



Engineering Merit Badge, Day 3 Homework: Energy Hogs (6b)

Answer key: Energy usage for Common Appliances

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	Power Draw (W) (1)			Annual Usage (hours per year)			Annual Consumption, kWh/year	Annual Cost, \$
	Active	Idle	Off	Active	Idle	Off		
Kitchen								
Coffee Maker	1,000	70	0	38	229	8,493	58	\$6
Dishwasher (3)				365	(4)		120	\$12
Microwave Oven	1,500		3	70		8,690	131	\$13
Toaster Oven	1,051			37			54	\$5
Refrigerator-Freezer							660	\$63
Freezer							470	\$45
Lighting								
18-W Compact Fluorescent	18			1,189			20	\$2
60-W Incandescent Lamp	60			672			40	\$4
100-W Incandescent Lamp	100			672			70	\$6
Torchiere Lamp-Halogen	300			1,460			440	\$42
Bedroom and Bathroom								
Hair Dryer	710			50			40	\$3
Waterbed Heater	350			3,051			1,070	\$103
Laundry Room								
Clothes Dryer				359	(4)		1,000	\$96
Clothes Washer (3)				392	(4)		110	\$10
Home Electronics								
Desktop PCs	75	4	2	2,990	330	5,440	237	\$23
Notebook PCs	25	2	2	2,368	935	5,457	72	\$7
Desktop Computer Monitors	42	1	1	1,865	875	6,020	85	\$8
Stereo Systems	33	30	3	1,510	1,810	5,440	119	\$11
Televisions	97		4	1,860		6,900	222 (7)	\$21
Analog, <40"	86			1,095	(5)		184	\$18
Analog, >40"	156			1,825	(5)		312	\$30
Digital, ED/HD TV, <40"	150			1,095	(5)		301	\$29
Digital, ED/HD TV, >40"	234			1,825	(5)		455	\$44
Set-top Boxes	20	0	20	6,450	0	2,310	178	\$17
DVD/VCR	17	13	3	170	5,150	3,430	78	\$7
Video Game Systems	36	36	1	405	560	7,795	41	\$4
Heating and Cooling								
Dehumidifier	600			1,620			970	\$93
Furnace Fan	295			1,350			400	\$38
Ceiling Fan (only fan motor)	35			2,310			81	\$8
Space Heater	1,320	1		584			314	\$30
Water Heating								
Water Heater-Family of 4	4,500			64	(6)		4,770	\$458
Portable Spa	4,350	275		25	8,735		2,525	\$242
Miscellaneous								
Rechargeable Power Tool	13	4		73			38	\$4
Vacuum	542			37			55	\$5
Pool Pump	1,000			792			790	\$76
Well Pump	725			115			80	\$8
Lawn Sprinkler	11			0			32	\$3
Aquarium Equipment	24			6,534			153	\$15



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Answer key: Sorted from Highest to Lowest

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	Power Draw (W) (1)			Annual Usage (hours per year)			Annual Consumption, kWh/year	Annual Cost, \$
	Active	Idle	Off	Active	Idle	Off		
Sorted from Highest Energy Usage to Lowest								
Water Heater-Family of 4	4,500			64	(6)		4,770	\$458
Portable Spa	4,350	275		25	8,735		2,525	\$242
Waterbed Heater	350			3,051			1,070	\$103
Clothes Dryer				359	(4)		1,000	\$96
Dehumidifier	600			1,620			970	\$93
Pool Pump	1,000			792			790	\$76
Refrigerator-Freezer							660	\$63
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Digital, ED/HD TV, >40"	234			1,825	(5)		455	\$44
Torchiere Lamp-Halogen	300			1,460			440	\$42
Furnace Fan	295			1,350			400	\$38
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Digital, ED/HD TV, <40"	150			1,095	(5)		301	\$29
Desktop PCs	75	4	2	2,990	330	5,440	237	\$23
Televisions	97		4	1,860		6,900	222 (7)	\$21
Analog, <40"	86			1,095	(5)		184	\$18
Set-top Boxes	20	0	20	6,450	0	2,310	178	\$17
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Lawn Sprinkler	11			0			32	\$3
18-W Compact Fluorescent	18			1,189			20	\$2



Engineering Merit Badge, Day 3 Homework: Energy Hogs (6b)

Answer key: Top Ten Offenders

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#	Sorted from Highest Energy Usage to Lowest	Power Draw (W) (1)			Annual Usage (hours per year)			Annual Consumption, kWh/year	Annual Cost, \$
		Active	Idle	Off	Active	Idle	Off		
1	Water Heater-Family of 4	4,500			64	(6)		4,770	\$458
2	Portable Spa	4,350	275		25	8,735		2,525	\$242
3	Waterbed Heater	350			3,051			1,070	\$103
4	Clothes Dryer				359	(4)		1,000	\$96
5	Dehumidifier	600			1,620			970	\$93
6	Pool Pump	1,000			792			790	\$76
7	Refrigerator-Freezer								
8	Freezer							470	\$45
9	Digital, ED/HD TV, >40"	234			1,825	(5)		455	\$44
10	Torchiere Lamp-Halogen	300			1,460			440	\$42



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NOTES and SOURCES

NOTES:

- 1) Power draw will vary due to appliance components and modes of operation.
- 2) \$0.096/kWh.
- 3) Excludes electricity for water heating and drying.
- 4) Cycles/year.
- 5) TVs <40" are estimated on 3 hours/day and TVs >40" are estimated on 5 hours/day.
- 6) Gallons/day.
- 7) Power, usage and annual consumption values for televisions are weighted averages of multiple usage types and screen sizes.

SOURCES:

BTS/A.D. Little, Electricity Consumption by Small End Uses in Residential Buildings, Aug. 1998, Exhibit 6-8, p. 6-10 for clothes washer, computer, dehumidifier, dishwasher, furnace fan, pool pump, torchiere lamp-halogen, waterbed heater, and well pump; LBNL, Energy Data Sourcebook for the U.S. Residential Sector, LBNL-40297, Sept. 1997, p. 100-102 for clothes dryers, Table 10.2, p. 108 for lighting, and p. 62-67 for water heaters; LBNL, Miscellaneous Electricity Use in the U.S. Residential Sector, LBNL-40295, Apr. 1998, Appendix D for hair dryers; EIA, Supplement to AEO 2008, June 2008, Table 21 for refrigerator and freezer; GAMA, Consumers' Directory of Certified Efficiency Ratings for Heating and Water Heating Equipment, Apr. 2000 for water heater power draw; EIA/TIAX, Commercial and Residential Sector Miscellaneous Electricity Consumption: FY2005 and Projections to 2030, Sept. 2006, p. 41-60 for coffee maker, microwave oven, stereo systems, TVs, DVD/VCR, ceiling fan, and portable spa; TIAX, Energy Consumption by Consumer Electronics in U.S. Residences, Final Report to the Consumer Electronics Association, Jan. 2007, p. 69-72 for desktop and notebook PCs, p. 62-63 for monitors, p. 85-90 for TVs, p. 76-81 for set-top boxes, and p. 103-105 for video game systems; and Energy Center of Wisconsin, Electricity Savings Opportunities for Home Electronics and Other Plug-In Devices in Minnesota Homes, May 2010, pp. 52-57 for toaster ovens, space heaters, power tools, vacuums, lawn sprinklers, and aquarium equipment.