Chapter 9
Alternative Fuel and Advanced Technology Vehicles and Characteristics

Summary Statistics from Tables in this Chapter

Source		
Table 9.1	Alternative fuel vehicles, 2000	432,344
	LPG	*268,000*
	CNG	*100,530*
	LNG	*1,900*
	M85	*18,365*
	E85[a]	*34,680*
	Electric	*8,661*
Table 9.4	Number of alternative fuel refuel sites, 2000	5,205
	LPG	*3,268*
	CNG	*1,217*
	Electric	*558*
Table 9.6	U.S. sales of advanced technology vehicles (calendar year 2000)	
	Honda Insight	*3,788*
	Toyota Prius	*5,562*

Fuel type abbreviations are used throughout this chapter.

LPG	=	*liquified petroleum gas*
CNG	=	*compressed natural gas*
M-85	=	*85% methanol, 15% gasoline*
E-85	=	*85% ethanol, 15% gasoline*
M-100	=	*100% methanol*
E-95	=	*95% ethanol, 5% gasoline*
LNG	=	*liquified natural gas*

[a]Does not include flex-fuel vehicles.

Alternative Fuels

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

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

DOE has established the Alternative Fuels Data Center (AFDC) in support of its work aimed at fulfilling the Alternative Motor Fuels Act (AMFA) directives. The AFDC is operated and managed by the National Renewable Energy Laboratory (NREL) in Golden, Colorado.

The purposes of the AFDC are:

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

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

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

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

There are more LPG vehicles in use than any other alternative fuel vehicle. The population of E85 vehicles, however, has grown the most since 1992. For details on alternative fuel use by fuel type, see Table 2.3.

Table 9.1
Estimates of Alternative Fuel Vehicles in Use, 1992–2001

Fuel type	1992	1995	1998	1999	2000[a]	2001[a]	Average annual percentage change 1992–2001
LPG	221,000	259,000	266,000	267,000	268,000	269,000	2.2%
CNG	23,191	50,218	78,782	89,556	100,530	109,730	18.9%
LNG	90	603	1,172	1,681	1,900	2,039	41.4%
M85	4,850	18,319	19,648	18,964	18,365	16,918	14.9%
M100	404	386	200	198	195	184	-8.4%
E85[b]	172	1,527	12,788	22,464	34,680	48,022	87.0%
E95	38	136	14	14	13	13	-11.2%
Electricity	1,607	2,860	5,243	6,964	8,661	10,400	23.1%
Total	**251,352**	**333,049**	**383,847**	**406,841**	**432,344**	**456,306**	**6.9%**

Source:
U. S. Department of Energy, Energy Information Administration, *Alternatives to Traditional Transportation Fuels,1999*, Washington, DC, 2000, web site www.eia.doe.gov/cneaf/alternate/page/datatables/atf1-13_00.html.
(Additional resources: www.eia.doe.gov)

[a]Based on plans or projections.
[b]Does not include flex-fuel vehicles.

Nearly 90% of private alternative fuel vehicles are fueled by LPG and CNG. The Federal Government does not own many LPG vehicles; its alternative fuel vehicle fleet is split almost 50/50 between CNG and E-85 vehicles in 2001.

Table 9.2
Estimates of Alternative Fuel Vehicles by Ownership, 1996 and 2001

	Private		State and local government		Federal Government	
Fuel type	1996	2001[a]	1996	2001[a]	1996	2001[a]
LPG	167,000	215,000	43,000	54,000	193	229
CNG	25,020	57,481	11,305	35,335	13,945	16,914
LNG	10	472	45	1,514	72	53
M-85	6,633	8,898	5,958	7,848	7,668	172
M-100	0	0	0	184	0	0
E-85	793	18,697	1,995	12,471	1,748	16,854
E-95	0	0	0	13	0	0
Electricity	2,451	4,643	487	4,977	188	780
Total	**201,907**	**305,191**	**62,790**	**116,342**	**23,814**	**35,002**

Source:
U. S. Department of Energy, Energy Information Administration, *Alternatives to Traditional Transportation Fuels, 1999*, Washington, DC, 2000, web site www.eia.doe.gov/cneaf/alternate/page/datatables/atf1-13_00.html.
(Additional resources: www.eia.doe.gov)

[a]Based on plans or projections.

Table 9.3
Alternative Fuel Vehicles Available by Manufacturer, Model Year 2001

Model	Fuel	Type	Emission class
Daimler Chrysler: 1-800-999-FLEET			
Minivan	E-85 flex fuel	Minivan	LEV
Ram Wagon	CNG dedicated	Large van	ULEV/ILEV/SULEV
Ram Van	CNG dedicated	Large van	ULEV/ILEV/SULEV
Ford: 1-877-ALT-FUEL			
Ranger	Electric-lead acid	Standard pickup	ZEV
Explorer Sport	E-85 flex-fuel	Sport utility vehicle	N/A
Crown Victoria	CNG dedicated	Large car	ULEV
Econoline	CNG dedicated	Full-size van	ULEV/ILEV/SULEV
F-Series	CNG dedicated or CNG/LPG bi-fuel	Standard pickup	LEV/ULEV/ILEV/ SULEV
E-Series Cutaway	CNG dedicated	Passenger van	ULEV
Taurus	E-85 flex-fuel	Large car	LEV
General Motors: 1-800-25Electric, 313-556-7723 or 1-888-GM-AFT-4U (CNG)			
EV1 (CA and AZ only)	Electric-lead acid or NiMH	Two-seater	ZEV
Chevrolet S-10	Electric-lead acid or NiMH	Small pickup	ILEV/ZEV
Chevrolet S-10	E85 flex-fuel	Small pickup	LEV
Chevrolet Cavalier	CNG bi-fuel	Subcompact	LEV
Honda: 1-888-CCHonda			
Insight[a]	Hybrid EV-NiMH	Two-seater	LEV/ULEV
Civic GX (CA, NY fleets only)	CNG dedicated	Subcompact	ILEV/ULEV/SULEV
Mazda: 1-800-222-5500			
B3000	E85 flex fuel	Standard pickup	LEV
Nissan: 1-310-771-3422			
Altra EV (CA fleets only)	Electric lithium-ion	Mid-size wagon	ZEV
Hypermini	Electric-lithium ion	Two-seater	ZEV
Solectria Corporation: 1-508-658-2231			
Civitan	Electric-lead acid	Service van	ZEV
Flash	Electric-lead acid	Small pickup truck	ZEV
Force	Electric-lead acid, NiMH, NiCd	Compact	ZEV
Toyota: 1-800-331-4331 (Press 3 for Alternative Fuel Information) (Fleet sales only)			
RAV4-EV (fleets only)	Electric-lead acid, NiMH	Sport utility vehicle	ZEV
Camry (fleets only)	CNG dedicated	Compact	ULEV
Prius[a]	Hybrid EV	Compact	SULEV

Source:
U.S. Department of Energy, National Alternative Fuels Data Center, web site, www.afdc.doe.gov/afvehicles.htm, January 2001. (Additional resources: www.afdc.nrel.gov)

Note:
LEV=low emission vehicle. ILEV=inherently low emission vehicle. ULEV=ultra low emission vehicle. ZEV=zero emission vehicle. TLEV=transitional low emission vehicle. SULEV=super ultra low emission vehicle.

[a]The Honda Insight and the Toyota Prius are considered advanced technology vehicles, not alternative fuel vehicles.

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

Table 9.4
Number of Alternative Refuel Sites by State and Fuel Type, 2000

State	M85 sites	CNG sites	E85 sites	LPG sites	LNG sites	Electric sites	Biodiesel sites	Total
Alabama	0	15	0	75	2	35	0	127
Alaska	0	0	0	9	0	0	0	9
Arizona	0	28	1	105	3	52	1	190
Arkansas	0	7	0	68	0	0	0	75
California	3	207	0	342	9	335	0	896
Colorado	0	44	1	68	1	0	0	114
Connecticut	0	25	0	33	0	1	0	59
Delaware	0	6	0	4	0	0	0	10
District of Columbia	0	3	0	0	0	1	0	4
Florida	0	39	0	149	1	3	0	192
Georgia	0	67	0	55	2	73	0	197
Hawaii	0	0	0	7	0	3	1	11
Idaho	0	8	1	34	0	1	0	44
Illinois	0	21	13	56	0	2	0	92
Indiana	0	34	2	45	3	1	0	85
Iowa	0	5	8	40	0	0	0	53
Kansas	0	5	1	68	1	0	0	75
Kentucky	0	6	1	25	0	0	0	32
Louisiana	0	14	0	33	0	0	0	47
Maine	0	0	0	20	0	0	0	20
Maryland	0	25	0	29	2	1	0	57
Massachusetts	0	15	0	37	0	3	0	55
Michigan	0	31	6	132	1	6	0	176
Minnesota	0	12	54	61	1	0	0	128
Mississippi	0	3	0	32	0	0	0	35
Missouri	0	7	5	130	0	0	0	142
Montana	0	10	1	42	1	0	0	54
Nebraska	0	5	7	29	0	0	0	41
Nevada	0	18	0	32	0	0	0	50
New Hampshire	0	1	0	29	0	1	0	31
New Jersey	0	22	0	28	0	0	0	50
New Mexico	0	14	1	88	1	0	0	104
New York	0	59	0	98	0	6	0	163
N. Carolina	0	9	0	77	0	8	0	94
N. Dakota	0	4	2	14	0	0	0	20
Ohio	0	47	0	75	1	1	0	124
Oklahoma	0	53	0	39	0	0	0	92
Oregon	0	14	0	50	1	0	0	65
Pennsylvania	0	53	0	106	1	1	0	161
Rhode Island	0	6	0	7	0	0	0	13
S. Carolina	0	4	0	60	0	1	0	65
S. Dakota	0	4	7	26	0	0	0	37
Tennessee	0	4	0	59	0	0	0	63
Texas	0	69	0	442	7	2	0	520
Utah	0	62	0	18	1	0	0	81
Vermont	0	0	0	17	0	7	0	24
Virginia	0	27	1	63	3	8	0	102
Washington	0	26	0	88	1	6	0	121
W. Virginia	0	39	0	10	0	0	0	49
Wisconsin	0	22	1	82	0	0	0	105
Wyoming	0	18	0	32	1	0	0	51
Total	**3**	**1,217**	**113**	**3,268**	**44**	**558**	**2**	**5,205**

Source:
U.S. Department of Energy, Alternative Fuels Data Center web site, www.afdc.doe.gov/refuel/state_tot.shtml, March 2001.

Clean Cities is a locally-based government/industry partnership, coordinated by the U.S. Department of Energy to expand the use of alternatives to gasoline and diesel fuel. By combining the decision-making with voluntary action by partners, the "grass-roots" approach of Clean Cities departs from traditional "top-down" Federal programs. It establishes a plan, carried out at the local level, for creating a sustainable, nationwide alternative fuels market.

Table 9.5
List of Clean Cities as of August 2001 by Designation

1. Atlanta, GA - 9/8/93
2. Denver, CO - 9/13/93
3. Philadelphia, PA - 9/22/93
4. State of Delaware - 10/12/93
5. Las Vegas, NV - 10/18/93
6. Washington, DC - 10/21/93
7. Boston, MA - 3/18/94
8. Austin, TX - 4/18/94
9. Florida Gold Coast - 5/3/94
10. Chicago, IL - 5/13/94
11. Land of Enchantment, NM - 6/1/94
12. Wisconsin - SE Area - 6/30/94
13. Colorado Springs, CO - 7/13/94
14. Long Beach, CA - 8/31/94
15. Lancaster, CA - 9/22/94
16. Salt Lake City, UT - 10/3/94
17. White Plains, NY - 10/4/94
18. Baltimore, MD - 10/7/94
19. Commonwealth CC Partnership, KY - 10/18/94
20. Rogue Valley, OR - 11/10/94
21. State of WV - 10/18/94
22. Sacramento, CA - 10/21/94
23. East Bay, CA - 10/21/94
24. San Joaquin Valley, CA - 10/21/94
25. San Francisco, CA - 10/21/94
26. South Bay (San Jose), CA - 10/21/94
27. Western New York - 11/4/94
28. Columbia-Willamette, OR - 11/10/94
29. St. Louis, MO - 11/18/94
30. Connecticut SW Area, - 11/21/94
31. Waterbury, CT - 11/21/94
32. Norwich, CT - 11/22/94
33. New London, CT - 11/22/94
34. Peoria, IL - 11/22/94
35. Kansas - SW Area - 3/30/95
36. Central New York - 6/15/95
37. Dallas/Ft. Worth, TX - 7/25/95
38. Honolulu, HI - 8/29/95
39. Missoula, MT - 9/21/95
40. New Haven, CT - 10/5/95
41. Central Arkansas - 10/25/95
42. Paso Del Norte, TX - 11/17/95
43. Pittsburgh, PA - 12/5/95
44. S. California Assn. Gov. - 3/1/96
45. Los Angeles, CA - 3/22/96
46. Coachella Valley, CA - 4/22/96
47. Weld/Larimer/Rocky Mountain National Park - 5/21/96
48. Central Oklahoma - 5/29/96
49. Hampton Roads, VA -10/4/96
50. San Diego, CA 12/12/96
51. Long Island, NY -10/18/96
52. Detroit, MI/Toronto, ON -12/18/96
53. Cincinnati, OH - 1/29/97
54. Evansville, IN - 1/30/97
55. Houston-Galveston, TX - 9/4/97
56. Portland, ME - 9/4/97
57. Tulsa, OK - 9/22/97
58. Maricopa Assn. of Govts. - 10/8/97
59. NW Riverside County, CA - 10/24/97
60. North Jersey, NJ - 10/31/97
61. Texas Coastal (Corpus Christi), TX - 3/30/98
62. Genesee Region (Rochester), NY - 5/28/98
63. Red River Valley/Grand Forks, ND - 8/10/98
64. Puget Sound, WA - 8/13/98
65. RI - Ocean States - 9/14/98
66. Omaha, NE - 9/18/98
67. Kansas City, KS/MO - 11/18/98
68. Central Indiana CC Alliance, IN - 3/4/99
69. Ann Arbor, MI - 4/19/99
70. Capital District (Albany), NY - 4/26/99
71. South Shore, IN - 6/15/99
72. Capital Clean Cities of CT - 6/21/99
73. Tuscon, AZ - 8/24/99
74. NE Clean Fuels Coalition (Cleveland) - 9/14/99
75. Florida Space Coast - 10/1/99
76. Manhattan Area, KS - 10/4//99
77. The Alamo Area (San Antonio) - 11/10/99
78. Baton Rouge, LA - 4/12/00
79. Truckee Meadows - 6/28/00
80. Raleigh, Durham, Chapel Hill, NC - 3/19/01
81. Twin Cities, MN - 5/31/01
82. State of Vermont - 6/25/01

For more information, contact the Clean Cities Hotline at (800) CCITIES, or write to: U.S. Department of Energy, EE-33, Clean Cities Program, 1000 Independence Avenue SW, Washington, DC 20585.

Source:
U.S. Department of Energy, Alternative Fuel Information, *Clean Cities: Guide to Alternative Fuel Vehicle Incentives & Laws*, Washington, DC, November 1996, and updates from web site, August 2001. (Additional resources: www.ccities.doe.gov)

The Honda Insight and Toyota Prius are the two advanced technology vehicles which are currently available to the public in the U.S. They are both hybrid vehicles, using both electricity (from batteries) and mechanical power (from a small internal combustion engine). Learn more about DOE's hybrid vehicle program at: www.ott.doe.gov/hev.

Table 9.6
Sales and Specifications of Available Advanced Technology Vehicles

	Honda Insight[a]	Toyota Prius
Fuel economy (city/hwy)	61/68 mpg	52/45 mpg
Fuel tank capacity	10.6 gal.	11.8 gal.
Acceleration (0-60 mph)	12.0 sec.	12.69 sec.
Emissions	ULEV/LEV	SULEV
Aerodynamics	0.25 Cd	0.29 Cd
Curb weight	1,856 lbs.	2,765 lbs.
Passenger capacity	2	5
Dimensions:		
Length	155.1 in.	169.6 in.
Width	66.7 in.	66.7 in.
Cargo Capacity	16.3 ft^3	11.8 ft^3
Price	$18,980	$20,450
	Calendar year sales in the U.S.	
1999	17	0
2000	3,788	5,562
2001 (January - July)	3,296	8,443
Total as of July 31, 2001	7,101	14,005

Source:
Manufacturer's web sites: www.honda2001.com/models/insight and prius.toyota.com. Sales data - Ward's Communications, Inc., *Wards Automotive Reports*, Southfield, MI, 2001.

[a]Specifications are for the base model. The Insight is also available with continuously variable transmission.

Hybrid-electric vehicles were chosen by DaimlerChrysler, Ford and General Motors in their efforts to develop environmentally friendly cars with up to triple the fuel efficiency of today's midsize cars--without sacrificing affordability, performance, or safety. The manufacturers are hoping to significantly improve national competitiveness in automotive manufacturing and to apply commercially viable innovation to conventional vehicles with these vehicles, which are currently only at the concept stage.

Table 9. 7
Comparative Specifications of Concept Hybrid-Electric Vehicles

Parameter	Dodge ESX3	Ford Prodigy	GM Precept
Fuel economy	72 mpg gas equiv. 80 mpg diesel[a]	72 mpg gas equiv. 80 mpg diesel[a]	80 mpg gas equiv. 90 mpg diesel[a]
Range	400 miles	660 miles	380 miles
Acceleration (0–60 mph)	11.0 seconds	12.0 seconds	11.5 seconds
Emissions	Target is Tier 2	Target is Tier 2	Target is Tier 2
Areodynamics	0.22 Cd	0.199 Cd	0.163 Cd
Curb weight	2,250 lbs.	2,387 lbs.	2,592 lbs.
Passenger capacity	5	5	5
Dimensions: Length Width	192.8 in. 74.2 in.	186.9 in. 69.1 in.	193.2 in. 67.9 in.
Cargo Capacity	16.0 ft^3	14.6 ft^3	4.4 ft^3
Safety	Meet FMVSS[b]	Meet FMVSS[b]	Meet FMVSS[b]

Source:
Media Information, 2000.

[a]Fuel economy for Dodge using "Designer" diesel (0 ppm sulfur); Ford using Swedish clean diesel (<10 ppm sulfur); GM using California low-sulfur diesel (<30 ppm sulfur).

The U.S. Advanced Battery Consortium (USABC)

Electric and hybrid-electric vehicles are required to be sold in California under the California Low-Emission Vehicle (LEV) program. Other states, such as New York, Texas, and Massachusetts, have indicated that they will also enforce the LEV program. The USABC was established in 1991 to concentrate efforts on battery development for future electric vehicles. The USABC consists of the Big Three U.S. auto manufacturers (Daimler-Chrysler, Ford, General Motors), the Electric Power Research Institute, and the U.S. Department of Energy.

A cooperative agreement between USABC and DOE was signed in September 1991 to develop advanced electric vehicle batteries. Under this agreement, Phase 1 of the USABC Electric Vehicle Battery Program ran from 1991 through 1996. A follow-on Phase 2 effort (1996–2000) was undertaken by a second cooperative agreement signed in August 1996 to continue the development of advanced electric vehicle batteries. An additional Phase 3 effort (2000–2004) is being undertaken by a third cooperative agreement signed in January 2000 to continue development of advanced lithium-based batteries. Similar to these three cooperative agreements between USABC and DOE to develop advanced batteries for electric vehicles, a fourth cooperative agreement (1995–2002) was entered into during September 1995 between USABC and DOE to develop high-power battery storage devices for hybrid vehicles.

Since its inception, the DOE-USABC Cooperative Program has worked to promote the convergence of advanced battery technologies and focus R&D resources on the most promising battery candidates for EV applications. Nickel-metal hydride batteries, developed by the USABC from 1992 through 1998, are being utilized in current-model EVs. USABC continues to work on lithium-based batteries with goals as shown below.

Table 9.8
U.S. Advanced Battery Consortium Goals for Electric Vehicle Batteries

Primary criteria	Long-term goals[a] (beyond 2002)
Power density[b] W/L	460
Specific power[b] W/kg [80% depth of discharge (DOD)/30 sec]	300
Energy density[b] Wh/L (C/3 discharge rate)	230
Specific energy[b] Wh/kg (C/3 discharge rate)	150
Life (years)	10
Cycle life[b] (cycles) (80% DOD)	1000 1600 (@ 50% DOD) 2670 (@ 30% DOD)
Power and capacity degradation[b] (% of rated spec)	20%
Ultimate price[c] ($/kWh) (10,000 units @ 40 kWh)	<$150 (desired to 75)
Operating environment	–30 to 65°C
Recharge time[b]	< 6 hours
Continuous discharge in 1 hour (no failure)	75% (of rated energy capacity)
Secondary criteria	**Long-term goals (2002)**
Efficiency[b] (C/3 discharge and C/6 charge)[d]	80%
Self-discharge[b]	< 20% in 12 days
Maintenance	No maintenance. Service by qualified personnel only.
Thermal loss[b]	Covered by self-discharge
Abuse resistance[b]	Tolerant Minimized by on-board controls

Source:
U.S. Department of Energy, Office of Transportation Technologies, Washington, DC, March 2001.

[a]For interim commercialization (reflects USABC revisions of September 1996).
[b]Specifics on criteria can be found in *USABC Electric Vehicle Battery Test Procedures Manual, Rev. 2*, DOE/ID-10479, January 1996.
[c]Cost to the original equipment manufacturers.
[d]Roundtrip charge/discharge efficiency.

The purpose of the Vehicle High-Power Energy Storage Program is to develop a low-cost, high-power energy storage device that meets or exceeds the energy storage requirements for the power-assist and the dual-mode hybrid vehicles by 2008, as shown in this table. Advanced high-power batteries were selected as the technology that has the potential to meet or exceed these requirements.

Table 9.9
Energy Storage Requirements for Hybrid Vehicles

Characteristics	Units	Power-assist hybrid	Dual-mode hybrid
Pulse discharge power[a] [at minimum operating state of change (SOC)]	kW	25 (constant for 18-sec pulse)	45 (constant for 12-sec pulse)
Peak regenerative pulse power[a] (2-second pulse at maximum operating SOC)	kW	30 (50-Wh pulse)	35 (97-Wh pulse)
Total available energy[a] (within operating SOC range)	kWh	0.3 (at C/1 rate)	1.5 (at 6-kW continuous power)
Minimum round-trip efficiency[a] on reference cycle	%	>90	>88
Cycle life,[a] for specified SOC increments:	cycles	300K power-assist cycles[a] (7.5 MWh)	3,750 dual-mode cycles[a] (22.5 MWh)
Cold-cranking power[a] at –30°C (three 2-sec pulses, 10-sec rest between pulses)	kW	5	5
Calendar life	year	15	15
Maximum weight	kg	40	100
Maximum volume	l	32	75
Production cost,[b] at 100,000 units per year	$	300	500
Maximum operating voltage	Vdc	≤440	≤440
Minimum operating voltage	Vdc	$\geq 0.55 \times V_{max}$	$\geq 0.5 \times V_{max}$
Maximum dc current	A	≤217	≤217
Maximum allowable self-discharge rate[a]	Wh/day	50	50
Temperature range:	°C		
Equipment operation		–40 to +52	–40 to +52
Equipment survival		–46 to +66	–46 to +66

Source:
U.S. Department of Energy, Office of Transportation Technologies, Washington, DC, March 2001.

[a]Specifics on characteristics and cycle life protocols can be found in *PNGV Battery Test Manual Rev.* 3, DOE/ID-10597, November 2000.
[b]Selling price to the vehicle manufacturers.
Note: The energy storage subsystem is recharged only by the on-board prime power source and regenerative power from braking. Nominal SOC must permit discharge or regenerative recharge without degradation in the performance of the energy storage subsystem. Power and energy values are as delivered/received at the dc terminals of the subsystem. Discharge pulse energy and power requirements are sufficient for the vehicle to reach top speed in 18 sec for the power-assist hybrid and 12 sec for the dual-mode hybrid.