World on the Edge - Supporting Data for Chapter 8

World Carbon Dioxide Emissions from Fossil Fuel Combustion in 2006 and 2008, with IEA Projection for 2020
World Electricity Consumption for Lighting by Sector and Potential Electricity Savings, 2005
Potential Worldwide Electricity Savings by Switching to More-Efficient Lighting and Implementing System Control
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GRAPH: U.S. Vehicle Sales, 1931-2009
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GRAPH: Passenger Car and Total Vehicle Sales in Japan, 1955-2009
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Vehicles in Operation in the United States, 2000-2009
Vehicles in Operation in the World, 2000-2009
Motor Gasoline Consumption, 2007
Miles of High Speed Rail in Various Countries and the World, 2010

A full listing of data for the entire book is on-line at:
http://www.earth-policy.org/books/wote/wote_data

This is part of a supporting dataset for Lester R. Brown, **World On the Edge: How to Prevent Environmental and Economic Collapse** (New York: W.W. Norton & Company, 2010). For more information and a free download of the book, see Earth Policy Institute on-line at www.earth-policy.org.

World Carbon Dioxide Emissions from Fossil Fuel Combustion in 2006 and 2008, with IEA Projection for 2020

Emissions	Growth Rate, 2006-2015	Growth Rate, 2015-2020	CO_2 Emissions, 2006	CO_2 Emissions, 2008	CO_2 Emissions, 2020
	Percent		Million Tons Carbon		
By Fuel:					
Coal	3.1	1.6	3,185	3,431	4,555
Oil	1.3	0.9	2,937	2,947	3,454
Gas	2.0	1.5	1,484	1,602	1,918
By Sector:					
Power Generation	2.9	1.6	3,119	3,250	4,365
Coal	3.2	1.7	2,273	2,365	3,300
Oil	-0.4	-1.9	241	236	211
Gas	2.8	2.0	605	650	853
Total Final Consumption	1.7	1.1	4,123	4,323	5,090
Coal	2.7	1.1	855	990	1,150
Oil	1.5	1.2	2,515	2,527	3,033
of which transport	*1.7*	*1.3*	*1,708*	*1,746*	*2,126*
of which marine bunkers	*1.0*	*1.0*	*159*	*158*	*326*
of which international aviation	*2.2*	*1.8*	*108*	*124*	*145*
Gas	1.4	1.2	754	807	907
Other Energy Sector			364	406	472
Total CO_2 Emissions	2.2	1.4	7,606	7,980	9,927

Notes: Power Generation refers to fuel use in electricity plants, heat plants, and combined heat and power, including both public plants and small plants that produce fuel for their own use. Total Final Consumption includes industry (e.g. construction, mining, manufacturing, and petrochemical feedstocks), transport, agriculture, residential, and non-energy use. Other Energy Sector includes transformation and transmission losses. Growth rates and 2020 projection are for the International Energy Agency Reference Scenario, which is "based on established trends and policies, without new initiatives by governments on energy security or climate change."

Source: Calculated by Earth Policy Institute with rates, 2006 data, and 2020 projection from International Energy Agency (IEA), *World Energy Outlook 2008* (Paris: 2008), p. 507; 2008 data from International Energy Agency (IEA), *World Energy Outlook 2010* (Paris: 2010), p. 620, with bunker data from Michael Chen, e-mail to Alexandra Giese, Earth Policy Institute, 30 November 2010.

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World Electricity Consumption for Lighting by Sector and Potential Electricity Savings, 2005

Lighting Sector	Worldwide Electricity Consumption for Lighting	Potential Electricity Savings	Potential Electricity Savings
	Terawatt-hours	Terawatt-hours	Percent
Total Residential Lighting	1,045	826	79
Total Commercial Lighting	1,460	971	66
OECD countries	915		
Non-OECD countries	545		
Total Industrial Lighting	632	307	49
Total Outdoor Stationary Lighting	281	113	40
Street lighting	147		
Car parks	113		
Traffic lights	19		
World Total, All Sectors	3,418	2,217	65

Notes: The World Total electricity consumption for lighting in 2005 represents 19% of the world's total electricity consumption of 17,982 TWh. IEA's *Light's Labour's Lost* presents electricity use as final energy consumption (13,952 TWh in 2005), omitting transmission and distribution losses. Because we are interested in total primary energy consumption, including these losses, a conversion factor of 1.288 was applied to all values obtained from *Light's Labour's Lost* (1.288 = 17,982/13,952).

As outlined in *Plan B 4.0*, reducing lighting electricity consumption by 65% would decrease the share of electricity consumption for lighting from 19% to 7% of world total electricity consumption. The resulting electricity savings is enough to close 705 coal-fired power plants of 500 MW each (a 500-MW coal-fired power plant produces 3.15 TWh of electricity per year operating at 72% capacity).

Source: Compiled by Earth Policy Institute from International Energy Agency (IEA), Light's Labour's Lost: Policies for Energy-efficient Lighting (Paris: 2006); 2005 electricity consumption estimated from IEA, World Energy Outlook 2006 (Paris: 2006).

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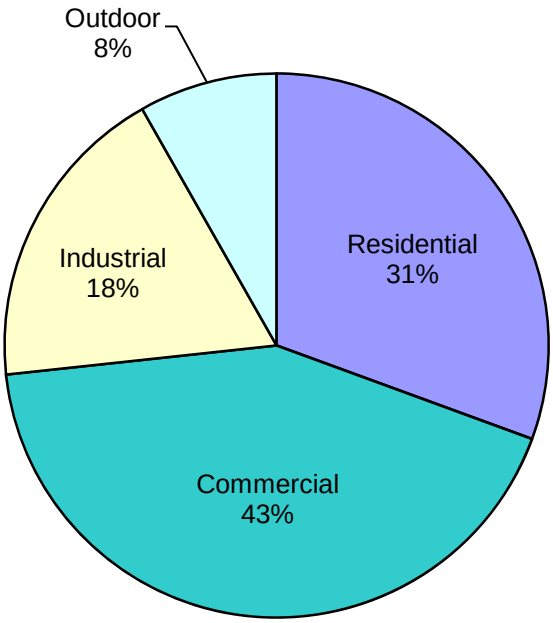
World Electricity Consumption for Lighting
by Sector, 2005



Total: 3,418 Terawatt-hours

Source: EPI from IEA

Potential Worldwide Electricity Savings by Switching to More-Efficient Lighting and Implementing System Control Technologies, 2005

Measure	Electricity Savings
	Terawatt-hours per Year
Residential - average efficacy equaling compact fluorescent (CFL) efficacy[1]	680
Residential - control systems[2]	146
Commercial, non-OECD - switching to best fluorescent systems[3]	235
Commercial, non-OECD - control systems[2]	124
Commercial, OECD - switching to best fluorescent systems[4]	409
Commercial, OECD - control systems[2]	202
Industrial - switching to best fluorescent systems[5]	91
Industrial - control systems[2]	216
Traffic lights - converting to LEDs[6]	15
External signage, U.S. - neon signs to LEDs[7]	9
Street lighting - mercury vapor lamps to high pressure sodium[8]	32
Car parks - dimming lights during off-peak hours[9]	57
Total Electricity Savings	**2,217**

Notes: Unless otherwise noted, electricity savings is calculated by assuming the average efficacy of lighting in a particular sector is increased to the lighting efficacy of the best fluorescent systems in use today (92.3 lm/W).

[1] Worldwide, residential lighting has an average source-lumen efficacy of 21.5 lm/W. Source-lumen refers to the lumens emitted by the light source (i.e. a lamp) as opposed to a luminaire. A 13-watt CFL has an average system efficacy (lamp plus ballast efficacy) of approximately 60 lm/W. The residential energy savings is calculated assuming that the average efficacy of lighting in the residential sector is increased to the average efficacy of a 13-watt CFL (i.e., from 21.5 lm/W to 60 lm/W).

[2] A study by CADDET estimates that lighting energy consumption in the commercial sector can be reduced by 30-50% through the implementation of control systems (i.e., sensors that turn lights off in unoccupied spaces or reduce lighting during daylight hours). The potential electricity savings in the residential and industrial sectors from control systems are likely similar to the commercial sector, so a 40% reduction in energy consumption is assumed for implementation of control systems.

[3] Average efficacy of commercial lighting in non-OECD countries is 52.6 lm/W.

[4] Average efficacy of commercial lighting in OECD countries including ballast losses is 51 lm/W.

[5] Worldwide, industrial sector lighting has an average source-lumen efficacy of 79 lm/W.

[6] Worldwide, traffic signals consume approximately 19.3 TWh/yr. Worldwide, if all incandescent-based signals were replaced by CFLs the energy saving would be around 15.5 TWh/yr.

[7] This value is for U.S. only; no good data exists for worldwide savings.

[8] Mercury vapor lamps provide 30% of outdoor lighting. Electricity savings are calculated by assuming that these mercury vapor lamps, with a luminaire efficacy of 13.5 lm/W, are replaced with tubular high-pressure sodium lamps with a luminaire efficacy of 50 lm/W.

[9] Assuming that 50% of illuminated hours are off-peak. All lights could be dimmed or 50% of lights could be switched off during non-peak hours.

Source: Calculated by Earth Policy Institute from International Energy Agency (IEA), *Light's Labour's Lost: Policies for Energy-efficient Lighting* (Paris: 2006); a conversion factor of 1.288 used to convert electricity consumption into final consumption calculated from IEA, *World Energy Outlook 2006* (Paris: 2006); IEA Centre for the Analysis and Dissemination of Demonstrated Energy Technologies (CADDET), *Saving Energy with Efficient Lighting in Commercial Buildings*, *CADDET Maxi Brochure 01 (*Sittard, Netherlands: CADDET), p. 5.

This is part of a supporting dataset for Lester R. Brown, **World On the Edge: How to Prevent Environmental and Economic Collapse** (New York: W.W. Norton & Company, 2010). For more information and a free download of the book, see Earth Policy Institute on-line at www.earth-policy.org.

Energy Savings from Plan B Efficiency Improvements, 2020

Sector	Energy Savings in 2020
	Petajoules
Lighting	20,434
Appliances	20,434
Buildings	6,611
Industry	30,794
Petrochemical	*11,805*
Steel	*5,374*
Cement	*3,615*
Other (motor systems, aluminum, paper)	*10,000*
Transport	78,655
Total	156,927

Summary:

Projected increase in energy demand from 2006 to 2020	138,156
Total energy savings from efficiency improvements in 2020	156,927
Net change in energy demand from 2006 to 2020	-18,771

Source: Earth Policy Institute, 2009. Data sources include International Energy Agency (IEA), *World Energy Outlook 2008* (Paris: 2008), pp. 506-07; IEA, *Light's Labour's Lost: Policies for Energy-efficient Lighting* (Paris: 2006), pp. 25, 29; Florian Bressand, et al., *Curbing Global Energy Demand Growth: The Energy Productivity Opportunity* (Washington, DC: McKinsey Global Institute, May 2007), p. 33, 106; Claude Mandil et al., *Tracking Industrial Energy Efficiency and CO_2 Emissions* (Paris: IEA, 2007), pp. 22-25, 39, 59–61, 140.

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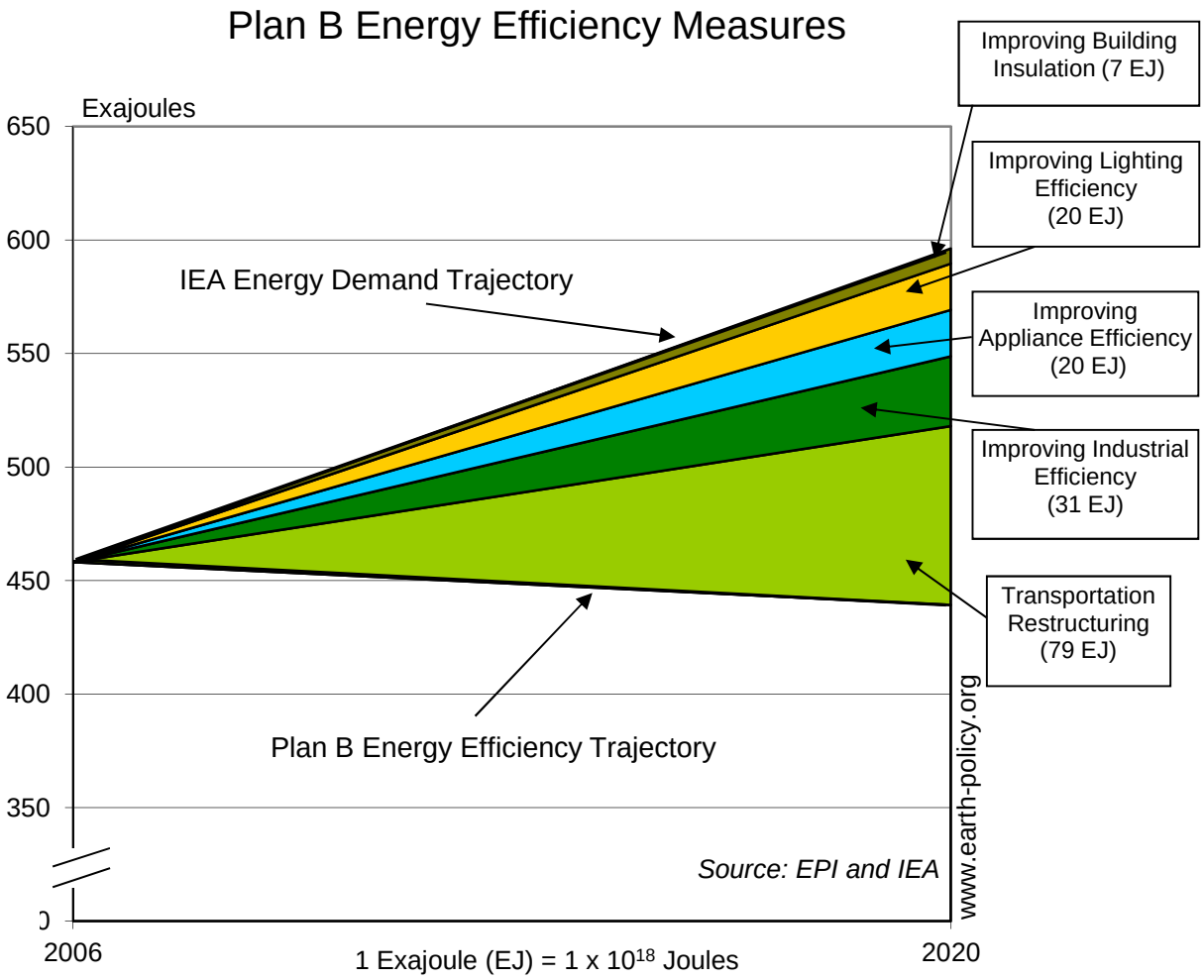
Plan B Energy Efficiency Measures
Exajoules
650
600
550
500
450
400
350
0
2006
2020
IEA Energy Demand Trajectory
Plan B Energy Efficiency Trajectory
Improving Building Insulation (7 EJ)
Improving Lighting Efficiency (20 EJ)
Improving Appliance Efficiency (20 EJ)
Improving Industrial Efficiency (31 EJ)
Transportation Restructuring (79 EJ)
Source: EPI and IEA
www.earth-policy.org
1 Exajoule (EJ) = 1 x 10^18 Joules

World Bicycle and Passenger Car Production, 1950-2007

Year	Bicycles[1]	Passenger Cars[2]
	Million	
1950	11	8
1951	11	7
1952	12	6
1953	13	8
1954	14	8
1955	15	11
1956	16	9
1957	17	10
1958	18	9
1959	19	11
1960	20	13
1961	20	11
1962	20	14
1963	20	16
1964	21	17
1965	21	19
1966	22	19
1967	23	19
1968	24	22
1969	25	23
1970	36	22
1971	39	26
1972	46	28
1973	52	30
1974	52	26
1975	43	25
1976	47	29
1977	49	31
1978	51	31
1979	54	31
1980	62	29
1981	65	27
1982	69	27
1983	74	30
1984	76	31
1985	79	32
1986	84	33
1987	98	33
1988	105	34
1989	95	36
1990	91	36
1991	96	35
1992	99	35
1993	99	34
1994	102	36
1995	104	36
1996	97	37
1997	90	38
1998	87	38
1999	96	40
2000	107	41
2001	99	40
2002	111	41
2003	120	41
2004	127	42
2005	123	44
2006	126	47
2007	130	49

Notes: [1] Bicycle data include electric bicycles. [2] Car data do not include commercial vehicles.

Source: Compiled by Earth Policy Institute with bicycle data compiled by Gary Gardner for "Bicycle Production Reaches 30 Million Units," in Worldwatch Institute, *Vital Signs 2009* (Washington, DC: 2009), pp. 53-54; car production for 1950-1970 from Worldwatch Institute, *Signposts 2002*, CD-ROM (Washington, DC: 2004); car production for 1971-2007 from Ward's Automotive Group, *World Motor Vehicle Data 2008* (Southfield, MI: 2008), pp. 239–42.

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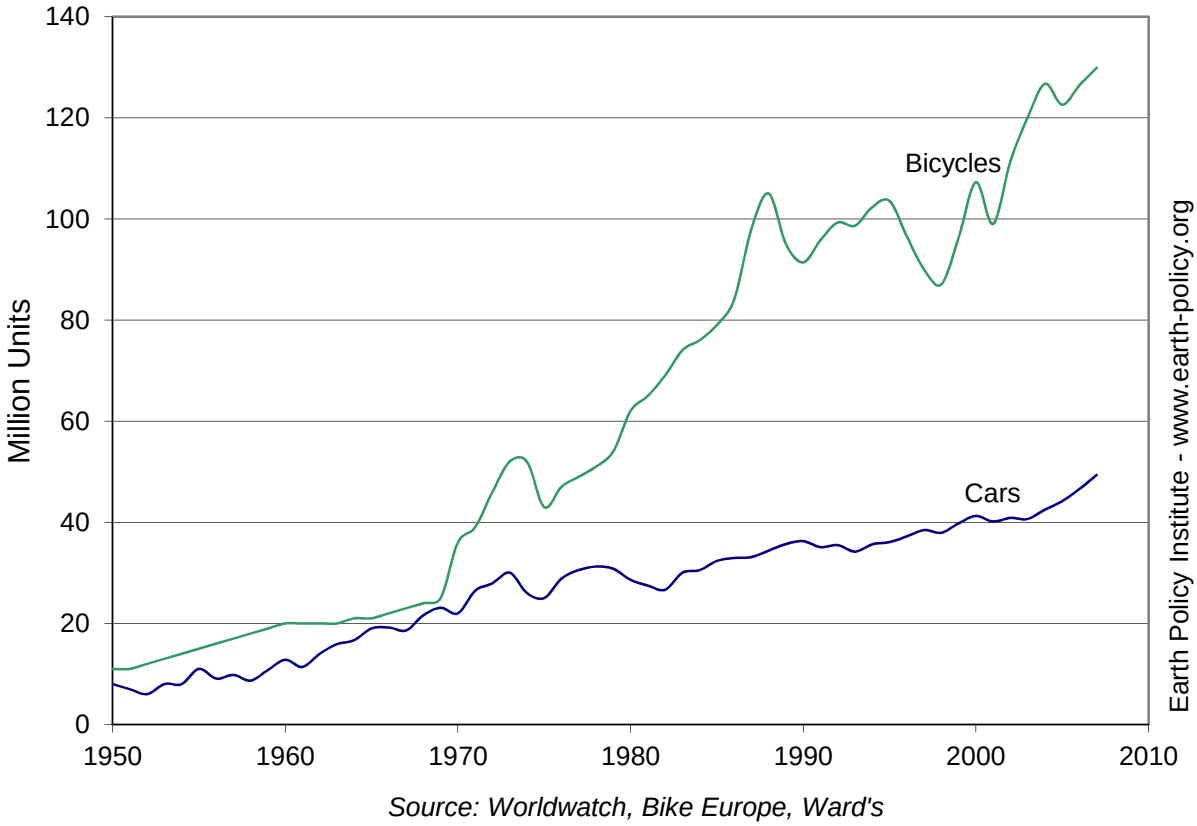
World Bicycle and Passenger Car Production, 1950-2007



Source: Worldwatch, Bike Europe, Ward's

Bicycle Trips as Share of Total Trips in Select Countries, 1974-2009

Year	United States	United Kingdom	France	Germany	Denmark	Netherlands
			Percent			
1974-1977	0.7	3	4	9	17	n/a
1981-1985	0.8	2	4	11	20	28
1989-1995	0.9	2	3	12	20	28
2000-2002	0.9	2	n/a	9	20	24
2008-2009	1.0	2	3	10	18	25

Note: Each datum is associated a single year within the range given, but which year varies by country. n/a indicates where data are unavailable.

Source: John Pucher and Ralph Buehler, "Walking and Cycling for Healthy Cities," *Built Environment*, vol. 36, no. 4 (December 2010), pp. 391-414.

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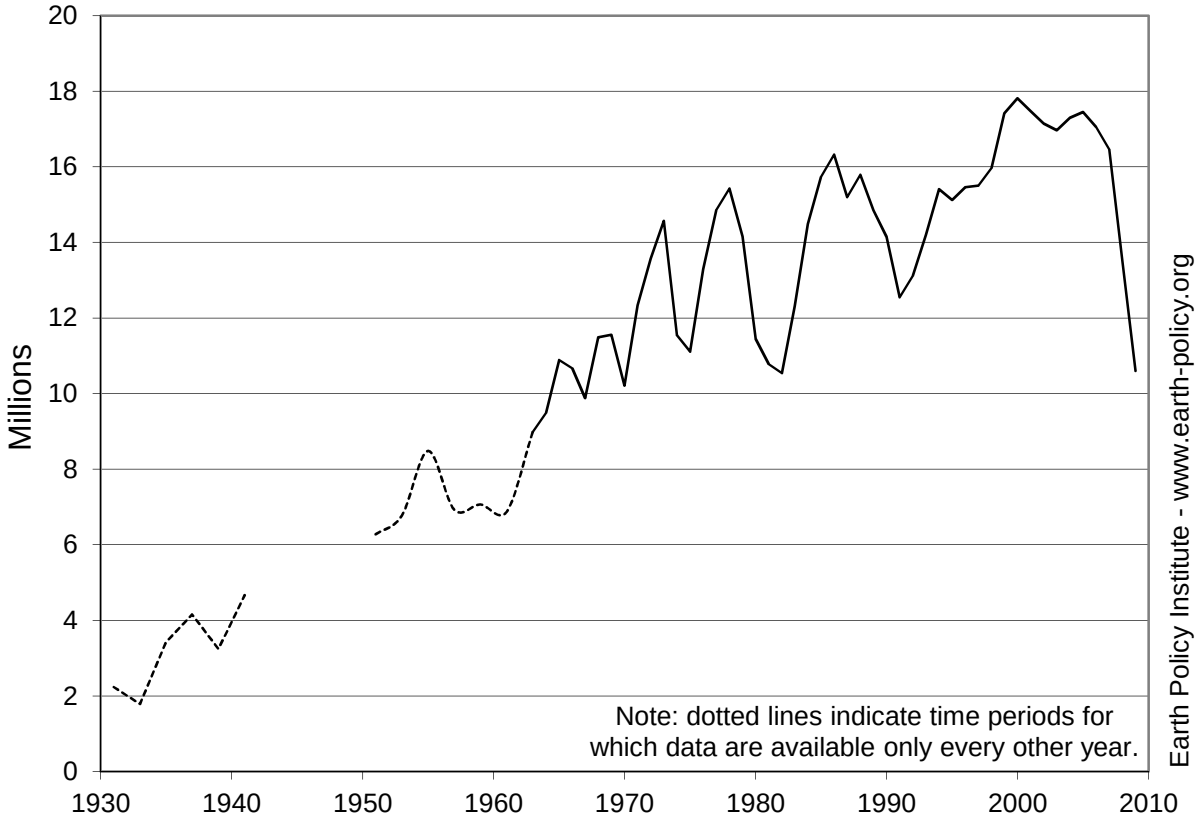
U.S. Vehicle Sales, 1931-2009

Year	Total
	Millions
1931	2.2
1933	1.8
1935	3.4
1937	4.2
1939	3.2
1941	4.7
…	…
1951	6.3
1953	6.8
1955	8.5
1957	6.9
1959	7.1
1961	6.9
1963	9.0
1964	9.5
1965	10.9
1966	10.7
1967	9.9
1968	11.5
1969	11.6
1970	10.2
1971	12.3
1972	13.6
1973	14.6
1974	11.5
1975	11.1
1976	13.3
1977	14.9
1978	15.4
1979	14.2
1980	11.4
1981	10.8
1982	10.5
1983	12.3
1984	14.5
1985	15.7
1986	16.3
1987	15.2
1988	15.8
1989	14.8
1990	14.1
1991	12.6
1992	13.1
1993	14.2
1994	15.4
1995	15.1
1996	15.5
1997	15.5
1998	16.0
1999	17.4
2000	17.8
2001	17.5
2002	17.1
2003	17.0
2004	17.3
2005	17.4
2006	17.0
2007	16.5
2008	13.5
2009	10.6

Note: 1942-1950 data unavailable.

Source: Ward's Automotive Group, "U.S. Car and Truck Sales, 1931-2009," at http://wardsauto.com/keydata, updated 2010.

U.S. Vehicle Sales, 1931-2009



Source: EPI; Ward's

Passenger Car and Total Vehicle Sales in Japan, 1955-2009

Year	Passenger Cars	Total Vehicles[1]
	Thousand Units	
1955	20	65
1960	145	408
1961	229	743
1962	259	933
1963	371	1,211
1964	494	1,494
1965	586	1,675
1966	740	2,060
1967	1,131	2,715
1968	1,569	3,309
1969	2,037	3,835
1970	2,379	4,100
1971	2,403	4,021
1972	2,627	4,367
1973	2,953	4,949
1974	2,287	3,850
1975	2,738	4,309
1976	2,449	4,104
1977	2,500	4,194
1978	2,857	4,682
1979	3,037	5,154
1980	2,854	5,016
1981	2,867	5,127
1982	3,038	5,261
1983	3,136	5,382
1984	3,096	5,437
1985	3,104	5,557
1986	3,146	5,708
1987	3,275	6,018
1988	3,717	6,721
1989	4,404	7,257
1990	5,103	7,777
1991	4,868	7,525
1992	4,454	6,959
1993	4,199	6,467
1994	4,210	6,527
1995	4,444	6,865
1996	4,669	7,078
1997	4,492	6,725
1998	4,093	5,879
1999	4,154	5,861
2000	4,260	5,963
2001	4,290	5,906
2002	4,441	5,792
2003	4,716	5,828
2004	4,768	5,853
2005	4,748	5,852
2006	4,642	5,740
2007	4,400	5,354
2008	4,228	5,082
2009	3,924	4,609

[1] Total Vehicles include cars, trucks, and buses.

Source: Japan Automobile Manufacturers Association, Inc. (JAMA), *Motor Vehicle Statistics of Japan 2010* (Tokyo: 6 September 2010), p. 8.

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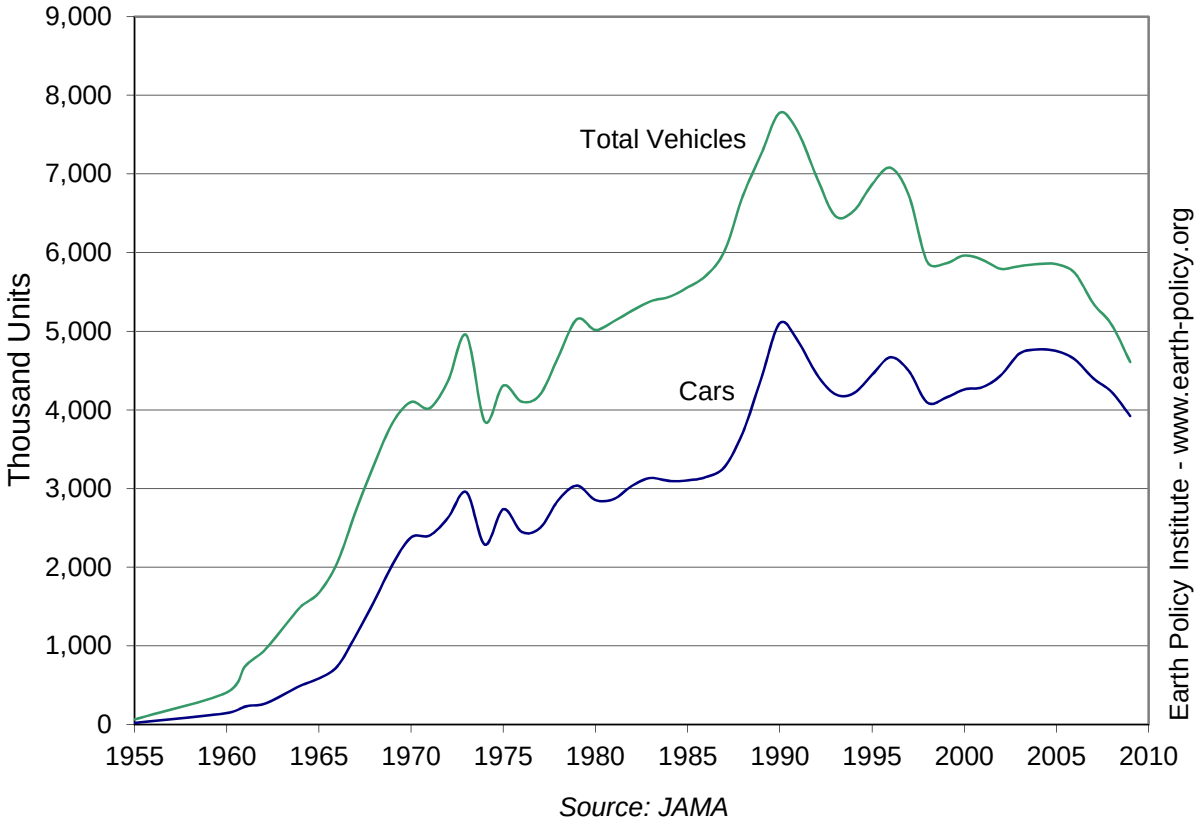
Passenger Car and Total Vehicle Sales in Japan, 1955-2009



Source: JAMA

U.S. Vehicle Scrappage and Sales, 2000-2009

Year	Total Vehicles in Use	New Vehicle Sales	Total Scrappage
		Millions	
2000	213.3	17.8	
2001	216.7	17.5	14.1
2002	221.0	17.1	12.8
2003	226.1	17.0	11.9
2004	231.4	17.3	12.0
2005	237.7	17.4	11.1
2006	244.6	17.0	10.1
2007	248.7	16.5	12.4
2008	250.2	13.5	12.0
2009	248.5	10.6	12.4

Source: Compiled by Earth Policy Institute with total vehicles in use from Ward's Automotive Group, "Vehicles in Operation by Country," tables from Paul Zajac and Lisa Williamson, e-mails to Earth Policy Institute, 3 June 2009, 9 October 2009, and 24 September 2010; and with new vehicle sales from Ward's Automotive Group, "U.S. Car and Truck Sales, 1931-2009," at http://wardsauto.com/keydata, updated 2010.

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Vehicles in Operation in the United States, 2000-2009

Year	Cars	Commercial Vehicles	Total
		Million Vehicles	
2000	127.7	85.6	213.3
2001	128.7	88.0	216.7
2002	129.9	91.1	221.0
2003	130.8	95.3	226.1
2004	132.8	98.6	231.4
2005	132.9	104.8	237.7
2006	135.0	109.6	244.6
2007	135.2	113.5	248.7
2008	135.9	114.4	250.2
2009	132.4	116.0	248.5

Source: Compiled by Earth Policy Institute from Ward's Automotive Group, "Vehicles in Operation by Country," tables from Paul Zajac and Lisa Williamson, e-mails to Earth Policy Institute, 3 June 2009, 9 October 2009, and 24 September 2010.

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Vehicles in Operation in the World, 2000-2009

Year	Cars	Commercial Vehicles	Total
		Million Vehicles	
2000	549.3	201.6	750.8
2001	562.4	207.6	769.9
2002	576.6	211.3	787.9
2003	590.0	224.3	814.3
2004	603.8	234.3	838.1
2005	618.0	246.0	864.0
2006	630.5	256.6	887.1
2007	645.7	265.6	911.3
2008	667.6	273.1	940.8
2009	681.2	284.1	965.3

Source: Compiled by Earth Policy Institute from Ward's Automotive Group, "Vehicles in Operation by Country," tables from Paul Zajac and Lisa Williamson, e-mails to Earth Policy Institute, 3 June 2009, 9 October 2009, and 24 September 2010.

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Motor Gasoline Consumption, 2007

Country	Total Final Consumption
	Billion Gallons
United States	116.7
China	16.9
Japan	13.4
Mexico	9.7
Canada	9.3
Russia	8.9
Germany	6.4
United Kingdom	5.4
Iran	5.3
Saudi Arabia	4.6
Australia	4.3
Indonesia	4.3
Brazil	4.2
Italy	3.8
Venezuela	3.5
India	3.2
France	2.9
South Africa	2.6
Malaysia	2.5
South Korea	2.3
Taiwan*	2.2
Spain	2.1
Nigeria	1.9
Thailand	1.6
Iraq	1.2

*Note: Value for Taiwan is estimate based on petroleum consumption.

Source: Compiled by Earth Policy Institute from International Energy Agency, “Oil by Country/Region,” at www.iea.org/stats/prodresult.asp?PRODUCT=Oil, viewed 23 September 2010; Taiwan from Gerhard Metschies, “Pain at the Pump,” *Foreign Policy* , July/August 2007 and U.S. Department of Energy, Energy Information Administration, “Taiwan Energy Profile,” at www.eia.doe.gov/country/country_energy_data.cfm?fips=TW, updated 14 July 2010.

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Miles of High Speed Rail in Various Countries and the World, 2010

Country	In Operation	Under Construction	Planned	Total
Belgium	131	0	0	131
France	1,185	131	1,635	2,951
Germany	803	236	419	1,458
Italy	577	0	247	824
The Netherlands	75	0	0	75
Poland	0	0	445	445
Portugal	0	0	629	629
Rusia	0	406	406	813
Spain	1,285	1,104	1,064	3,453
Sweden	0	0	469	469
Switzerland	22	45	0	67
United Kingdom	71	0	128	198
Total Europe	**4,148**	**1,923**	**5,441**	**11,512**
China	2,549	3,846	1,813	8,209
Taiwan	216	0	0	216
India	0	0	309	309
Iran	0	0	297	297
Japan	1,584	318	364	2,266
Saudi Arabia	0	0	344	344
South Korea	258	0	0	258
Turkey	147	319	1,049	1,515
Total Asia	**4,753**	**4,483**	**4,177**	**13,413**
Morocco	0	125	300	425
Argentina	0	0	197	197
Brazil	0	0	319	319
USA	226	0	563	789
Total other countries	**226**	**125**	**1,379**	**1,730**
Total World	**9,128**	**6,531**	**10,996**	**26,654**

Note: The International Union of Railways (UIC) defines high-speed rail as having an average velocity of at least 155 mi/hour, with some exceptions.

Source: International Union of Railways, “Miles of High Speed Lines in the World,” at www.uic.org/spip.php?article573, updated 19 December 2010.

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