

**ALTERNATIVE FUEL & ADVANCED TECHNOLOGY
VEHICLES & CHARACTERISTICS**

Chapter 6



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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: **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 – afdc.energy.gov

Alternative Fueling Station Locator – afdc.energy.gov/stations/#/find/nearest

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

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

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

Tools – afdc.energy.gov/tools

The Energy Information Administration (EIA) is no longer publishing estimates of the number of alternative vehicles in use in the United States. EIA does publish the number of alternative fuel vehicles “made available” each year, beginning in 2004. The alternative fuel vehicles “made available” are estimates from vehicle manufacturer production and companies performing vehicle conversions. The data are more of a proxy for alternative fuel vehicle sales than for vehicle population, but EIA cautions that the data are not actual sales data.

Table 6.1
Estimates of Alternative Fuel Highway Vehicles Made Available, 2004-2018

Year	CNG	Electric ^a	E85	Hydrogen	LNG	LPG
2004	7,752	2,200	674,678	31	136	2,150
2005	3,304	2,281	743,948	74	68	700
2006	3,128	2,715	1,011,399	40	92	473
2007	2,487	3,152	1,115,069	63	26	356
2008	4,440	2,802	1,175,345	63	384	695
2009	3,770	2,255	805,777	26	126	861
2010	4,973	2,229	1,484,945	64	231	747
2011	5,674	25,382	2,116,273	107	137	1,054
2012	7,672	46,624	2,446,966	56	101	1,134
2013	9,454	130,323	2,665,470	10	344	2,700
2014	6,662	92,594	2,433,113	3	535	1,708
2015	8,744	118,560	1,881,500	2	7	2,248
2016	7,840	162,951	1,272,091	29	10	1,932
2017	5,939	258,689	1,150,097	2,842	0	2,837
2018	4,451	253,678	813,774	2,513	0	2,468
	<i>Average annual percentage change</i>					
2004-2018	-3.9%	40.4%	1.3%	36.9%	-100.0%	1.0%
2008-2018	0.0%	56.9%	-3.6%	44.6%	-100.0%	13.5%

Note: “Made available” refers to the supply of warranted alternative fuel vehicles by manufacturers and aftermarket conversion companies. These do not represent sales.

Source:

U. S. Department of Energy, Energy Information Administration website, “Alternative Fuel Vehicle Data,” www.eia.gov/renewable/afv, September 2019. (Additional resources: www.eia.gov)

^a Includes plug-in hybrid-electric vehicles and all-electric vehicles.

Hybrid vehicle sales began in 1999 and plug-in electric vehicle sales began in 2010. Hybrids captured 5.5% of the light vehicle market in 2021. All-electric vehicles accounted for 3.2% of the light vehicle market in 2021, nearly double that of 2020.

Table 6.2 (Updated June 2022)
Hybrid and Plug-In Vehicle Sales, 1999-2021

Calendar year	Hybrid vehicle sales (thousands)	Plug-in hybrid vehicle sales (thousands)	All-electric vehicle sales ^a (thousands)	All light vehicle sales ^a (thousands)	Hybrid share of all light vehicles	Plug-in hybrid share of all light vehicles	All-electric share of all light vehicles
1999	0.0	0.0	0.0	16,711	0.0%	0.0%	0.0%
2000	9.4	0.0	0.0	17,164	0.1%	0.0%	0.0%
2001	20.3	0.0	0.0	16,950	0.1%	0.0%	0.0%
2002	36.0	0.0	0.0	16,675	0.2%	0.0%	0.0%
2003	47.6	0.0	0.0	16,494	0.3%	0.0%	0.0%
2004	84.2	0.0	0.0	16,737	0.5%	0.0%	0.0%
2005	205.9	0.0	0.0	16,774	1.2%	0.0%	0.0%
2006	251.9	0.0	0.0	16,336	1.5%	0.0%	0.0%
2007	351.1	0.0	0.0	15,867	2.2%	0.0%	0.0%
2008	315.8	0.0	0.0	13,015	2.4%	0.0%	0.0%
2009	290.3	0.0	0.0	10,236	2.8%	0.0%	0.0%
2010	274.6	0.3	0.0	11,394	2.4%	0.0%	0.0%
2011	266.5	7.7	10.1	12,542	2.1%	0.1%	0.1%
2012	434.6	38.6	14.6	14,220	3.1%	0.3%	0.1%
2013	495.5	49.0	48.1	15,279	3.2%	0.3%	0.3%
2014	452.2	55.4	63.5	16,192	2.8%	0.3%	0.4%
2015	384.4	43.0	71.1	17,107	2.2%	0.3%	0.4%
2016	346.9	72.9	86.7	17,179	2.0%	0.4%	0.5%
2017	362.9	91.2	104.5	16,827	2.2%	0.5%	0.6%
2018	338.1	123.9	207.1	16,919	2.0%	0.7%	1.2%
2019	380.8	85.8	233.8	16,630	2.3%	0.5%	1.4%
2020	455.1	69.0	238.5	14,123	3.2%	0.5%	1.7%
2021	799.0	173.5	459.4	14,570	5.5%	1.2%	3.2%
<i>Average annual percentage change</i>							
2000-2021	23.6%	^c	^c	-0.8%			
2011-2021	11.5%	36.6%	46.5%	1.5%			

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, 2022. (Additional resources: www.anl.gov/energy-systems/project/light-duty-electric-drive-vehicles-monthly-sales-updates)

All Light Vehicle Sales – Table 3.11.

^a Includes plug-in hybrid-electric vehicles and all-electric vehicles.

^b Includes cars and trucks up to 10,000 lb gross vehicle weight.

^c Data are not available.

Trolleybus, heavy rail, and light rail use nearly all alternative fuels. However, the 53.4% of buses using alternative fuels in 2020 replace a lot of traditional fuel use.

Table 6.3
Transit Vehicle Alternative Fuel Shares by Mode, 1992-2020

Year	Bus ^a	Trolleybus	Vanpool	Demand response	Commuter rail self-propelled ^b	Commuter rail locomotive ^b	Heavy rail ^c	Light rail ^d
1992	2.0%	e	e	e	e	e	e	e
1993	4.1%	e	e	5.8%	e	e	e	e
1994	6.5%	e	e	7.5%	e	e	e	e
1995	6.3%	e	e	11.2%	e	e	e	e
1996	6.4%	100.0%	e	14.0%	e	e	99.9%	100.0%
1997	5.6%	100.0%	e	13.8%	e	e	100.0%	100.0%
1998	6.5%	100.0%	e	13.2%	e	e	100.0%	100.0%
1999	7.5%	100.0%	e	11.4%	e	e	100.0%	100.0%
2000	7.9%	100.0%	e	8.5%	e	e	100.0%	100.0%
2001	9.8%	100.0%	e	5.8%	e	e	100.0%	100.0%
2002	11.8%	100.0%	e	5.1%	e	e	100.0%	100.0%
2003	13.0%	100.0%	e	5.1%	e	e	100.0%	100.0%
2004	13.3%	100.0%	e	5.1%	e	e	100.0%	98.9%
2005	16.0%	100.0%	e	4.9%	e	e	100.0%	100.0%
2006	20.8%	100.0%	e	6.4%	99.3%	11.0%	100.0%	98.0%
2007	22.4%	100.0%	e	5.3%	99.5%	10.2%	100.0%	98.4%
2008	31.6%	100.0%	e	10.9%	99.1%	3.6%	100.0%	99.2%
2009	30.4%	100.0%	e	10.5%	99.5%	10.0%	100.0%	98.2%
2010	33.5%	100.0%	e	8.0%	99.5%	11.3%	100.0%	98.3%
2011	36.6%	100.0%	e	7.7%	99.8%	11.6%	100.0%	98.4%
2013	40.4%	100.0%	e	8.3%	99.2%	16.6%	100.0%	98.4%
2014	41.4%	100.0%	17.0%	16.4%	95.0%	4.1%	100.0%	100.0%
2015	46.9%	100.0%	27.4%	17.0%	98.0%	3.2%	100.0%	100.0%
2016	49.1%	100.0%	29.3%	15.9%	98.2%	1.7%	100.0%	100.0%
2017	54.3%	100.0%	32.1%	19.5%	67.9%	4.4%	100.0%	100.0%
2018	53.8%	100.0%	30.3%	14.4%	98.9%	2.5%	100.0%	100.0%
2019	54.5%	100.0%	0.4%	17.0%	98.9%	2.5%	100.0%	100.0%
2020	53.4%	100.0%	0.2%	13.6%	99.5%	6.6%	100.0%	100.0%

Source:

American Public Transportation Association, *2021 Public Transportation Fact Book*, Washington, DC, May 2021, 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 An electric railway with the capacity for a heavy volume of traffic.

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

^e Data are not available.

Table 6.4
E85 Flex-Fuel Vehicles Available by Manufacturer, Model Year 2021

Model	EPA Size Class	Range E85 (Miles)
Chevrolet Silverado 2WD	Standard Pick-up Trucks 2WD	288/340
Chevrolet Silverado 4WD	Standard Pick-up Trucks 4WD	288/340
Ford Explorer FFV AWD	Standard SUV 4WD	283
Ford F150 Pickup 2WD FFV	Standard Pick-up Trucks 2WD	382/432
Ford F150 Pickup 2WD FFV	Standard Pick-up Trucks 2WD	335/378
Ford F150 Pickup 4WD FFV	Standard Pick-up Trucks 4WD	358/405
Ford F150 Pickup 4WD FFV	Standard Pick-up Trucks 4WD	311/351
Ford Transit Connect Van FFV	Special Purpose Vehicle 2WD	300
Ford Transit Connect Wagon LWB FFV	Special Purpose Vehicle 2WD	300
Ford Transit T150 Wagon 2WD FFV	Vans, Passenger Type	296
Ford Transit T150 Wagon 4WD FFV	Vans, Passenger Type	296
GMC Sierra 2WD	Standard Pick-up Trucks 2WD	288/340
GMC Sierra 4WD	Standard Pick-up Trucks 4WD	288/340

Note: Vehicles with two ranges listed have two fuel tank size options.

Source:

U.S. Department of Energy and U.S. Environmental Protection Agency, Fuel Economy Website, Power Search www.fueleconomy.gov/feg/powerSearch.jsp. Data accessed: July 29, 2021.

Table 6.5
B20, CNG, and LPG Vehicles Available by Manufacturer, Model Year 2021

Model	Fuel ^a	EPA Size Class	Range (Miles)
Cadillac Escalade 2WD	B20	Standard SUV 2WD	^a
Cadillac Escalade 4WD	B20	Standard SUV 4WD	^a
Chevrolet Colorado 2WD	B20	Small Pick-up Trucks 2WD	483
Chevrolet Colorado 4WD	B20	Small Pick-up Trucks 4WD	462
Chevrolet Colorado ZR2 4WD	B20	Small Pick-up Trucks 4WD	399
Chevrolet Silverado 2WD	B20	Standard Pick-up Trucks 2WD	648
Chevrolet Silverado 4WD	B20	Standard Pick-up Trucks 4WD	576
Chevrolet Suburban 2WD	B20	Standard SUV 2WD	644
Chevrolet Suburban 4WD	B20	Standard SUV 4WD	616
Chevrolet Tahoe 2WD	B20	Standard SUV 2WD	672
Chevrolet Tahoe 4WD	B20	Standard SUV 4WD	616
Ford F150 Pickup 4WD	B20	Standard Pick-up Trucks 4WD	529/598
GMC Canyon 2WD	B20	Small Pick-up Trucks 2WD	483
GMC Canyon 4WD	B20	Small Pick-up Trucks 4WD	462
GMC Sierra 2WD	B20	Standard Pick-up Trucks 2WD	624
GMC Sierra 4WD	B20	Standard Pick-up Trucks 4WD	576
GMC Sierra 4WD AT4	B20	Standard Pick-up Trucks 4WD	576
GMC Yukon 2WD	B20	Standard SUV 2WD	598
GMC Yukon 4WD	B20	Standard SUV 4WD	572
GMC Yukon XL 2WD	B20	Standard SUV 2WD	713
GMC Yukon XL 4WD	B20	Standard SUV 4WD	682
Jeep Gladiator EcoDiesel 4x4	B20	Standard Pick-up Trucks 4WD	^a
Jeep Gladiator Rubicon EcoDiesel 4x4	B20	Standard Pick-up Trucks 4WD	^a
Jeep Wrangler 4dr EcoDiesel 4x4	B20	Small SUV 4WD	458
Jeep Wrangler Rubic 4dr EcoDiesel 4x4	B20	Small SUV 4WD	421
Land Rover Range Rover	B20	Standard SUV 4WD	545
Land Rover Range Rover Sport	B20	Standard SUV 4WD	545
RAM 1500 4X2	B20	Standard Pick-up Trucks 2WD	598/676
RAM 1500 4X4	B20	Standard Pick-up Trucks 4WD	552/624
RAM 1500 HFE 4X2	B20	Standard Pick-up Trucks 2WD	^a
No light vehicles fueled with CNG are available in this model year.			
No light vehicles fueled with LPG are available in this model year.			

Note: Vehicles with two ranges listed have two fuel tank size options.

Source:

U.S. Department of Energy and U.S. Environmental Protection Agency, Fuel Economy Website, Power Search www.fueleconomy.gov/feg/powerSearch.jsp. Data accessed July 29, 2021.

^a All diesel vehicles are capable of using B20.

Table 6.6
Hybrid-Electric Vehicles Available by Manufacturer, Model Year 2021

Model	EPA Size Class	Range (Miles)
Acura NSX	Two Seaters	a
Audi A4 allroad quattro	Small Station Wagons	398
Audi A4 quattro	Compact Cars	428
Audi A4 S line quattro	Compact Cars	413
Audi A5 Cabriolet quattro	Subcompact Cars	a
Audi A5 quattro	Subcompact Cars	a
Audi A5 Sportback quattro	Midsize Cars	a
Audi A5 Sportback S line quattro	Midsize Cars	a
Audi A6 Allroad	Midsize Station Wagons	a
Audi A6 quattro 2L	Midsize Cars	502
Audi A6 quattro 3L	Midsize Cars	a
Audi A7 quattro	Midsize Cars	463
Audi A8 3L	Large Cars	a
Audi A8 4L	Large Cars	391
Audi Q5	Small SUV 4WD	462
Audi Q5 Sportback	Small SUV 4WD	a
Audi Q7	Standard SUV 4WD	450
Audi Q8	Standard SUV 4WD	450
Audi RS 6 Avant	Midsize Station Wagons	a
Audi RS 7	Midsize Cars	a
Audi RS Q8	Standard SUV 4WD	a
Audi S6	Midsize Cars	a
Audi S7	Midsize Cars	a
Audi S8	Large Cars	a
BMW 540i	Midsize Cars	a
BMW 540i xDrive	Midsize Cars	468
BMW M340i	Compact Cars	a
BMW M340i xDrive	Compact Cars	a
BMW M440i Convertible	Subcompact Cars	a
BMW M440i xDrive Coupe	Subcompact Cars	390
BMW X5 sDrive40i	Standard SUV 2WD	504
BMW X5 xDrive40i	Standard SUV 4WD	504
BMW X6 sDrive40i	Standard SUV 2WD	504
BMW X6 xDrive40i	Standard SUV 4WD	504
BMW X7 xDrive40i	Standard SUV 4WD	460
Ford Escape AWD HEV	Small SUV 4WD	a
Ford Escape FWD HEV	Small SUV 2WD	a
Ford Explorer HEV AWD	Standard SUV 4WD	465
Ford Explorer HEV RWD	Standard SUV 2WD	502
Ford F150 Pickup 2WD HEV	Standard Pick-up Trucks 2WD	765
Ford F150 Pickup 4WD HEV	Standard Pick-up Trucks 4WD	734
Honda Accord	Large Cars	614
Honda Accord Sport/Touring	Large Cars	550
Honda CR-V AWD	Small SUV 4WD	406
Honda Insight	Midsize Cars	551
Honda Insight Touring	Compact Cars	509
Hyundai Motor Company Elantra Hybrid	Midsize Cars	550
Hyundai Motor Company Elantra Hybrid Blue	Midsize Cars	594
Hyundai Motor Company Ioniq	Large Cars	a
Hyundai Motor Company Ioniq Blue	Large Cars	a
Hyundai Motor Company Santa Fe Hybrid	Small SUV 4WD	a
Hyundai Motor Company Santa Fe Hybrid Blue	Small SUV 4WD	a
Hyundai Motor Company Sonata Hybrid	Large Cars	620
Hyundai Motor Company Sonata Hybrid Blue	Large Cars	686
Jaguar E-PACE MHEV	Small SUV 4WD	a
Jaguar F-PACE P340 MHEV	Small SUV 4WD	a
Jaguar F-PACE P400 MHEV	Small SUV 4WD	a

Table 6.6 (continued)
Hybrid-Electric Vehicles Available by Manufacturer, Model Year 2021

Model	EPA Size Class	Range (Miles)
Jeep Wrangler 2dr 4X4	Small SUV 4WD	368
Jeep Wrangler 4dr 4X4	Small SUV 4WD	452
Kia Motors Corporation Niro	Small Station Wagons	a
Kia Motors Corporation Niro FE	Small Station Wagons	a
Kia Motors Corporation Niro Touring	Small Station Wagons	a
Kia Motors Corporation Sorento Hybrid	Small SUV 2WD	a
Land Rover Defender 110 MHEV	Standard SUV 4WD	a
Land Rover Defender 90 MHEV	Standard SUV 4WD	a
Land Rover Discovery MHEV	Standard SUV 4WD	a
Land Rover Range Rover MHEV	Standard SUV 4WD	550
Land Rover Range Rover Sport MHEV	Standard SUV 4WD	580
Land Rover Range Rover Velar P340 MHEV	Small SUV 4WD	a
Land Rover Range Rover Velar P400 MHEV	Small SUV 4WD	a
Lexus ES 300h	Midsize Cars	581
Lexus LC 500h	Subcompact Cars	644
Lexus LS 500h	Midsize Cars	a
Lexus LS 500h AWD	Midsize Cars	a
Lexus NX 300h AWD	Small SUV 4WD	459
Lexus RX 450h AWD	Standard SUV 4WD	516
Lexus RX 450h L AWD	Standard SUV 4WD	499
Lexus UX 250h	Compact Cars	445
Lexus UX 250h AWD	Compact Cars	413
Mercedes-Benz AMG CLS53 4MATIC+	Compact Cars	547
Mercedes-Benz AMG E53 4MATIC+	Midsize Cars	a
Mercedes-Benz AMG E53 4MATIC+ (Convertible)	Subcompact Cars	485
Mercedes-Benz AMG E53 4MATIC+ (Coupe)	Subcompact Cars	418
Mercedes-Benz AMG GLE 53 4MATIC+	Standard SUV 4WD	428
Mercedes-Benz AMG GLE 53 4MATIC+ (coupe)	Standard SUV 4WD	450
Mercedes-Benz AMG GLE 63 S 4MATIC+	Standard SUV 4WD	360
Mercedes-Benz AMG GLE 63 S 4MATIC+ (coupe)	Standard SUV 4WD	382
Mercedes-Benz AMG GLS 63 4MATIC+	Standard SUV 4WD	381
Mercedes-Benz AMG GT 43 4MATIC+	Compact Cars	a
Mercedes-Benz AMG GT 53 4MATIC+	Compact Cars	a
Mercedes-Benz CLS 450	Compact Cars	a
Mercedes-Benz CLS 450 4MATIC	Compact Cars	a
Mercedes-Benz E 450 (convertible)	Subcompact Cars	435
Mercedes-Benz E 450 (coupe)	Subcompact Cars	452
Mercedes-Benz E 450 4MATIC	Midsize Cars	549
Mercedes-Benz E 450 4MATIC (convertible)	Subcompact Cars	435
Mercedes-Benz E 450 4MATIC (coupe)	Subcompact Cars	435
Mercedes-Benz E 450 4MATIC All-Terrain (wagon)	Midsize Station Wagons	506
Mercedes-Benz GLE 450 4MATIC	Standard SUV 4WD	518
Mercedes-Benz GLE 580 4MATIC	Standard SUV 4WD	428
Mercedes-Benz GLS 450 4MATIC	Standard SUV 4WD	500
Mercedes-Benz GLS 580 4MATIC	Standard SUV 4WD	428
Mercedes-Benz GLS 600 4MATIC Maybach	Standard SUV 4WD	381
Mercedes-Benz S 500 4MATIC	Large Cars	a
Mercedes-Benz S 580 4MATIC	Large Cars	a
Mercedes-Benz S 580 4MATIC Maybach	Large Cars	a
RAM 1500 3.6L 4X2	Standard Pick-up Trucks 2WD	506/572
RAM 1500 5.7L 4X2	Standard Pick-up Trucks 2WD	437/494
RAM 1500 HFE 4X2	Standard Pick-up Trucks 2WD	a
RAM 3.6L 1500 4X4	Standard Pick-up Trucks 4WD	483/546
RAM 5.7L 1500 4X4	Standard Pick-up Trucks 4WD	437/494
Toyota Avalon Hybrid	Midsize Cars	568
Toyota Avalon Hybrid XLE	Midsize Cars	581
Toyota Camry Hybrid LE	Midsize Cars	686
Toyota Camry Hybrid SE/XLE/XSE	Midsize Cars	607
Toyota Corolla Hybrid	Compact Cars	593
Toyota Highlander Hybrid	Small SUV 2WD	616

Table 6.6 (continued)
Hybrid-Electric Vehicles Available by Manufacturer, Model Year 2021

Toyota Highlander Hybrid AWD	Standard SUV 4WD	598
Toyota Highlander Hybrid AWD LTD/PLAT	Standard SUV 4WD	598
Toyota Prius	Midsize Cars	588
Toyota Prius AWD	Midsize Cars	519
Toyota Prius Eco	Midsize Cars	633
Toyota RAV4 Hybrid AWD	Small SUV 4WD	580
TOYOTA Sienna AWD	Special Purpose Vehicle, minivan 2WD	648
TOYOTA Sienna AWD	Special Purpose Vehicle, minivan 4WD	630
Toyota Venza AWD	Small SUV 4WD	566

Note: Vehicles with two ranges listed have two fuel tank size options.

Source:

U.S. Department of Energy and U.S. Environmental Protection Agency, Fuel Economy Website, Power Search www.fueleconomy.gov/feg/powerSearch.jsp. Data accessed July 29, 2021.

^aData are not available.

Table 6.7
Plug-in Hybrid Vehicles Available by Manufacturer, Model Year 2021

Model	EPA Size Class	Range (Miles)
Audi A7 quattro (PHEV)	Midsize Cars	Elec 24 / Total 416
Audi A8L (PHEV)	Large Cars	Elec 18 / Total 397
Audi Q5 (PHEV)	Small SUV 4WD	Elec 19 / Total 378
Bentley Bentayga (PHEV)	Standard SUV 4WD	Elec 18 / Total 372
BMW 330e (PHEV)	Compact Cars	Elec 23 / Total 302
BMW 330e xDrive (PHEV)	Compact Cars	Elec 20 / Total 271
BMW 530e (PHEV)	Compact Cars	Elec 21 / Total 323
BMW 530e xDrive (PHEV)	Compact Cars	Elec 19 / Total 302
BMW 745e xDrive (PHEV)	Large Cars	Elec 17 / Total 270
BMW I3 with Range Extender (PHEV)	Subcompact Cars	Elec 126 / Total 72
BMW I3s with Range Extender (PHEV)	Subcompact Cars	Elec 126 / Total 72
BMW Mini Cooper SE Countryman ALL4 (PHEV)	Midsize Cars	Elec 18 / Total 280
BMW X3 xDrive30e (PHEV)	Small SUV 4WD	Elec 18 / Total 318
BMW X5 xDrive45e (PHEV)	Standard SUV 4WD	Elec 31 / Total 373
Chrysler Pacifica Hybrid (PHEV)	Minivan 2WD	Elec 32 / Total 487
Ferrari SF90 Stradale Coupe (PHEV)	Two Seaters	Elec 9 / Total 320
Ford Escape FWD PHEV	Small SUV 2WD	Elec 37 / Total 487
Jeep Wrangler 4dr 4xe (PHEV)	Small SUV 4WD	Elec 22 / Total 346
Karma GS-6 PHEV (21-inch wheels)	Subcompact Cars	Elec 61 / Total 266
Karma GS-6 PHEV (22-inch wheels)	Subcompact Cars	Elec 54 / Total 224
Karma Revero GT PHEV (21-inch wheels)	Subcompact Cars	Elec 61 / Total 266
Karma Revero GT PHEV (22-inch wheels)	Subcompact Cars	Elec 54 / Total 224
Kia Niro Plug-in Hybrid	Small Station Wagons	Elec 26 / Total 530
Land Rover Range Rover (PHEV)	Standard SUV 4WD	Elec 19 / Total 461
Land Rover Range Rover Sport (PHEV)	Standard SUV 4WD	Elec 19 / Total 461
Lincoln Aviator AWD (PHEV)	Standard SUV 4WD	Elec 21 / Total 443
Lincoln Corsair AWD (PHEV)	Small SUV 4WD	Elec 28 / Total 400
Mitsubishi Outlander PHEV	Small SUV 4WD	Elec 24 / Total 292
Polestar Automotive Polestar-1 (PHEV)	Minicompact Cars	Elec 52 / Total 417
Porsche Cayenne e-Hybrid (PHEV)	Standard SUV 4WD	Elec 17 / Total 414
Porsche Cayenne e-Hybrid Coupe (PHEV)	Standard SUV 4WD	Elec 17 / Total 414
Porsche Cayenne Turbo S e-Hybrid (PHEV)	Standard SUV 4WD	Elec 15 / Total 359
Porsche Cayenne Turbo S e-Hybrid Coupe (PHEV)	Standard SUV 4WD	Elec 15 / Total 359
Porsche Panamera 4 E-Hybrid (PHEV)	Large Cars	Elec 19 / Total 463
Porsche Panamera 4 E-Hybrid Executive (PHEV)	Large Cars	Elec 19 / Total 463
Porsche Panamera 4S E-Hybrid (PHEV)	Large Cars	Elec 19 / Total 461
Porsche Panamera 4S E-Hybrid Executive (PHEV)	Large Cars	Elec 19 / Total 461
Porsche Panamera 4S E-Hybrid Sport Turismo (PHEV)	Large Cars	Elec 19 / Total 461
Porsche Panamera Turbo S E-Hybrid (PHEV)	Large Cars	Elec 17 / Total 413
Porsche Panamera Turbo S E-Hybrid Executive (PHEV)	Large Cars	Elec 17 / Total 413
Porsche Panamera Turbo S E-Hybrid Sport Turismo (PHEV)	Large Cars	Elec 17 / Total 413
Subaru Crosstrek Hybrid AWD (PHEV)	Small SUV 4WD	Elec 17 / Total 464
Toyota Prius Prime (PHEV)	Midsize Cars	Elec 25 / Total 618
Toyota RAV4 Prime AWD (PHEV)	Small SUV 4WD	Elec 42 / Total 558
Volvo S60 AWD (PHEV)	Compact Cars	Elec 22 / Total 485
Volvo S90 AWD (PHEV)	Midsize Cars	Elec 21 / Total 473
Volvo V60 AWD (PHEV)	Small Station Wagons	Elec 22 / Total 485
Volvo XC60 AWD (PHEV)	Small SUV 4WD	Elec 19 / Total 502
Volvo XC90 AWD (PHEV)	Standard SUV 4WD	Elec 18 / Total 505

Note: For Range, the term "Elec" refers to the charge depleting portion of operation where electricity is exclusively or primarily used.

Source:

U.S. Department of Energy and U.S. Environmental Protection Agency, Fuel Economy Website, Power Search www.fueleconomy.gov/feg/powerSearch.jsp. Data accessed July 29, 2021.

Table 6.8
All-Electric and Fuel Cell Vehicles Available by Manufacturer, Model Year 2021

Model	Drive Type	EPA Size Class	Range (Miles)
Audi e-tron	EV	Standard SUV 4WD	222
Audi e-tron Sportback	EV	Standard SUV 4WD	218
BMW I3 BEV (120 Ah battery)	EV	Subcompact Cars	153
BMW I3s BEV (120 Ah battery)	EV	Subcompact Cars	153
Chevy Bolt (BEV)	EV	Small Station Wagons	259
Ford Mustang Mach-E AWD	EV	Small Station Wagons	211
Ford Mustang Mach-E AWD Extended	EV	Small Station Wagons	270
Ford Mustang Mach-E California Route 1 (RWD)	EV	Small Station Wagons	305
Ford Mustang Mach-E RWD	EV	Small Station Wagons	230
Ford Mustang Mach-E RWD Extended	EV	Small Station Wagons	300
Hyundai Ioniq Electric	EV	Midsize Cars	170
Hyundai Kona Electric	EV	Small SUV 2WD	258
Jaguar I-Pace EV400	EV	Small SUV 4WD	234
Kandi K27	EV	Compact Cars	59
Kia Niro Electric	EV	Small Station Wagons	239
Mini Cooper SE Hardtop 2 Door	EV	Subcompact Cars	110
Nissan Leaf (40 kW-hr battery pack)	EV	Midsize Cars	149
Nissan Leaf (62 kW-hr battery pack)	EV	Midsize Cars	226
Nissan Leaf SV/SL (62 kW-hr battery pack)	EV	Midsize Cars	215
Porsche Taycan Performance Battery	EV	Compact Cars	200
Porsche Taycan Performance Battery Plus	EV	Compact Cars	225
Porsche Taycan 4S Performance Battery	EV	Large Cars	199
Porsche Taycan 4S Performance Battery Plus	EV	Large Cars	227
Porsche Taycan Turbo	EV	Large Cars	212
Porsche Taycan Turbo S	EV	Large Cars	201
Tesla Model 3 Long Range AWD	EV	Midsize Cars	353
Tesla Model 3 Performance AWD	EV	Midsize Cars	315
Tesla Model 3 Standard Range Plus RWD	EV	Midsize Cars	263
Tesla Model S Long Range	EV	Large Cars	405
Tesla Model S Performance (19" Wheels)	EV	Large Cars	387
Tesla Model S Performance (21" Wheels)	EV	Large Cars	334
Tesla Model S Plaid (21" Wheels)	EV	Large Cars	348
Tesla Model X Long Range Plus	EV	Standard SUV 4WD	371
Tesla Model X Performance (20" Wheels)	EV	Standard SUV 4WD	341
Tesla Model X Performance (22" Wheels)	EV	Standard SUV 4WD	300
Tesla Model Y Long Range AWD	EV	Small SUV 4WD	326
Tesla Model Y Performance AWD	EV	Small SUV 4WD	303
Tesla Model Y Standard Range Plus RWD	EV	Small SUV 2WD	244
Volkswagen ID.4 1st	EV	Small SUV 2WD	250
Volkswagen ID.4 Pro	EV	Small SUV 2WD	260
Volkswagen ID.4 Pro S	EV	Small SUV 2WD	250
Volvo Polestar 2	EV	Midsize Cars	233
Volvo XC40 AWD BEV	EV	Small SUV 4WD	208
Honda Clarity	FCEV	Midsize Cars	360
Hyundai Nexo	FCEV	Small SUV 2WD	354
Hyundai Nexo Blue	FCEV	Small SUV 2WD	380
Toyota Mirai Limited	FCEV	Compact Cars	357
Toyota Mirai XLE	FCEV	Compact Cars	402

Note: EV = electric vehicle; FCEV = hydrogen fuel cell vehicle.

Source:

U.S. Department of Energy and U.S. Environmental Protection Agency, Fuel Economy Website, Power Search www.fueleconomy.gov/feg/powerSearch.jsp. Data accessed July 29, 2021.

In 1991 there were only two alternative fuel vehicle (AFV) models on the market which were fueled by M85. In 2020 there were 130 different models of AFV on the market, with 64% of those being electric vehicles which include plug-in hybrid-electric vehicles. Another 19% of the models available in 2020 were fueled by E85.

Table 6.9
Number of Alternative Fuel Light Vehicle Models Available, 1991–2020
(number of models available)

Model year	Propane ^a	CNG ^a	Ethanol (E85)	Methanol (M85)	Electric vehicle ^b	Hydrogen	Total
1991	0	0	0	2	0	0	2
1992	0	2	1	2	0	0	5
1993	0	2	1	4	0	0	7
1994	0	2	1	2	0	0	5
1995	0	10	0	2	1	0	13
1996	0	10	1	1	0	0	12
1997	3	9	1	1	3	0	17
1998	3	12	2	0	8	0	25
1999	5	16	6	0	16	0	43
2000	2	15	8	0	12	0	37
2001	5	16	11	0	10	0	42
2002	5	18	16	0	6	0	45
2003	1	16	22	0	5	0	44
2004	1	16	19	0	1	0	37
2005	0	5	24	0	0	0	29
2006	0	5	22	0	0	0	27
2007	0	1	31	0	0	0	32
2008	1	1	31	0	1	0	34
2009	1	1	36	0	1	0	39
2010	0	1	34	0	1	0	36
2011	0	1	72	0	2	0	75
2012	1	6	62	0	6	1	76
2013	6	11	84	0	15	1	117
2014	14	19	90	0	16	2	141
2015	10	17	84	0	27	3	141
2016	5	12	66	0	29	3	115
2017	8	9	45	0	51	2	115
2018	7	9	53	0	57	2	128
2019	7	7	40	0	72	4	130
2020	8	10	25	0	83	4	130
	<i>Average annual percentage change</i>						
1991-2019	c	c	c	-100.0%	c	c	15.5%
2009-2019	c	25.9%	-3.0%	c	55.56%	c	13.7%

Note: Model count differs from data on Tables 6.4-6.7 because heavier vehicles, such as Ford F-250 or RAM 2500 are included.

Source:

U.S. Department of Energy, Alternative Fuels Data Center website, “Light-Duty AFV, HEV, and Diesel Model Offerings, By Fuel Type,” www.afdc.energy.gov/data/10303, August 2021. (Additional resources: www.afdc.energy.gov)

^a Dedicated and bi-fuel vehicles.

^b Electric vehicles include plug-in hybrid-electric vehicles but do not include neighborhood electric vehicles, low-speed electric vehicles, or two-wheeled electric vehicles.

^c Average annual percentage change cannot be calculated from zero.

Table 6.10
Hybrid-Electric Medium/Heavy Trucks and Buses Available by Manufacturer, 2021

Manufacturer - Model	Drive type	Truck type
Ford E350, E450 Cutaway	Hybrid Electric	Vocational/Cab Chassis
Ford E350, E450 Stripped Chassis	Hybrid Electric	Vocational/Cab Chassis
Ford F-59 Stripped Chassis	Hybrid Electric	Vocational/Cab Chassis
Ford Super Duty Chassis Cab F350, F450, F550	Hybrid Electric	Vocational/Cab Chassis
Ford Super Duty F250, F350, F450	Hybrid Electric	Pickup
Ford Transit 250/350 Cargo Van	Hybrid Electric	Van
Ford Transit 250/350 Passenger Van	Hybrid Electric	Passenger Van/Shuttle Bus
Ford Transit CC-CA 250, 350	Hybrid Electric	Vocational/Cab Chassis
Ford F-59 Stripped Chassis	Hybrid E85 Electric	Vocational/Cab Chassis
ENC AXESS 35'	Hybrid Diesel Electric	Transit Bus
ENC AXESS 40'	Hybrid Diesel Electric	Transit Bus
ENC E-Z RIDER II 30'	Hybrid Diesel Electric	Transit Bus
ENC E-Z RIDER II 32'	Hybrid Diesel Electric	Transit Bus
ENC E-Z RIDER II 35'	Hybrid Diesel Electric	Transit Bus
Gillig BRT, BRT Plus, Commuter	Hybrid Diesel Electric	Transit Bus
Gillig Low Floor, Low Floor Plus	Hybrid Diesel Electric	Transit Bus
Gillig Trolley	Hybrid Diesel Electric	Transit Bus
Global M4 Hybrid	Hybrid Diesel Electric	Street Sweeper
Hino 195h, 195hDC Hybrid Cab-Over	Hybrid Diesel Electric	Vocational/Cab Chassis
Hometown Trolley Streetcar	Hybrid Diesel Electric	Passenger Van/Shuttle Bus
MCI D4000 Hybrid Commuter Coach	Hybrid Diesel Electric	Transit Bus
MCI D4500 Hybrid Commuter Coach	Hybrid Diesel Electric	Transit Bus
New Flyer Xcelsior 40'	Hybrid Diesel Electric	Transit Bus
New Flyer Xcelsior 60'	Hybrid Diesel Electric	Transit Bus
Nova Bus LFS Artic HEV	Hybrid Diesel Electric	Transit Bus
Nova Bus LFS HEV	Hybrid Diesel Electric	Transit Bus
US Hybrid HySweep sweeper	Hybrid Diesel Electric	Street Sweeper

Source:

U.S. Department of Energy, Alternative Fuels Data Center website, www.afdc.energy.gov/vehicles/search, August 2021. (Additional resources: www.afdc.energy.gov)

Table 6.11
Electric-Drive Medium/Heavy Trucks and Buses Available by Manufacturer, 2021

Manufacturer - Model	Drive type	Truck type
Ford Super Duty F250, F350, F450	Plug-in Hybrid Electric	Pickup
US Hybrid H2Truck	Plug-in Hybrid Electric	Tractor
US Hybrid H2Cargo	Plug-in Hybrid Electric	Step Van
US Hybrid H2Ride 30	Plug-in Hybrid Electric	Passenger Van/Shuttle Bus
US Hybrid H2Ride 32	Plug-in Hybrid Electric	Passenger Van/Shuttle Bus
Blue Bird All American RE Electric	Electric	School Bus
Blue Bird All American RE Electric Activity	Electric	Passenger Van/Shuttle Bus
Blue Bird Micro Bird Activity G5 Electric	Electric	Passenger Van/Shuttle Bus
Blue Bird Micro Bird G5 Electric	Electric	School Bus
Blue Bird Vision Electric	Electric	School Bus
Blue Bird Vision Electric Activity	Electric	Passenger Van/Shuttle Bus
BYD 23' Electric Motor Coach	Electric	Passenger Van/Shuttle Bus
BYD 30' Electric transit	Electric	Transit Bus
BYD 35' Double Decker Electric Bus	Electric	Transit Bus
BYD 35' Electric Motor Coach	Electric	Passenger Van/Shuttle Bus
BYD 35' Electric Transit	Electric	Transit Bus
BYD 40' Electric Motor Coach	Electric	Passenger Van/Shuttle Bus
BYD 40' Electric Transit	Electric	Transit Bus
BYD 45' Double Decker Electric Bus	Electric	Transit Bus
BYD 45' Electric Motor Coach	Electric	Passenger Van/Shuttle Bus
BYD 60' Electric Transit	Electric	Transit Bus
BYD 6F	Electric	Vocational/Cab Chassis
BYD 6R	Electric	Refuse
BYD 8R	Electric	Refuse
BYD 8TT Day Cab	Electric	Tractor
BYD 8Y Terminal Tractor	Electric	Tractor
Chanje V8100 Panel Van	Electric	Van
COBUS Industries e.COBUS 2700	Electric	Transit Bus
COBUS Industries e.COBUS 2700S	Electric	Transit Bus
COBUS Industries e.COBUS 3000	Electric	Transit Bus
Collins Bus Type A School Bus (DE516)	Electric	School Bus
Collins Bus Type A School Bus (DE516WF)	Electric	School Bus
Ford E-450 Box Truck	Electric	Vocational/Cab Chassis
Ford E450 Cutaway	Electric	Vocational/Cab Chassis
Ford E-450 School Bus	Electric	School Bus
Ford E-450 Shuttle	Electric	Passenger Van/Shuttle Bus
Ford E-450 Step Van	Electric	Step Van
Ford E450 Stripped Chassis	Electric	Vocational/Cab Chassis
Ford E-450 Work Truck	Electric	Vocational/Cab Chassis
Ford F-550 Bus	Electric	Passenger Van/Shuttle Bus
Ford F-59 School Bus	Electric	School Bus
Ford F-59 Shuttle Bus	Electric	Passenger Van/Shuttle Bus
Ford F-59 Step Van	Electric	Step Van
Ford F-59 Stripped Chassis	Electric	Vocational/Cab Chassis
Ford F-650 Box Truck	Electric	Vocational/Cab Chassis
Ford Transit 250/350 Cargo Van	Electric	Van
Ford Transit 250/350 Passenger Van	Electric	Passenger Van/Shuttle Bus
Ford Transit CC-CA 250, 350	Electric	Vocational/Cab Chassis
Gillig Low Floor Plus	Electric	Transit Bus
Global M3 SUPERCHARGED	Electric	Street Sweeper

Table 6.11 (Continued)
Electric-Drive Medium/Heavy Trucks and Buses Available by Manufacturer, 2021

Global M4 SUPERCHARGED	Electric	Street Sweeper
GreenPower Motor Co AV Star	Electric	Passenger Van/Shuttle Bus
GreenPower Motor Co BEAST	Electric	School Bus
GreenPower Motor Co EV250	Electric	Transit Bus
GreenPower Motor Co EV350	Electric	Transit Bus
GreenPower Motor Co EV550	Electric	Transit Bus
GreenPower Motor Co EV Star	Electric	Passenger Van/Shuttle Bus
GreenPower Motor Co EV Star+	Electric	Passenger Van/Shuttle Bus
GreenPower Motor Co EV Star Cargo	Electric	Van
GreenPower Motor Co EV Star Cargo+	Electric	Van/Vocational/Cab Chassis
GreenPower Motor Co EV Star CC	Electric	Vocational/Cab Chassis
Hometown Trolley Commuter	Electric	Passenger Van/Shuttle Bus
Hometown Trolley Mainstreet	Electric	Transit Bus
Hometown Trolley Streetcar	Electric	Transit Bus
Hometown Trolley Urban	Electric	Transit Bus
Hometown Trolley View	Electric	Transit Bus
Hometown Trolley Villager	Electric	Passenger Van/Shuttle Bus
Kalmar Ottawa T2E	Electric	Tractor
Lion Electric LION6	Electric	Vocational/Cab Chassis
Lion Electric LION8	Electric	Vocational/Cab Chassis
Lion Electric LION8	Electric	Refuse
Lion Electric LION8T	Electric	Tractor
Lion Electric LIONA	Electric	School Bus
Lion Electric LIONC	Electric	School Bus
Lion Electric LIOND	Electric	School Bus
Lion Electric LIONM	Electric	Passenger Van/Shuttle Bus
Mack LR	Electric	Refuse
MCI D45 CRT LE CHARGE	Electric	Transit Bus
MCI J4500e CHARGE	Electric	Transit Bus
Mercedes-Benz eSprinter	Electric	Van
New Flyer Xcelsior CHARGE 35'	Electric	Transit Bus
New Flyer Xcelsior CHARGE 40'	Electric	Transit Bus
New Flyer Xcelsior CHARGE 60'	Electric	Transit Bus
Nova Bus LFSe	Electric	Transit Bus
Nova Bus LFSe+	Electric	Transit Bus
Orange EV T Series terminal	Electric	Tractor
Peterbilt 220EV	Electric	Vocational/Cab Chassis
Peterbilt 520EV	Electric	Refuse
Peterbilt 579EV	Electric	Tractor
Proterra ZX5 35-Foot Bus	Electric	Transit Bus
Proterra ZX5+ 35-Foot Bus	Electric	Transit Bus
Proterra ZX5 40-Foot Bus	Electric	Transit Bus
Proterra ZX5+ 40-Foot Bus	Electric	Transit Bus
Proterra ZX5MAX 40-Foot Bus	Electric	Transit Bus
Starcraft Allstar 22	Electric	Passenger Van/Shuttle Bus
Starcraft E-Quest	Electric	School Bus
Starcraft E-Quest XL	Electric	School Bus
Thomas Built Saf-T-Liner C2 Jouley	Electric	School Bus
Turtle Top Ford - Terra Transit	Electric	Passenger Van/Shuttle Bus
US Hybrid eCargo	Electric	Step Van
US Hybrid eTruck drayage	Electric	Tractor
Van Hool CX45E	Electric	Transit Bus
Volvo VNR Electric	Electric	Tractor
Workhorse C-Series	Electric	Step Van
ENC AXESS-FC 35'	Hydrogen Fuel Cell	Transit Bus

Table 6.11 (Continued)
Electric-Drive Medium/Heavy Trucks and Buses Available by Manufacturer, 2021

ENC AXESS-FC 40'	Hydrogen Fuel Cell	Transit Bus
New Flyer Xcelsior CHARGE H2 40'	Hydrogen Fuel Cell	Transit Bus
New Flyer Xcelsior CHARGE H2 60'	Hydrogen Fuel Cell	Transit Bus
US Hybrid H2Truck	Hydrogen Fuel Cell	Tractor
US Hybrid H2Cargo	Hydrogen Fuel Cell	Step Van
US Hybrid H2Ride 30	Hydrogen Fuel Cell	Passenger Van/Shuttle Bus
US Hybrid H2Ride 32	Hydrogen Fuel Cell	Passenger Van/Shuttle Bus

Source:

U.S. Department of Energy, Alternative Fuels Data Center website, www.afdc.energy.gov/vehicles/search, August 2021. (Additional resources: www.afdc.energy.gov)

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

Table 6.12
Number of Alternative Refuel Sites by State and Fuel Type, 2021

State	B20 sites	CNG sites	E85 sites	Electric stations	Electric charging outlets	Hydrogen sites	LNG sites	LPG sites	Totals by State ^a
Alabama	10	31	33	257	627	0	2	70	773
Alaska	0	1	0	39	69	0	0	3	73
Arizona	75	29	19	791	2,006	1	7	78	2,215
Arkansas	17	15	66	144	425	0	0	35	558
California	22	326	251	13,891	39,091	52	41	261	40,044
Colorado	6	33	87	1486	3,682	1	0	52	3,861
Connecticut	1	17	3	518	1,373	1	0	20	1,415
Delaware	0	2	1	114	277	1	0	9	290
Dist. of Columbia	7	2	4	278	781	0	0	0	794
Florida	7	57	110	2,480	6,368	0	3	139	6,684
Georgia	4	50	65	1555	3,842	0	4	87	4,052
Hawaii	8	0	1	388	824	2	0	1	836
Idaho	0	11	5	136	340	0	0	24	380
Illinois	20	40	298	997	2,552	0	2	94	3,006
Indiana	7	32	238	342	897	0	1	53	1,228
Iowa	12	11	333	252	528	0	0	33	917
Kansas	7	21	60	480	985	0	1	37	1,111
Kentucky	3	9	71	177	409	0	1	22	515
Louisiana	2	22	22	158	383	0	1	50	480
Maine	1	2	0	274	577	0	0	8	588
Maryland	27	15	45	1171	3,142	0	0	28	3,257
Massachusetts	8	13	7	1902	4,287	2	1	30	4,348
Michigan	10	24	246	781	1,700	2	0	87	2,069
Minnesota	157	22	445	562	1,297	0	0	48	1,969
Mississippi	1	7	4	110	427	0	2	73	514
Missouri	2	20	120	1012	2,116	0	1	64	2,323
Montana	0	1	2	70	200	0	0	27	230
Nebraska	3	9	88	160	341	0	1	27	469
Nevada	1	6	11	427	1280	0	0	23	1321
New Hampshire	2	4	0	152	322	0	0	18	346
New Jersey	5	28	7	710	1,891	0	0	13	1,944
New Mexico	2	11	18	173	425	0	1	55	512
New York	26	55	83	2,774	7,018	1	0	45	7,228
North Carolina	109	39	99	1029	2,537	0	1	80	2,865
North Dakota	1	1	46	55	122	0	0	19	189
Ohio	10	52	209	847	1,948	2	4	73	2,298
Oklahoma	1	116	74	294	1045	0	0	122	1358
Oregon	37	16	4	948	2,360	0	2	44	2,463
Pennsylvania	5	90	146	1071	2,494	0	3	86	2,824
Rhode Island	3	3	0	227	576	0	0	5	587
South Carolina	33	11	47	371	790	0	1	49	931
South Dakota	0	0	81	50	137	0	0	22	240
Tennessee	8	20	91	674	1,582	0	4	66	1,771
Texas	18	108	269	2,190	5,145	0	15	382	5,937
Utah	1	46	1	847	1,777	0	0	42	1,867
Vermont	2	3	0	309	837	0	0	1	843
Virginia	4	24	66	1017	2,947	1	1	84	3,127
Washington	33	25	14	1,711	4,208	1	1	83	4,365
West Virginia	0	2	38	105	283	0	0	14	337
Wisconsin	4	42	259	469	910	0	1	63	1,279
Wyoming	0	8	9	65	178	0	0	20	215
Totals by Fuel	722	1,532	4,196	47,040	120,358	67	102	2,869	129,846

Source:

U.S. Department of Energy, Alternative Fuels Data Center website,
www.afdc.energy.gov/afdc/fuels/stations_counts.html, August 2021. (Additional resources: www.afdc.energy.gov)

^a Totals by State is the total number of fuel types available at stations. Stations are counted once for each type of fuel available. For electric, the number of charging outlets was used.

There were just over 3,000 propane stations in the United States in 1992 making up 89% of all alternative refueling stations. Electric vehicle stations are now counted as all other fuels, with a station being one geographic location where electricity is provided. Previously, the series changed to use the number of charging plugs in 2011. There were more electric vehicle refueling stations in 2021 than any other alternative fuel.

Table 6.13
Number of Alternative Refuel Stations, 1992–2021
(number of stations)

Year	Propane	CNG	LNG	Biodiesel ^a	Ethanol (E85)	Methanol (M85)	Electric vehicle ^b	Hydrogen	Total	
1992	3,297	349	c	0	2	43	c	c	3,691	
1993	3,297	497	c	0	7	50	c	c	3,851	
1994	3,299	1,042	c	0	32	82	c	c	4,455	
1995	3,299	1,065	c	0	37	88	188	c	4,677	
1996	4,252	1,419	72	0	68	95	194	c	6,100	
1997	4,255	1,426	71	0	71	106	310	c	6,239	
1998	5,318	1,268	66	0	40	91	486	c	7,269	
1999	4,153	1,267	46	0	49	51	490	c	6,056	
2000	3,268	1,217	44	2	113	3	558	c	5,205	
2001	3,403	1,232	44	16	154	0	693	c	5,542	
2002	3,431	1,166	36	79	149	0	873	7	5,741	
2003	3,966	1,035	62	142	188	0	830	7	6,230	
2004	3,689	917	58	176	200	0	671	9	5,720	
2005	2,995	787	40	304	436	0	588	14	5,164	
2006	2,619	732	37	459	762	0	465	17	5,091	
2007	2,331	731	35	805	1,325	0	432	33	5,692	
2008	2,110	771	38	633	1,699	0	440	51	5,742	
2009	2,420	803	37	660	1,982	0	484	63	6,449	
2010	2,604	869	43	615	2,296	0	626	58	7,111	
2011	2,551	941	43	633	2,494	0	2,100	56	8,818	
2012	2,644	1,155	61	690	2,519	0	6,200	58	13,327	
2013	2,967	1,290	84	832	2,616	0	8,100	53	15,942	
2014	2,931	1,495	103	783	2,840	0	10,712	51	18,915	
2015	3,749	1,607	117	713	3,012	0	13,696	35	22,929	
2016	3,654	1,730	140	716	3,095	0	17,723	58	27,116	
2017	3,510	1,682	137	704	3,379	0	19,792	63	29,267	
2018	3,319	1,621	129	680	3,627	0	22,826	62	32,264	
2019	3,176	1,576	118	611	3,786	0	26,959	64	36,290	
2020	2,956	1,549	106	712	3,946	0	31,738	63	41,070	
2021	2,869	1,532	102	722	4,196	0	47,040	67	56,528	
				<i>Average annual percentage change</i>						
1992-2021	-0.5%	5.2%	c	c	30.2%	-100.0%	c	c	9.9%	
2011-2021	1.2%	5.0%	9.0%	1.3%	5.3%	c	36.5%	1.8%	20.4%	

Source:

U.S. Department of Energy, Alternative Fuels Data Center website, “U.S. Alternative Fueling Stations by Fuel Type,” www.afdc.energy.gov/data/10332. (Additional resources: www.afdc.energy.gov)

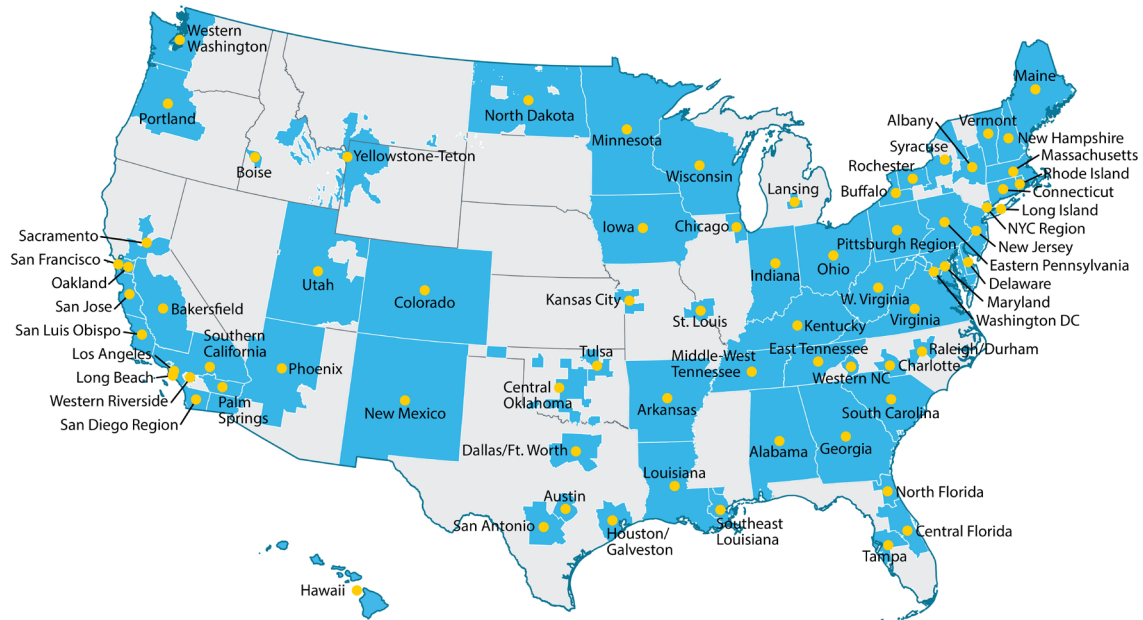
^a Stations selling biodiesel blends less than B20 are included in the station count for years 2005-2007 only.

^b For all years, an electric vehicle station is one geographic location where electric vehicles can charge..

^c Data are not 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, Clean Cities website, "Clean Cities Coalition Locations,"
cleancities.energy.gov/coalitions/locations, February 2022. (Additional resources: cleancities.energy.gov)

The 2019 California Vehicle Survey

Data on vehicles operating in California are necessary for the California Energy Commission to forecast future state transportation needs. The California Vehicle Survey was begun two decades ago to meet those needs and has been conducted periodically since that time. The survey uses a multi-method sampling approach with samples stratified by the six regions defined across California (San Francisco, Sacramento, Central Valley, Los Angeles, San Diego, and the Rest of California). The survey includes both residential and commercial light vehicle owners, as well as an add-on survey for those who own or lease plug-in electric vehicles (PEV). The PEV owner survey asks questions related to vehicle refueling, charging, use, and incentives. Data from the California Vehicle Survey are shown in Tables 6.14-6.16 and Figures 6.2 and 6.3. Additional information on this survey can be found at: www.energy.ca.gov/data-reports/surveys/california-vehicle-survey.

In the 2019 California Vehicle Survey, Level 1 and Level 2 charging are still the primary charging type to both residential and commercial plug-in electric vehicle owners. The commercial plug-in electric vehicle owners were more likely to report charging DC fast chargers.

Table 6.14
Primary Vehicle Charging Type, 2019 California Vehicle Survey

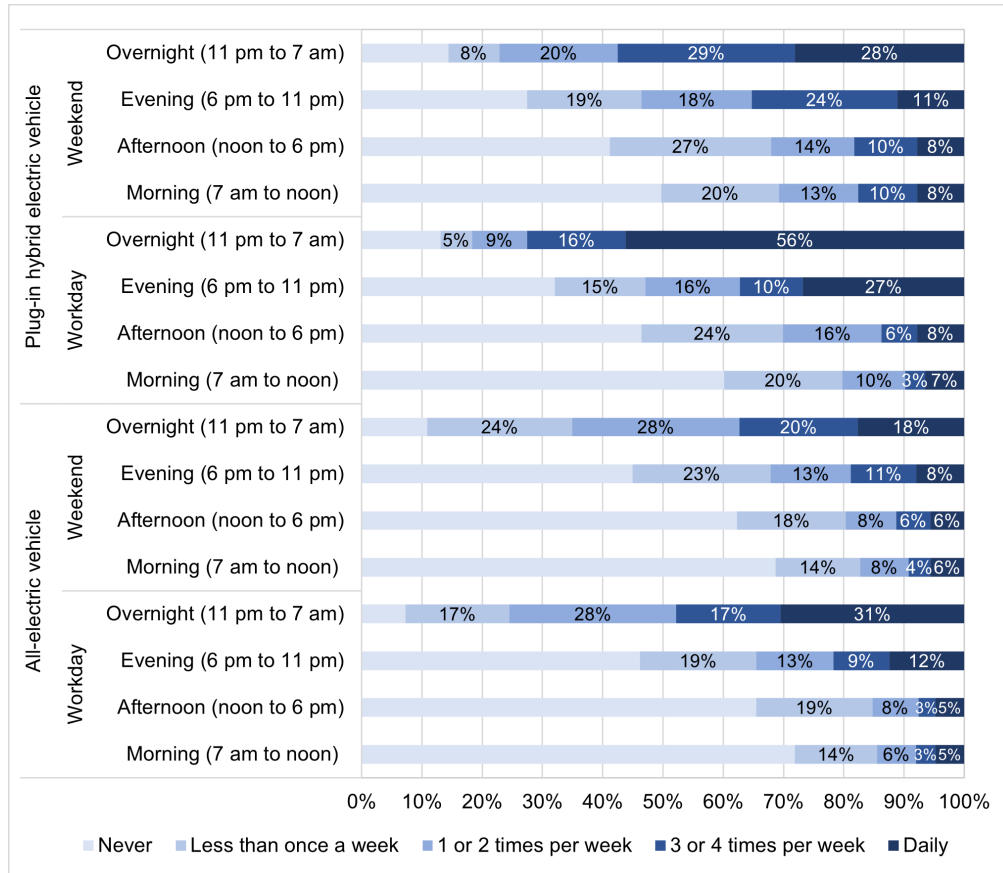
Charging frequency	Plug-in hybrid electric vehicle owners		All-electric vehicle owners		Total	
	Count	Percent	Count	Percent	Count	Percent
Residential Vehicle Owners						
Level 1 (120 V)	156	72%	116	35%	272	49%
Level 2 (240 V)	50	23%	211	63%	261	47%
Direct Current (DC) fast charger	11	5%	8	2%	19	3%
Total	217	100%	335	100%	552	100%
Commercial Vehicle Owners						
Level 1 (120 V)	5	28%	7	29%	12	29%
Level 2 (240 V)	10	56%	13	54%	23	55%
Direct Current (DC) fast charger	3	17%	4	17%	7	17%
Total	18	100%	24	100%	42	100%

Note: Vehicle owners were asked to name the primary charging type regardless of location.

Source:
2019 California Vehicle Survey, California Energy Commission (2021).

California residential plug-in vehicle charging occurs more frequently in the overnight and evening hours. Some utilities offer lower rates for off-peak electricity usage which usually begins in the evening. Plug-in vehicle owners in those areas can schedule their charging to take advantage of lower rates.

Figure 6.2. Typical Daily Charging Times for Residential Plug-in Electric Vehicles, 2019 California Vehicle Survey

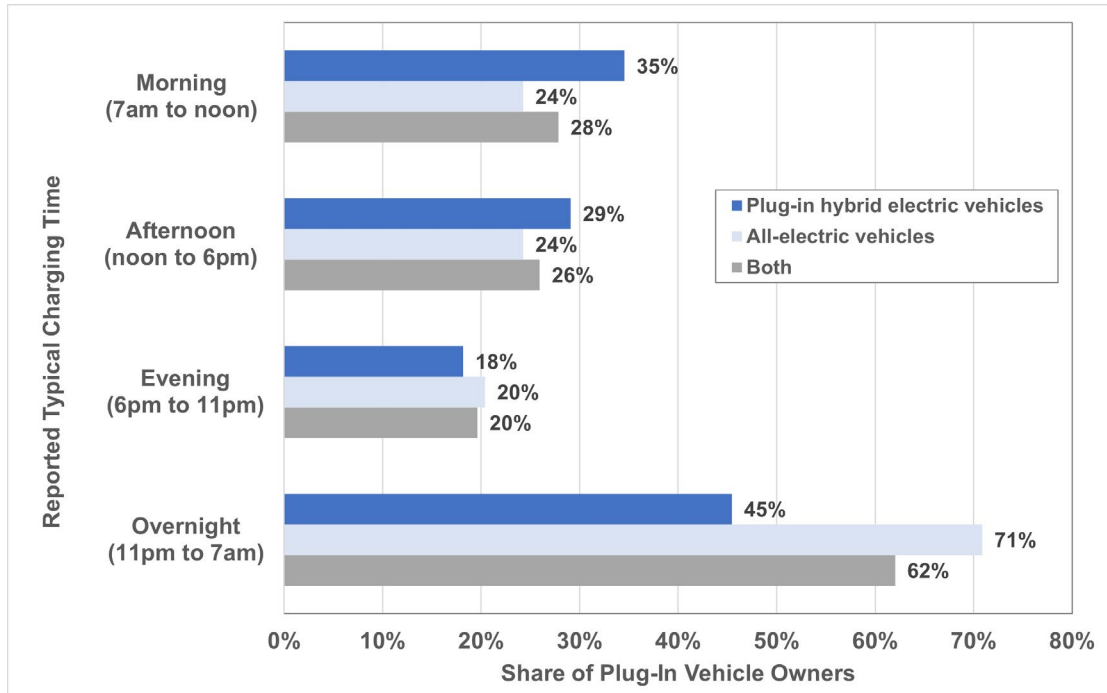


Note: All-electric vehicle samples N=249. Plug-in hybrid electric vehicle samples N=153.

Source: 2019 California Vehicle Survey, California Energy Commission (2021). Accessed December 21, 2021, from <https://www.energy.ca.gov/data-reports/surveys/california-vehicle-survey>

California commercial plug-in vehicle patterns showed most charging occurring during morning and overnight periods. All-electric vehicles were more likely to charge during the overnight time period.

Figure 6.3. Typical Daily Charging Times for Commercial Plug-in Electric Vehicles Onsite, 2019 California Vehicle Survey



Note: Electric vehicles include both all-electric and plug-in hybrid electric vehicles. N=267.

Source:

2019 California Vehicle Survey, California Energy Commission (2021). Accessed December 30, 2021, from <https://www.energy.ca.gov/data-reports/surve>

The 2019 California Vehicle Survey revealed that state rebates and federal tax incentives were the two most important factors cited by household owners in making it possible to buy or lease a plug-in vehicle.

Table 6.15
Ranking of Important Incentives for Household Acquiring an Electric Vehicle,
2019 California Vehicle Survey

How important were each of the following factors in making it possible for you to buy or lease your electric vehicle?	Share of PEV owners answering "extremely important" or "very important"
Federal tax credit (up to \$7,000)	69%
State rebate (up to \$2,500)	66%
HOV lane access	55%
Local/utility incentive (rebate or tax incentive, up to \$5,000)	35%
Manufacturer/dealer incentives (e.g. low interest rate, cash back)	33%
Parking incentives (employer, business, or government)	13%
The availability of car share/car rental as part of purchase	7%

Source:

2019 California Vehicle Survey, California Energy Commission (2021). Accessed December 21, 2021, from <https://www.energy.ca.gov/data-reports/surveys/california-vehicle-survey>

The 2019 California Vehicle Survey showed the satisfaction of residential and commercial plug-in electric vehicle owners. Overall, the owners in California were favorable to plug-in electric vehicles. The satisfaction for residential vehicle owners was higher than for commercial vehicle owners.

Table 6.16
Overall Experience with Plug-in Electric Vehicles, 2019 California Vehicle Survey

Overall experience with the plug-in electric vehicles	Residential vehicle owners	Commercial vehicle owners
I hate it	0.2%	0.7%
A failure	0.2%	0.4%
Unsatisfactory	1.6%	0.7%
Satisfactory	7.1%	17.6%
Excellent	18.4%	24.0%
Delightful	10.0%	6.0%
I love it	62.5%	50.6%

Note: The survey had responses from 282 residential vehicle owners and 135 commercial vehicle owners.

Source:

2019 California Vehicle Survey, California Energy Commission (2021). Accessed December 30, 2021, from <https://www.energy.ca.gov/data-reports/surveys/california-vehicle-survey>

Table 6.17
Properties of Conventional and Alternative Liquid Fuels

Property	Liquid Fuels			
	Gasoline	Low-sulfur diesel	Methanol	Ethanol (E100)
Standard chemical formula ^a	C ₄ to C ₁₂	C ₈ to C ₂₅	CH ₃ OH	CH ₃ CH ₂ OH
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) (Fuel unit measured/GGE)	1.0 (E0 gasoline)	0.889 (Diesel gal/GGE)	2.04 Methanol gal/GGE)	1.20-1.37 (E85 ^b 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:

U.S. Department of Energy, Alternative Fuels Data Center website, “Fuel Properties Comparison,” www.afdc.energy.gov/fuels/fuel_comparison_chart.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 1 gallon of E85 has 73% to 83% of the energy of one gallon of gasoline (variation due to ethanol content in E85).

Table 6.18
Properties of Conventional and Alternative Gaseous Fuels

Property	Gaseous Fuels		
	Propane (LPG)	CNG	Hydrogen
Standard chemical formula ^a	C ₃ H 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) (Fuel unit measured/GGE)	1.34-1.38 (LPG gal/GGE)	5.56-5.71 (lb. mass/GGE) ^b	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:

U.S. Department of Energy, Alternative Fuels Data Center website, "Fuel Properties Comparison," www.afdc.energy.gov/fuels/fuel_comparison_chart.pdf, July 2015, and communication with George Mitchell, National Renewable Energy Laboratory, July 2015.

^a Standard Chemical Formulas represent idealized fuels.

^b 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).