World on the Edge - Energy Data - Efficiency

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 Technologies, 2005
Energy Savings from Plan B Efficiency Improvements, 2020
GRAPH: Plan B Energy Efficiency Measures

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 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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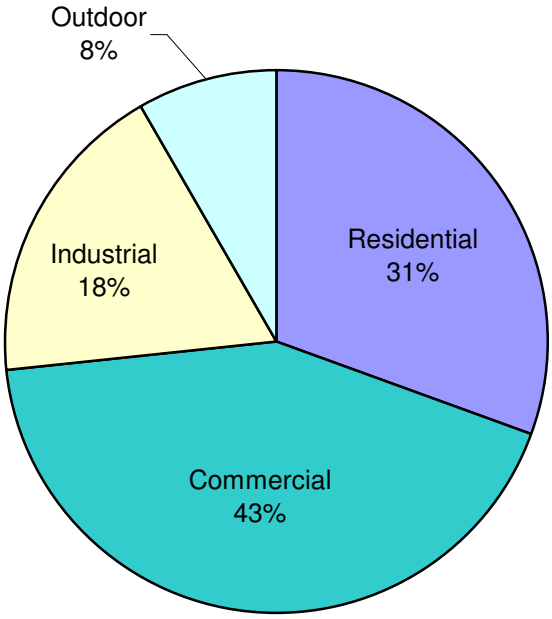
World Electricity Consumption for Lighting
by Sector, 2005



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.

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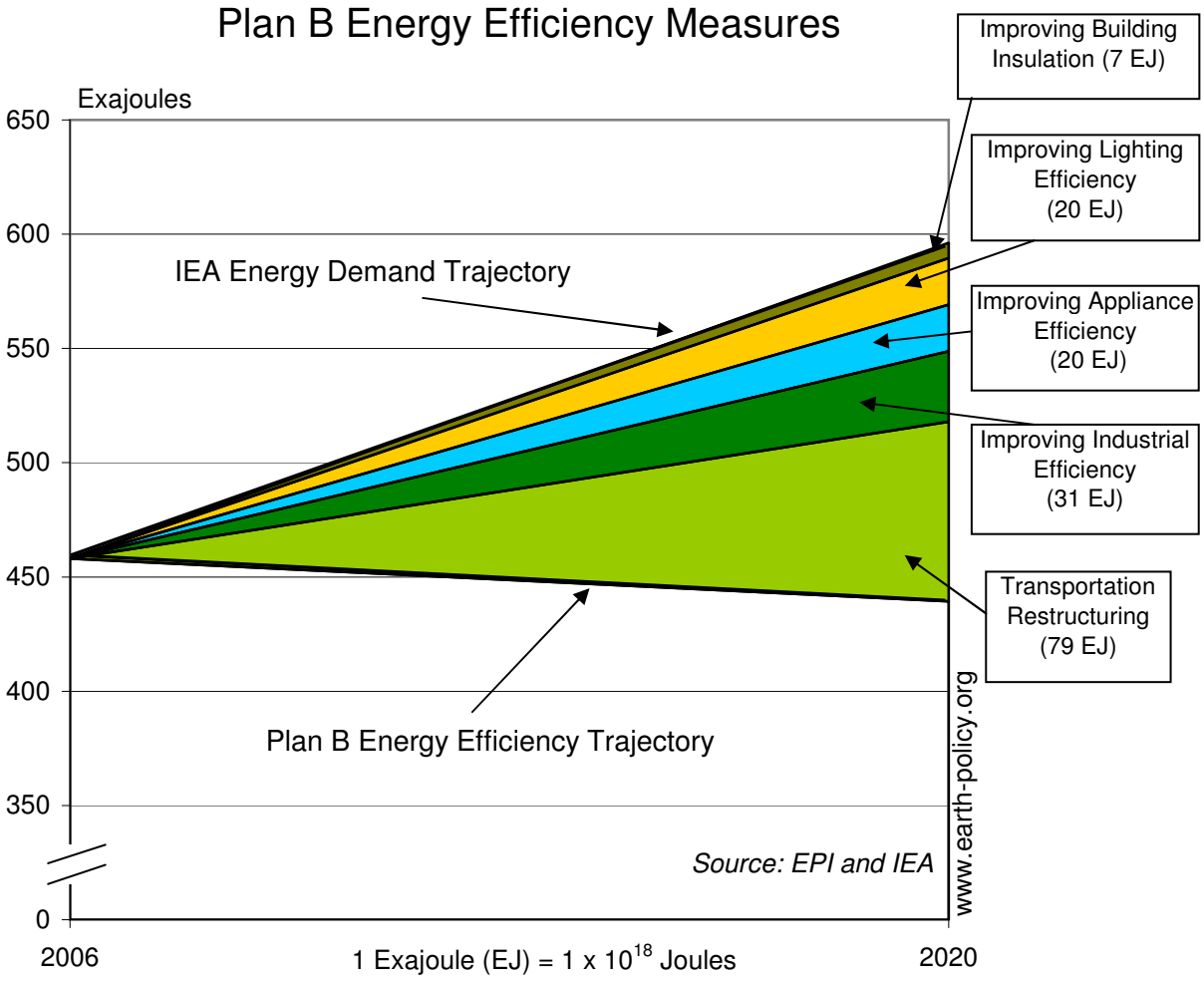
Plan B Energy Efficiency Measures
Exajoules
650
600
550
500
450
400
350
0
2006
2020
IEA Energy Demand Trajectory
Plan B Energy Efficiency Trajectory
Improving Building Insulation (7 EJ)
Improving Lighting Efficiency (20 EJ)
Improving Appliance Efficiency (20 EJ)
Improving Industrial Efficiency (31 EJ)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