,354	0	0	618,506	0	57,462	421	**938,643**
2011	139,477	118,214	3,436	0	0	862,837	0	67,295	527	**1,191,786**
				Average annual percentage change						
1995-2011	-1.3%	5.5%	11.5%	-100.0%	-100.0%	48.6%	-100.0%	21.8%		**10.3%**

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

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

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

[b] Includes only those E85 vehicles believed to be used as alternative-fuels vehicles (AFVs), primarily fleet-operated vehicles; excludes other vehicles with E85-fueling capability. In 1997, some vehicle manufacturers began including E85-fueling capability in certain model lines of vehicles. For 2009, the Energy Information Administration (EIA) estimates that the number of E85 vehicles that are capable of operating on E85, motor gasoline, or both, is about 10 million. Many of these AFVs are sold and used as traditional gasoline-powered vehicles.

[c] Excludes HEVs.

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

Table 6.2
Alternative Fuel Transit Vehicles, 2014

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

Note: HEV = hybrid-electric vehicle; PHEV = plug-in hybrid-electric vehicle; EV = electric vehicle; FCV = fuel cell vehicle; LEV = low emission vehicle; ILEV = inherently low emission vehicle; ULEV = ultra-low emission vehicle; ZEV = zero emission vehicle; TLEV = transitional low emission vehicle; SULEV = super ultra-low emission vehicle; AT-PZEV = advanced technology - partial zero emissions vehicle. See Chapter 12 for details on emissions.

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

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

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

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

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

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

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

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

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

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

Figure 6.1. Clean Cities Coalitions

Source:
U.S. Department of Energy, Alternative Fuel Data Center, May 2015. (Additional resources: www.eere.energy.gov/cleancities/progs/coalition_locations.php)

Table 6.9
Properties of Conventional and Alternative Liquid Fuels

Property	Liquid Fuels			
	Gasoline	Low-sulfur diesel	Methanol	Ethanol
Standard chemical formula[a]	C_4 to C_{12}	C_8 to C_{25}	CH_3OH	CH_3CH_2OH
Physical state	Liquid	Liquid	Liquid	Liquid
Molecular weight	100–105	~200	32.04	46.07
Composition (weight %)				
Carbon	85–88	87	37.5	52.2
Hydrogen	12–15	13	12.6	13.1
Oxygen	0	0	49.9	34.7
Main fuel source(s)	Crude oil	Crude oil	Natural gas, coal, or woody biomass	Corn, grains, or agricultural waste
Gasoline gallon equivalent (GGE)[b] (Fuel unit measured/GGE)	1.0 (EO gasoline)	0.889 (Diesel gal/GGE)	2.04 Methanol gal/GGE)	1.20-1.37 (E85[c] gal/GGE) 1.03 (E10 gal/GGE)
Specific gravity (60˚ F/ 60˚ F)	0.72–0.78	0.85	0.796	0.794
Density (lb./gal @ 60˚ F)	6.0–6.5	7.079	6.63	6.61
Boiling temperature (F˚)	80–437	356–644	149	172
Freezing point (F˚)	-40	-40–30	-143.5	-173.2
Autoignition temperature (F˚)	495	~600	897	793
Reid vapor pressure (psi)	8–15	<0.2	4.6	2.3

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

[a] Standard Chemical Formulas represent idealized fuels. Some table values are expressed in ranges to represent typical fuel variations that are encountered in the field.

[b] GGE table values above reflect BTU range for common gasoline baseline references (E0, E10, and indolene certification fuel).

[c] 1 gallon of E85 has 73% to 83% of the energy of one gallon gasoline (variation due to ethanol content in E85)

Table 6.10
Properties of Conventional and Alternative Gaseous Fuels

Property	Gaseous Fuels		
	Propane (LPG)	CNG	Hydrogen
Standard chemical formula[a]	C_3H_8	CH_4	H_2
Physical state	Pressurized liquid	Compressed gas	Compressed gas or liquid
Molecular weight	44.1	16.04	2.02
Composition (weight %)			
Carbon	82	75	0
Hydrogen	18	25	100
Oxygen	n/a	n/a	0
Main fuel source(s)	Underground reserves	Underground reserves and renewable Bio-gas	Natural gas, methanol, electrolysis, and other energy sources
Gasoline gallon equivalent (GGE)[b] (Fuel unit measured/GGE)	1.34-1.38 (LPG gal/GGE)	5.56-5.71 (lb. mass/GGE)[c]	0.991-1.017 (kg mass/GGE)
Diesel gallon equivalent (DGE) (Fuel unit measured/DGE)	1.54 (LPG gal/DGE)	6.38 (lb. mass/DGE)	n/a
Specific Gravity (60˚ F/60˚F)	1.55	0.60	0.069
Density (lb./cu ft @ 60˚F)	0.124	0.0458	0.0056
Freezing point (F˚)	-305.8	-296	-435
Boiling Point (˚F)	-44	-260	-423
Autoignition temperature (F˚)	850-950	1,004	1,050-1,080
Reid vapor pressure (psi)	208	n/a	n/a

Note: n/a = not applicable.

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

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[a] Standard Chemical Formulas represent idealized fuels. Some table values are expressed in ranges to represent typical fuel variations that are encountered in the field.

[b] GGE table values above reflect BTU range for common gasoline baseline references (E0, E10, and indolene certification fuel).

[c] CNG: 1 Gasoline Gallon Equivalent = 5.66 lb. (as referenced by NIST Special Publication 854; Report of the 78th NCWM (1993); p. 326; NG data derived from field sampling of pipeline natural gas by IGT/GRI).