Household Electrical Energy Usage

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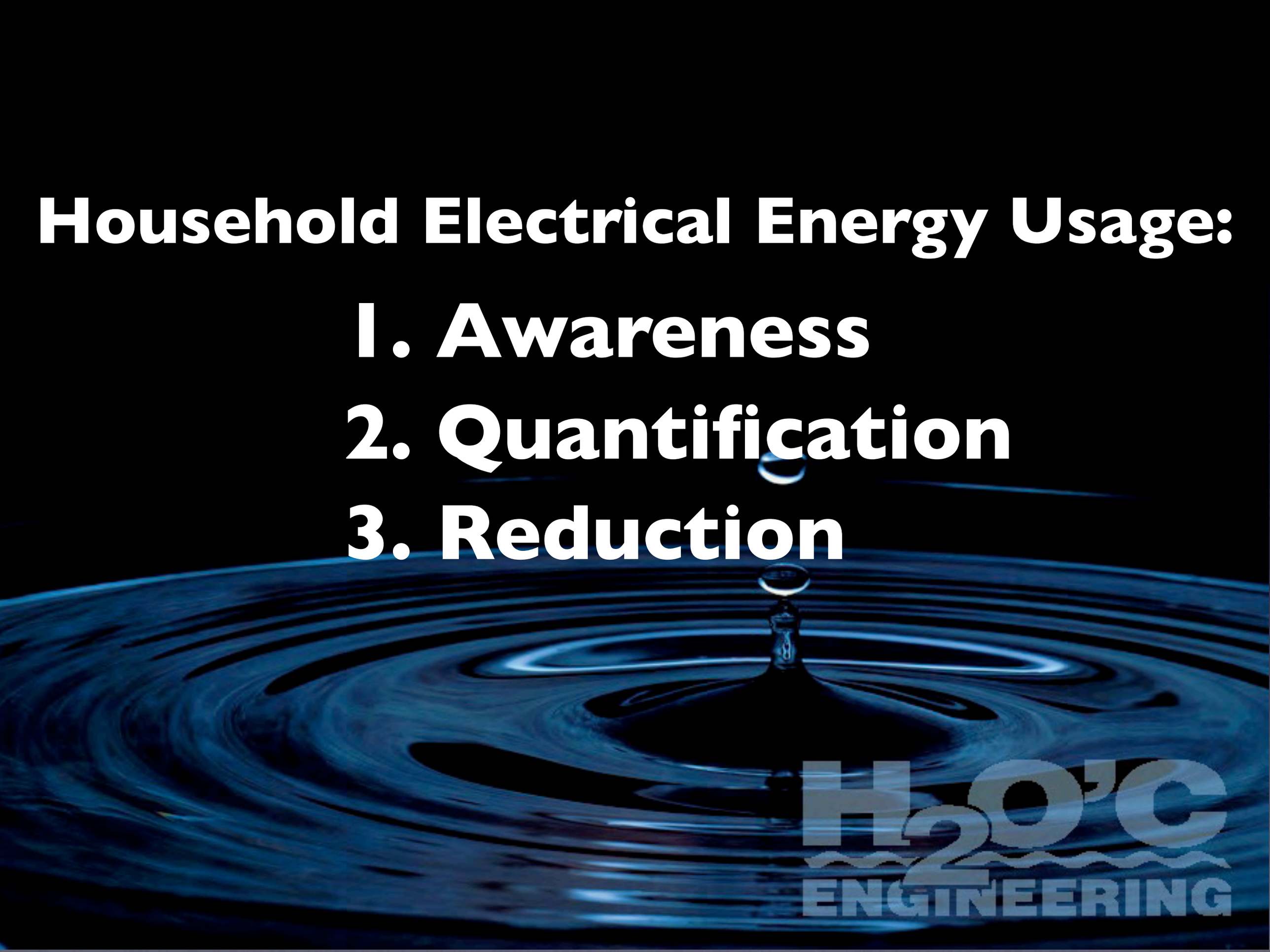
Household Electrical Energy Usage:

1. Awareness

2. Quantification

3. Reduction



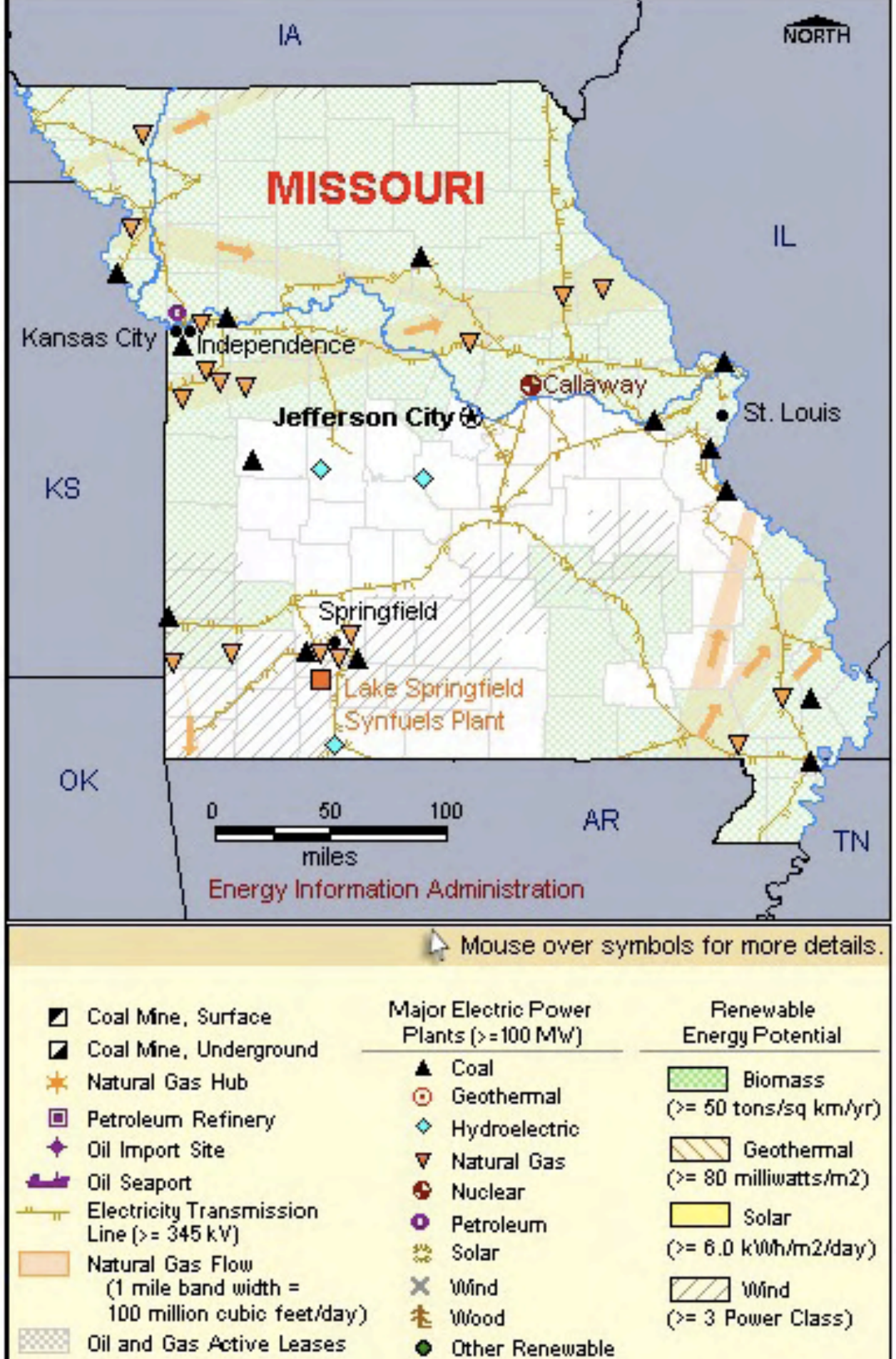
Household Electrical Energy Usage:

1. Clue In

2. Count Up

3. Cut Down

H2O'C ENGINEERING

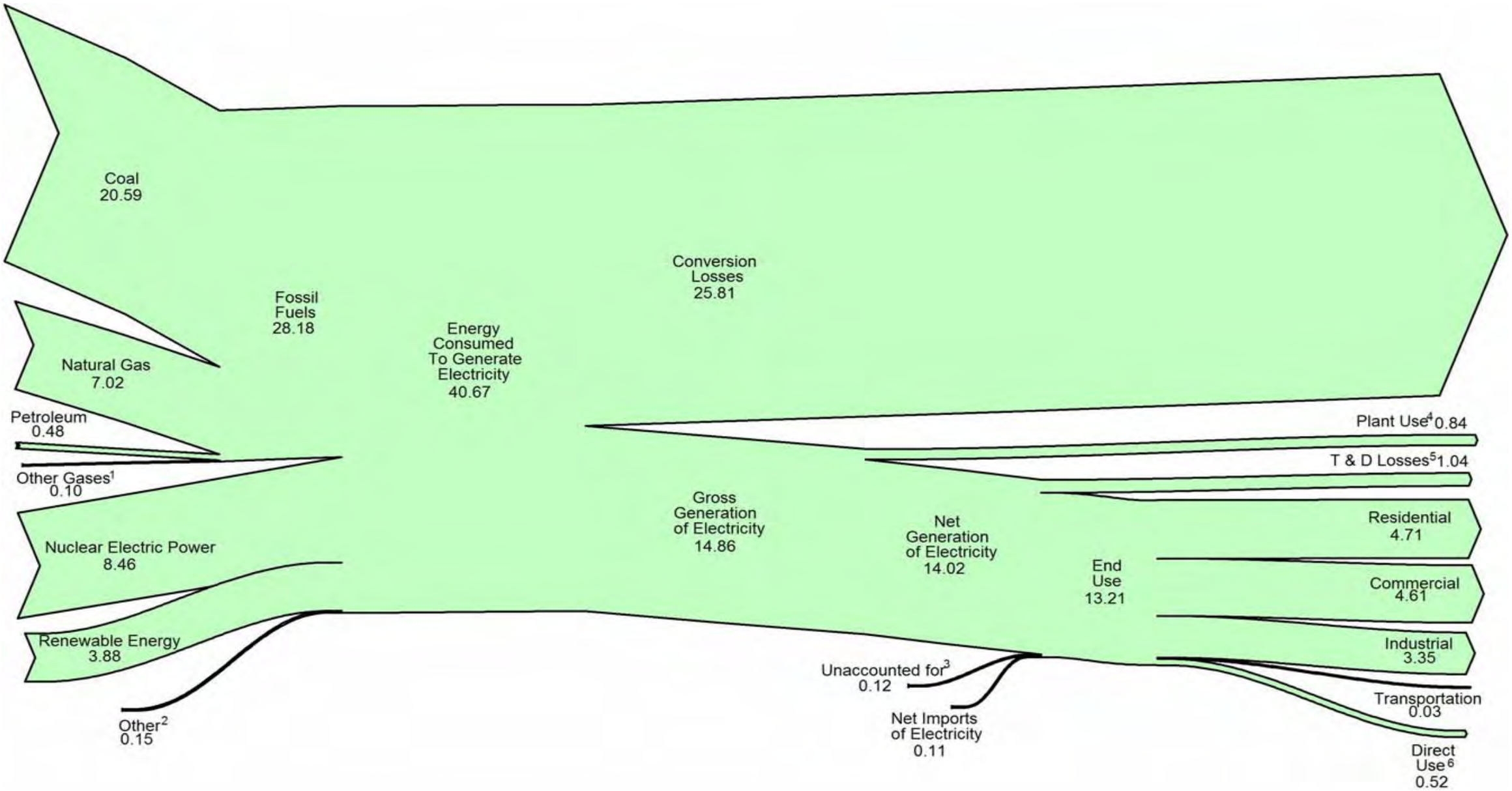


Missouri Quick Facts

- Missouri was the first State west of the Mississippi River to produce coal commercially, although output today is minimal.
- The western leg of the Rockies Express natural gas pipeline passes near Kansas City before terminating in northeast Missouri.
- Coal is the dominant fuel for electricity generation in Missouri and typically supplies more than four-fifths of the electricity market.

US DOE Energy Information Administration, February 4, 2010

Figure 8.0 Electricity Flow, 2008
(Quadrillion Btu)



[1] Blast furnace gas, propane gas, and other manufactured and waste gases derived from fossil fuels.

[2] Batteries, chemicals, hydrogen, pitch, purchased steam, sulfur, miscellaneous technologies, and non-renewable waste (municipal solid waste from non-biogenic sources, and tire-derived fuels).

[3] Data collection frame differences and nonsampling error. Derived for the diagram by subtracting the "T & D Losses" estimate from "T & D Losses and Unaccounted for" derived from Table 8.1.

[4] Electric energy used in the operation of power plants.

[5] Transmission and distribution losses (electricity losses that occur between the point of generation and delivery to the customer) are estimated as 7 percent of gross generation.

[6] Use of electricity that is 1) self-generated, 2) produced by either the same entity that consumes the power or an affiliate, and 3) used in direct support of a service or industrial process located within the same facility or group of facilities that house the generating equipment. Direct use is exclusive of station use.

Notes: • Data are preliminary. • See Note, "Electrical System Energy Losses," at the end of Section 2. • Values are derived from source data prior to rounding for publication. • Totals may not equal sum of components due to independent rounding.

Sources: Tables 8.1, 8.4a, 8.9, A6 (column 4), and Energy Information Administration, Form EIA-923, "Power Plant Operations Report."

Cost of Electricity

City of Columbia

Residential Electric Rates

This schedule is available to customers where service is supplied to a residential dwelling for single-phase service under provisions of the City's Ordinance Section 27-112.

Customer Charge: $6.95 per month

Energy Charge	Usage	Rate
summer	first 750 kWh	9.275 cents per kWh
	next 1,250 kWh	12.637 cents per kWh
	all remaining kWh	13.642 cents per kWh
non-summer	first 750 kWh	9.275 cents per kWh
	all remaining kWh	10.764 cents per kWh

Summer months: June through September
Non-summer months: October through May

Minimum Monthly Bill

The minimum monthly bill/customer charge shall be $6.95.

$6.95 + 9.3 cents/kWh

(goes up a few cents if you're using a lot)

Cost of Electricity

State of Missouri, US

Electricity	Missouri	U.S. Avg.	Period
Residential	8.39 cents/kWh	11.76 cents/kWh	Oct-09
Commercial	6.55 cents/kWh	10.22 cents/kWh	Oct-09
Industrial	5.00 cents/kWh	6.68 cents/kWh	Oct-09

Missouri: 8.39 cents/kWh

US: 11.76 cents/kWh

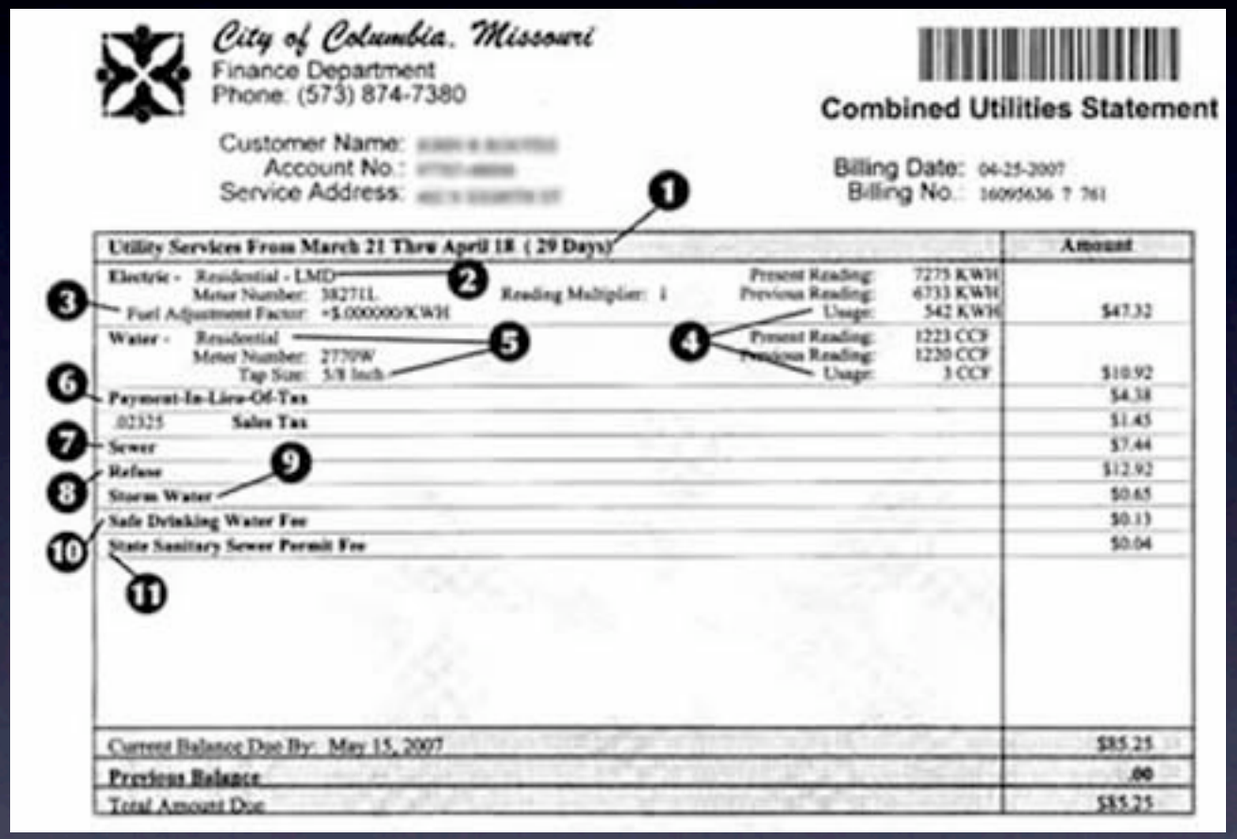
Cost of Electricity
by State

Rank	State	Electricity Residential (cents/kWh)
1	Hawaii	26.45
2	Connecticut	20.78
3	New York	19.17
4	Alaska	16.75
5	New Hampshire	16.41
6	Massachusetts	16.36
7	New Jersey	15.71
8	Vermont	15.50
9	Maine	15.30
10	Maryland	14.90
10	Rhode Island	14.90
11	Delaware	14.75
12	California	14.08
13	District of Columbia	14.00
14	Nevada	13.53
15	Michigan	12.56
16	Florida	12.31
17	Texas	12.26
18	Wisconsin	11.97
19	Pennsylvania	11.93
	United States	11.76
20	Illinois	11.42
21	Arizona	11.05
22	Virginia	10.95
23	North Carolina	10.84
24	Ohio	10.83
25	South Carolina	10.80
26	Colorado	10.55
27	New Mexico	10.41
28	Oklahoma	10.35
29	Alabama	10.25
30	Mississippi	10.21
31	Georgia	10.20
32	Minnesota	10.05
33	Kansas	9.99
34	Iowa	9.91
35	Arkansas	9.72
36	Indiana	9.58
37	Tennessee	9.12
38	Montana	9.07
39	South Dakota	8.97
40	Oregon	8.95
41	Wyoming	8.91
42	Nebraska	8.54
43	Kentucky	8.44
44	Utah	8.43
45	Missouri	8.39
46	West Virginia	8.28
47	Louisiana	8.17
48	Idaho	8.15
49	Washington	7.87
50	North Dakota	7.83

Reduction

Energy efficiency is not entirely a function of our hardware and appliances.
It's also a function of our lifestyles, choices, and actions.

Monthly Electric Bill



City of Columbia, Missouri
Finance Department
Phone: (573) 874-7380

Combined Utilities Statement

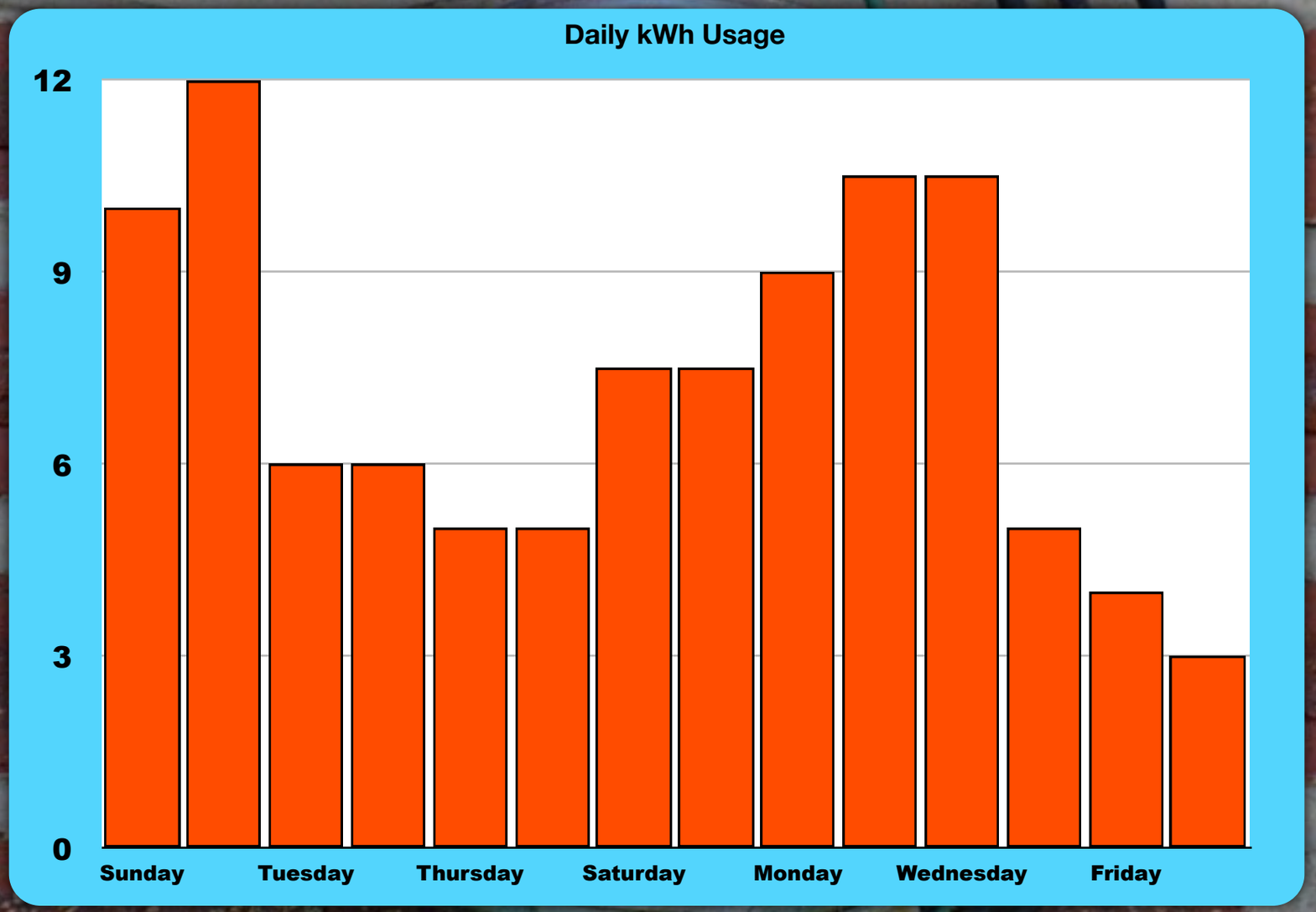
Customer Name:
Account No.:
Service Address:

Billing Date: 04-25-2007
Billing No.: 160955636 7 761

Utility Services From March 21 Thru April 18 (29 Days)			Amount
Electric - Residential - LMD Meter Number: 38271L Fuel Adjustment Factor: +$.000000/KWH	Reading Multiplier: 1	Present Reading: 7275 KWH Previous Reading: 6733 KWH Usage: 542 KWH	$47.32
Water - Residential Meter Number: 2770W Tap Size: 5/8 Inch		Present Reading: 1223 CCF Previous Reading: 1220 CCF Usage: 3 CCF	$10.92
Payment-In-Lieu-Of-Tax			$4.38
.02325 Sales Tax			$1.45
Sewer			$7.44
Refuse			$12.92
Storm Water			$0.65
Safe Drinking Water Fee			$0.13
State Sanitary Sewer Permit Fee			$0.04
Current Balance Due By: May 15, 2007			$85.25
Previous Balance			.00
Total Amount Due			$85.25

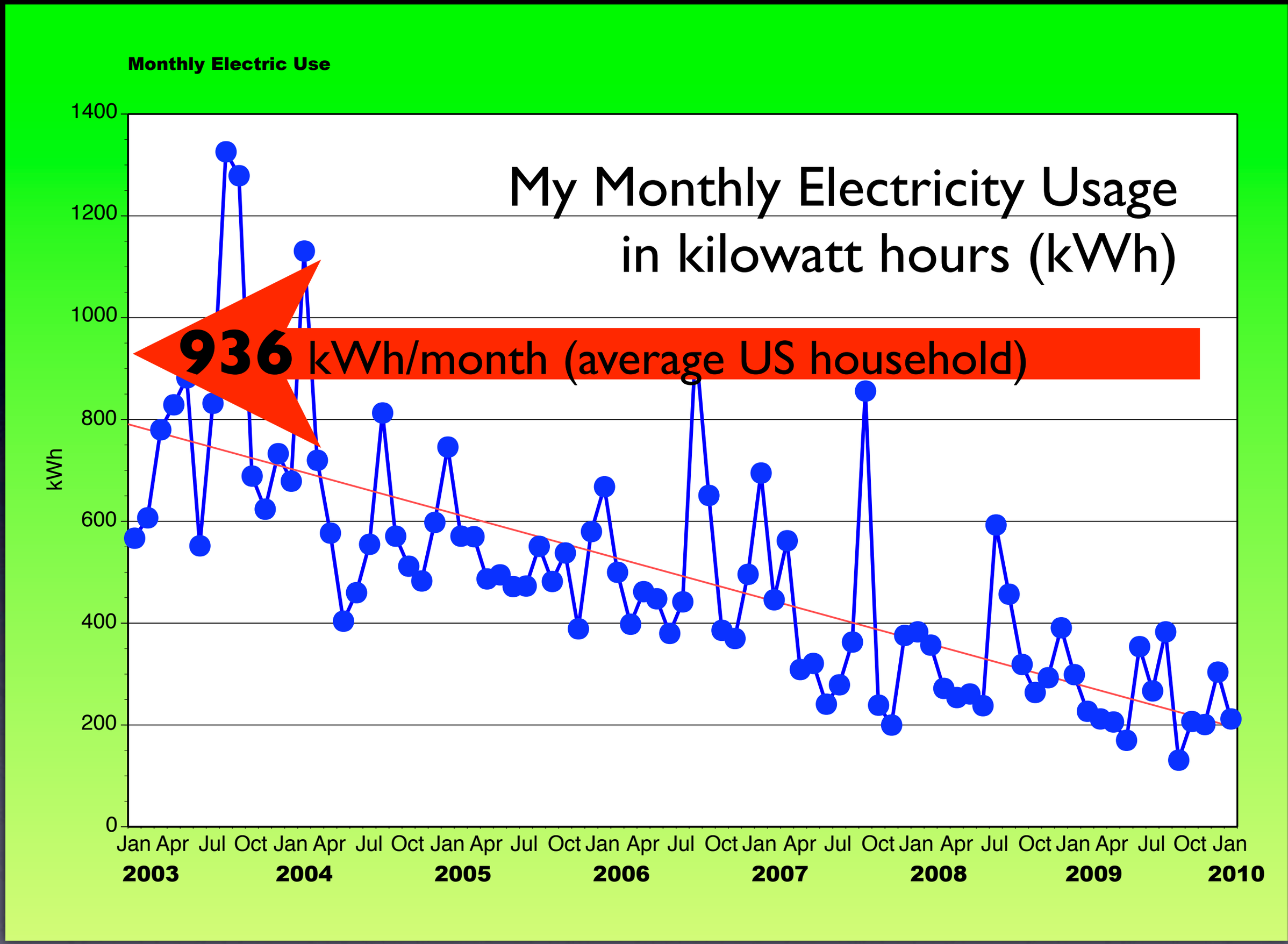
monthly report

Meet Your Meter



"If you cannot measure it, you cannot improve it."

-Lord Kelvin


Monthly Electric Use
My Monthly Electricity Usage
in kilowatt hours (kWh)
936 kWh/month (average US household)
kWh
1400
1200
1000
800
600
400
200
0
Jan Apr Jul Oct Jan Apr Jul Oct Jan Apr Jul Oct Jan Apr Jul Oct Jan Apr Jul Oct Jan Apr Jul Oct Jan Apr Jul Oct Jan
2003
2004
2005
2006
2007
2008
2009
2010

936 kWh/month (average US household)

÷ 720 hours in a month

= 1.3 kW constant power usage

The average US house is consuming

1,300 watts ALL THE TIME

936 kWh/month (average US household)

The average US house consumes

32 kWh EACH DAY

...which translates to daily
CO_2 emissions of

44 pounds

Measuring Individual Appliances

KILL A WATT™

METER

0.28 KWH

Volt

Amp

Watt

VA

Hz

PF

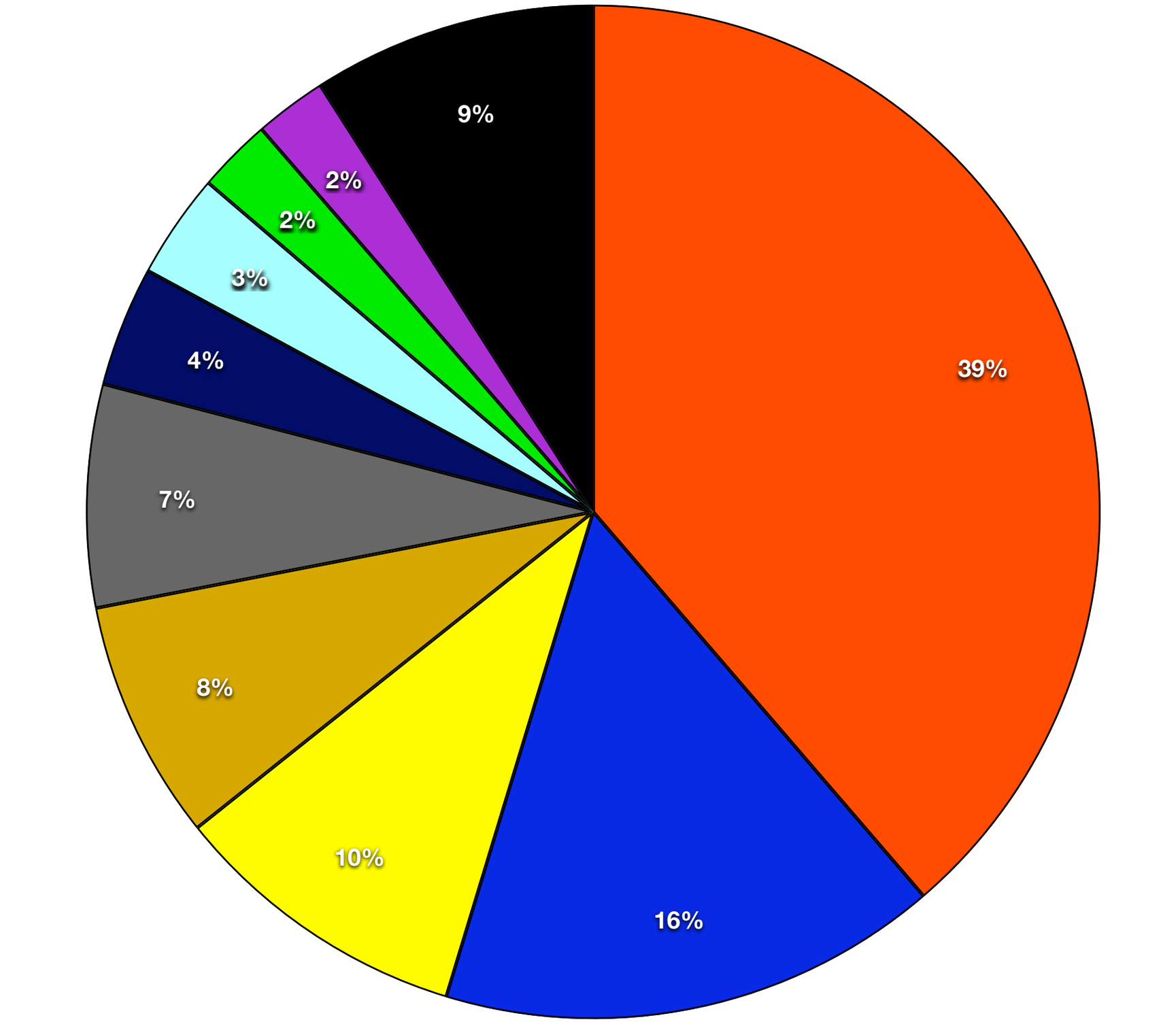
KWH

Hour

item	power ON	standby	hours ON/day	kWh/use	uses/month	**kWh/month**
	watts	watts				
air conditioner						
gas furnace	560	15	5			**92.6**
refrigerator	130	2	10			**39.8**
TV & stereo	300	0	2.5			**22.5**
large pond pump	30		24			**21.6**
clothes dryer	3,500			5	4	**20.0**
lights (6)	90		4			**10.8**
computer	200	5	1			**9.5**
second TV	200	1	1			**6.7**
modem & router	9		24			**6.5**
phones	7		24			**5.0**
small pond pump	5		24			**3.6**
laptop	50		2			**3.0**
electric meter	3		24			**2.2**
hair dryer	1,200		0.05			**1.8**
power strips	5	2	4			**1.8**
microwave	600		0.1			**1.8**
clothes washer				0.21	8	**1.7**
clock radio	4	2	1			**1.5**
clock	2		24			**1.4**
sleep fan	6		8			**1.4**
garage door opener	350		0.02			**0.2**
dishwasher						
vacuum cleaner						
TOTAL						**255**

Accounting for All Electrical Usage:

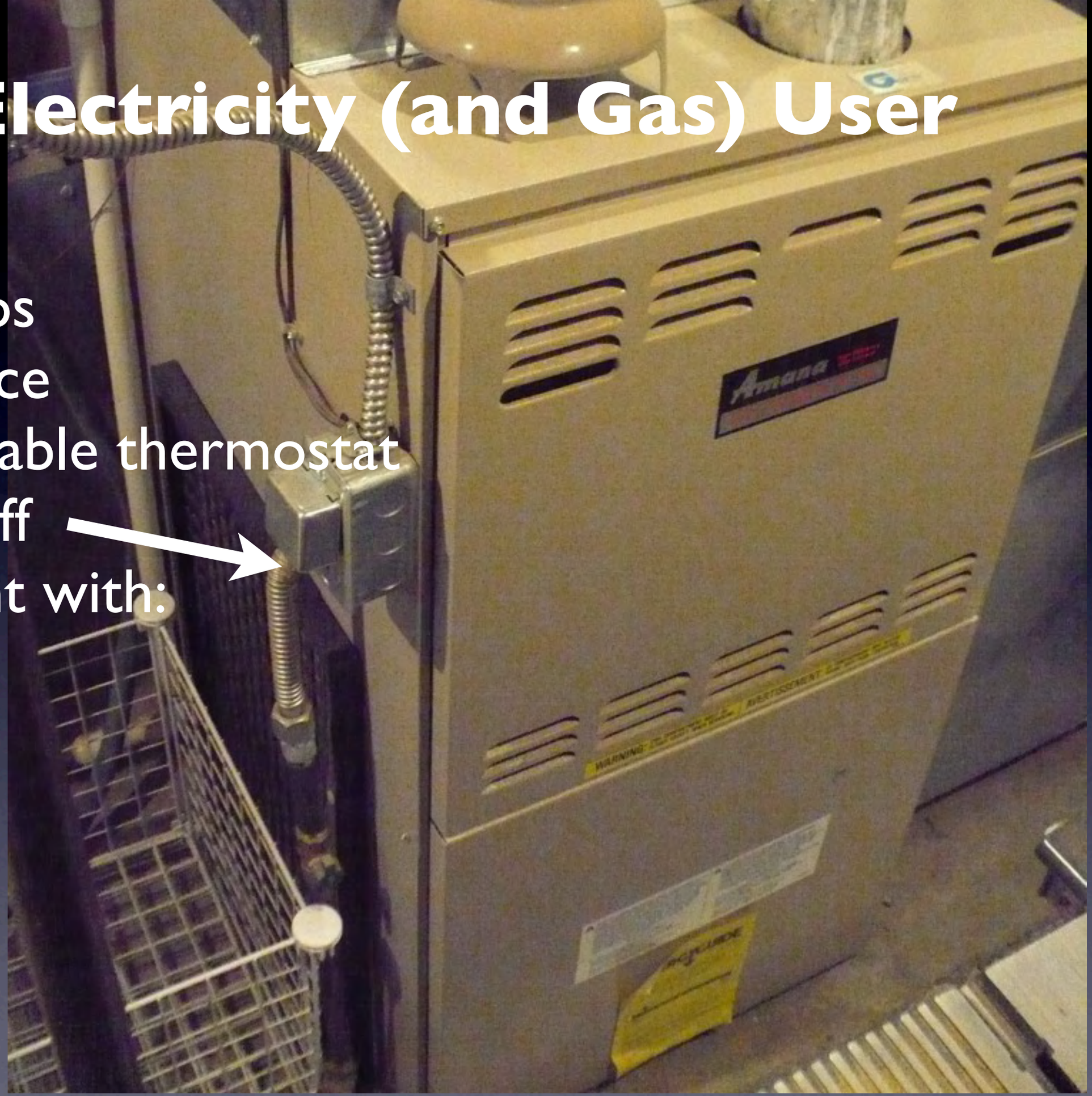
Measurements, Calculations, Assumptions


39%
16%
10%
8%
7%
4%
3%
2%
2%
9%
gas furnace
clothes dryer
modem & router
refrigerator
lights (6)
other
TV & stereo
computer
large pond pump
second TV

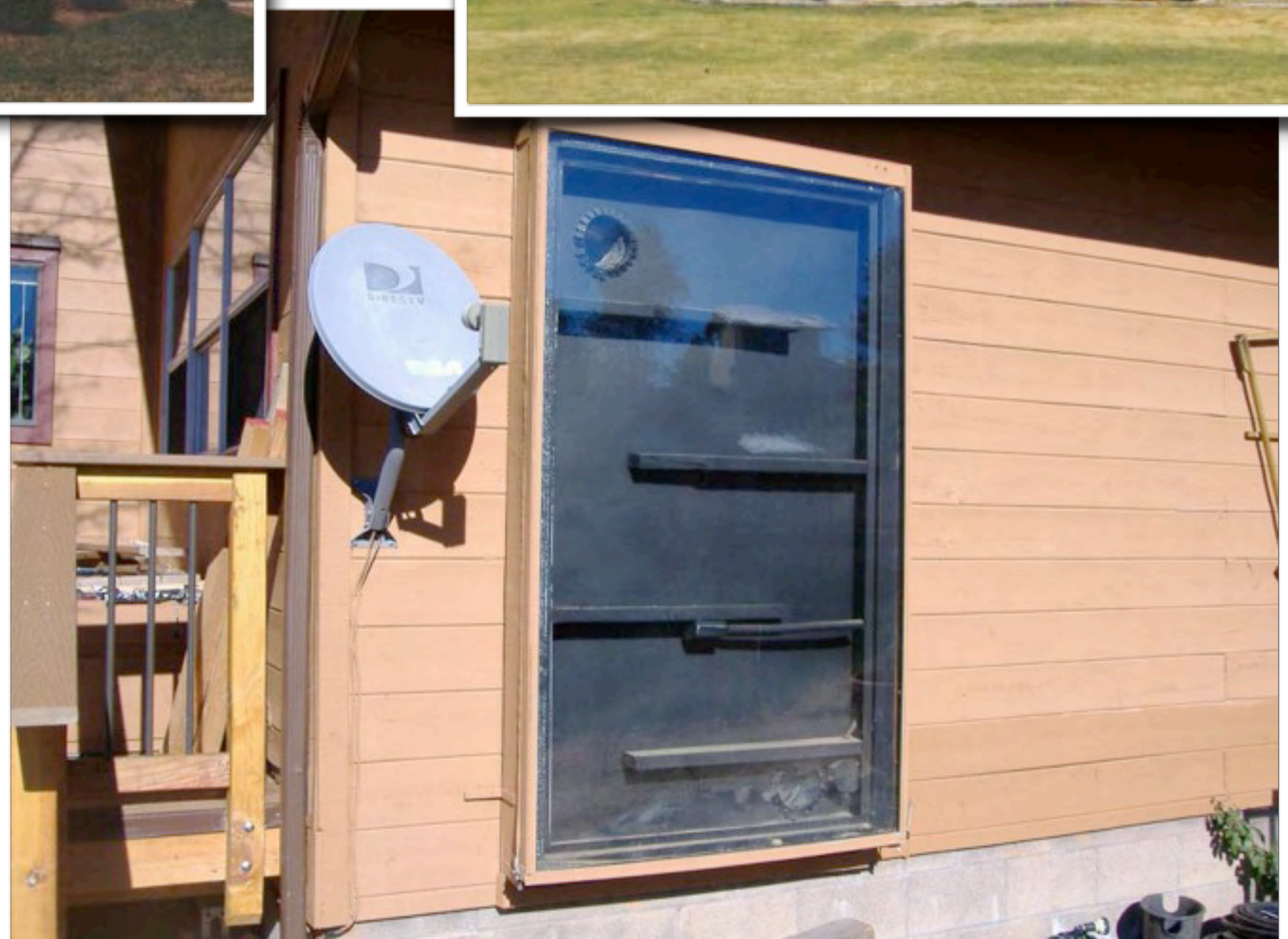
- Regular maintenance (clean coils, fins, etc.)
- Proper settings
- Don't buy a brand new Energy Star refrigerator and then keep using your old one as a beer and soda fridge
- Do you really need an extra freezer? Heated towel rack? Waterbed? Digital photo frame running 24/7? Dusk-to-dawn lighting? George Foreman electric cheese straightener?

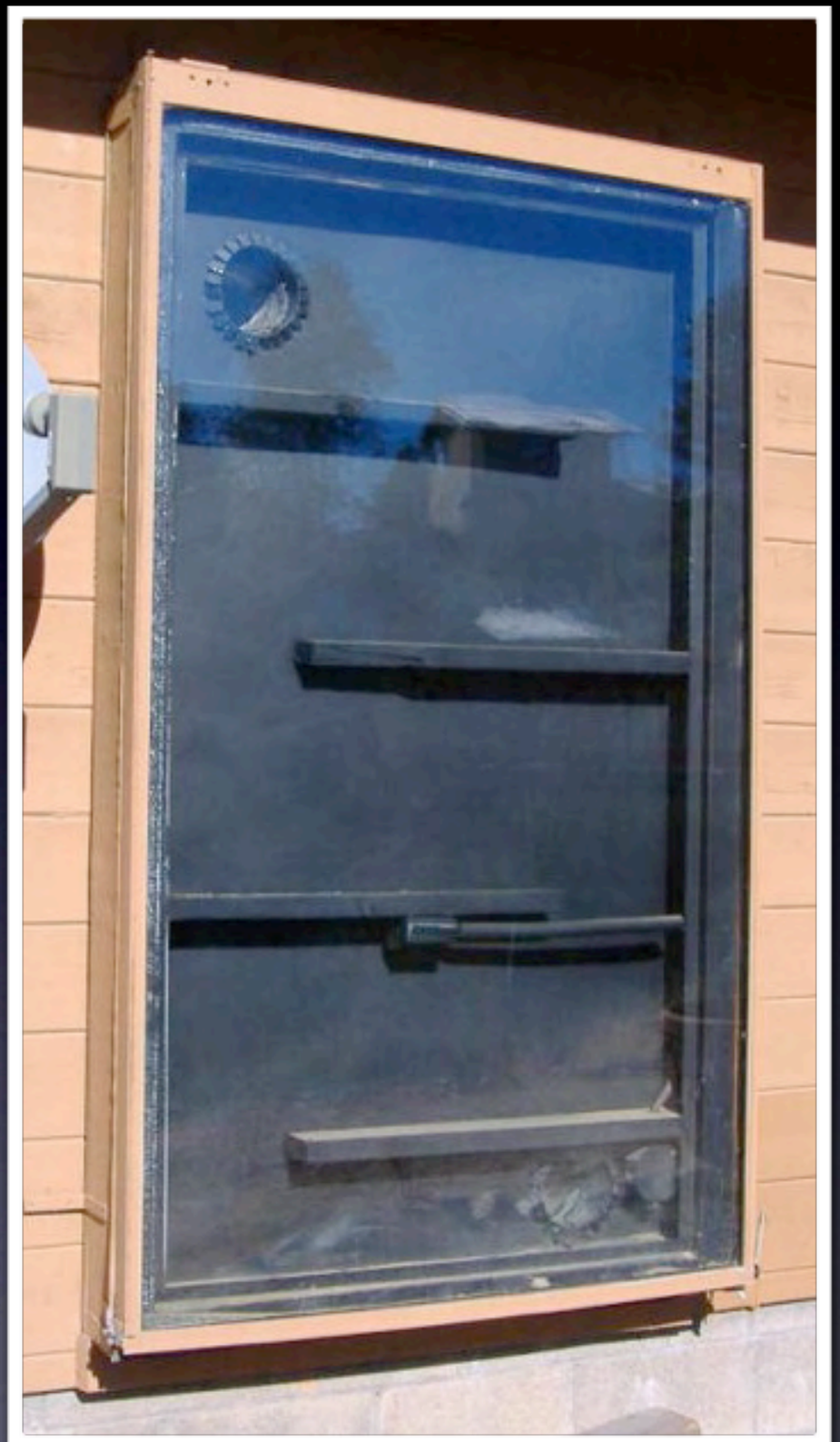
Big Electricity (and Gas) User

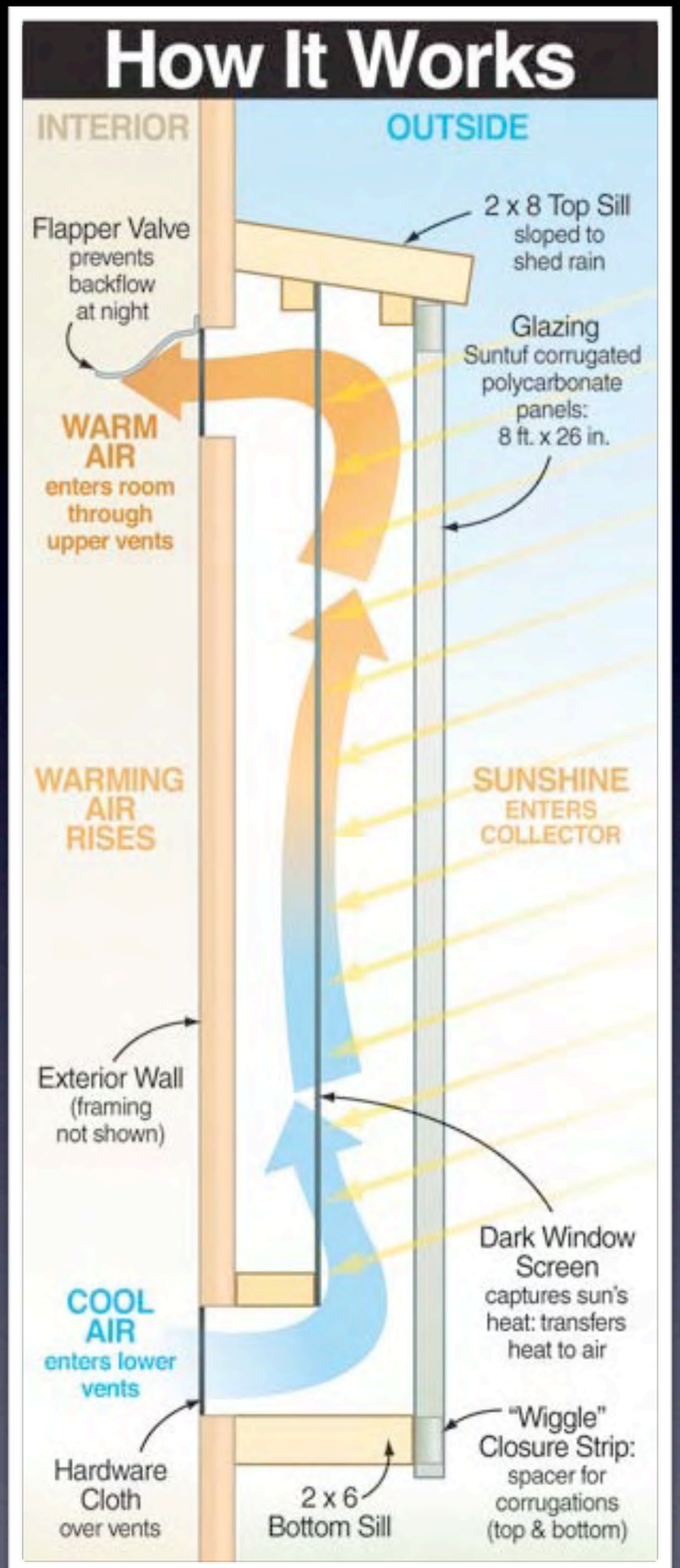
- insulation
- seal air gaps
- maintenance
- programmable thermostat
- switch it off
- supplement with:
  - solar heat
  - wood
  - a sweater



Solar Space Heating






How It Works
INTERIOR
OUTSIDE
Flapper Valve
prevents backflow at night
2 x 8 Top Sill
sloped to shed rain
Glazing
Suntuf corrugated polycarbonate panels:
8 ft. x 26 in.
WARM AIR
enters room through upper vents
WARMING AIR RISES
SUNSHINE
ENTERS COLLECTOR
Exterior Wall
(framing not shown)
Dark Window Screen
captures sun's heat: transfers heat to air
COOL AIR
enters lower vents
"Wiggle" Closure Strip:
spacer for corrugations (top & bottom)
Hardware Cloth
over vents
2 x 6
Bottom Sill

Phantom Loads

MODE Settings:

"Normal:" 17 watts

Energy-Saver: < 1 watt


SONY
AQUOS
SHARP
controls wall outlet


TEST MONTHLY
TEST KEY
SEE DIRECTIONS FOR INSTRUCTION

Wee Amp:
3 watts

Full Rig:
100 watts

Lo-Watt, Med-Fi

Switch It Off

1.3 Watts constantly
= 1 kWh/month

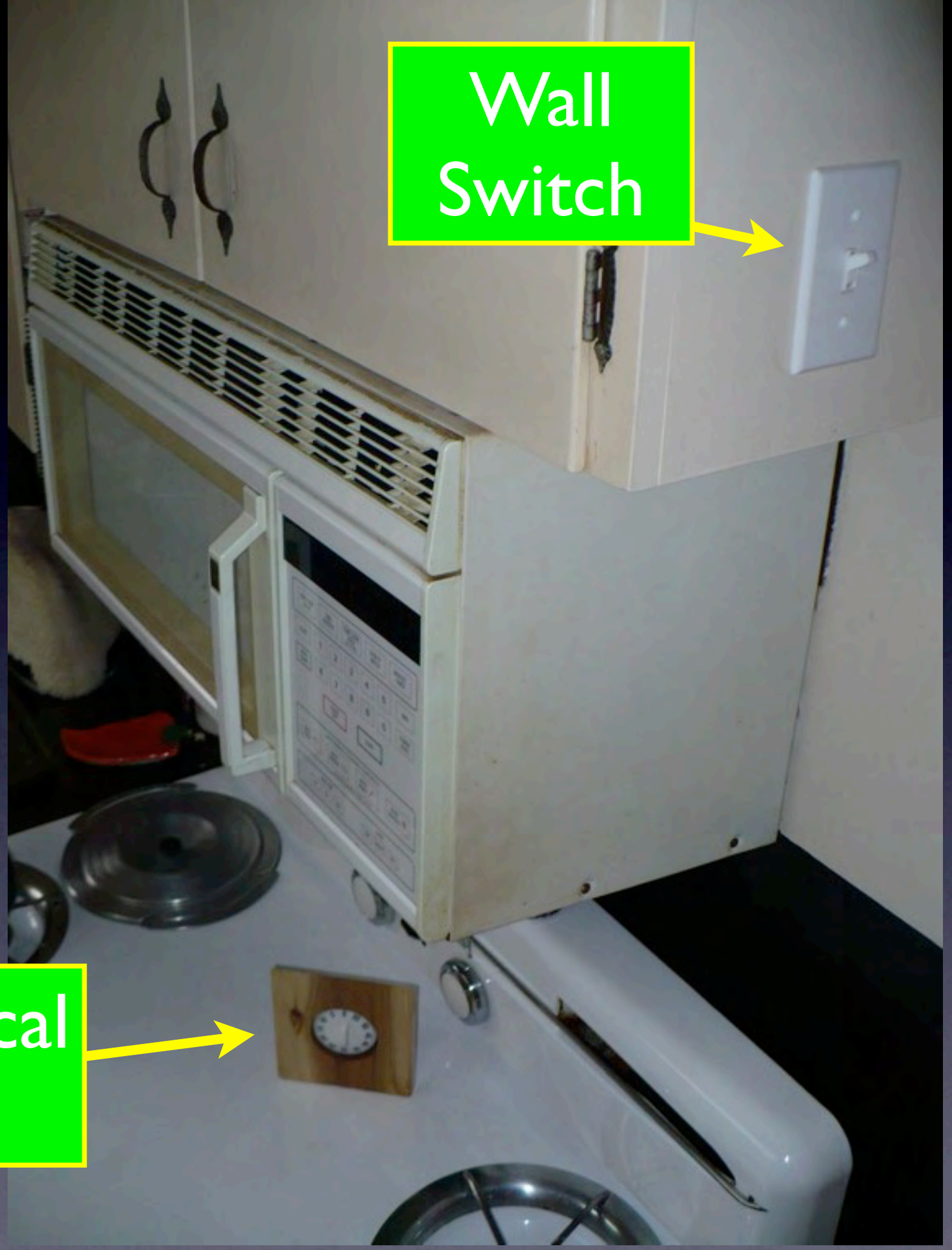
Almost the same monthly usage as a washing machine.


TIME
6:57
PM
TIMEX
HOUR
MINUTE
ON
OFF
TIME


KILL A WATT™
10

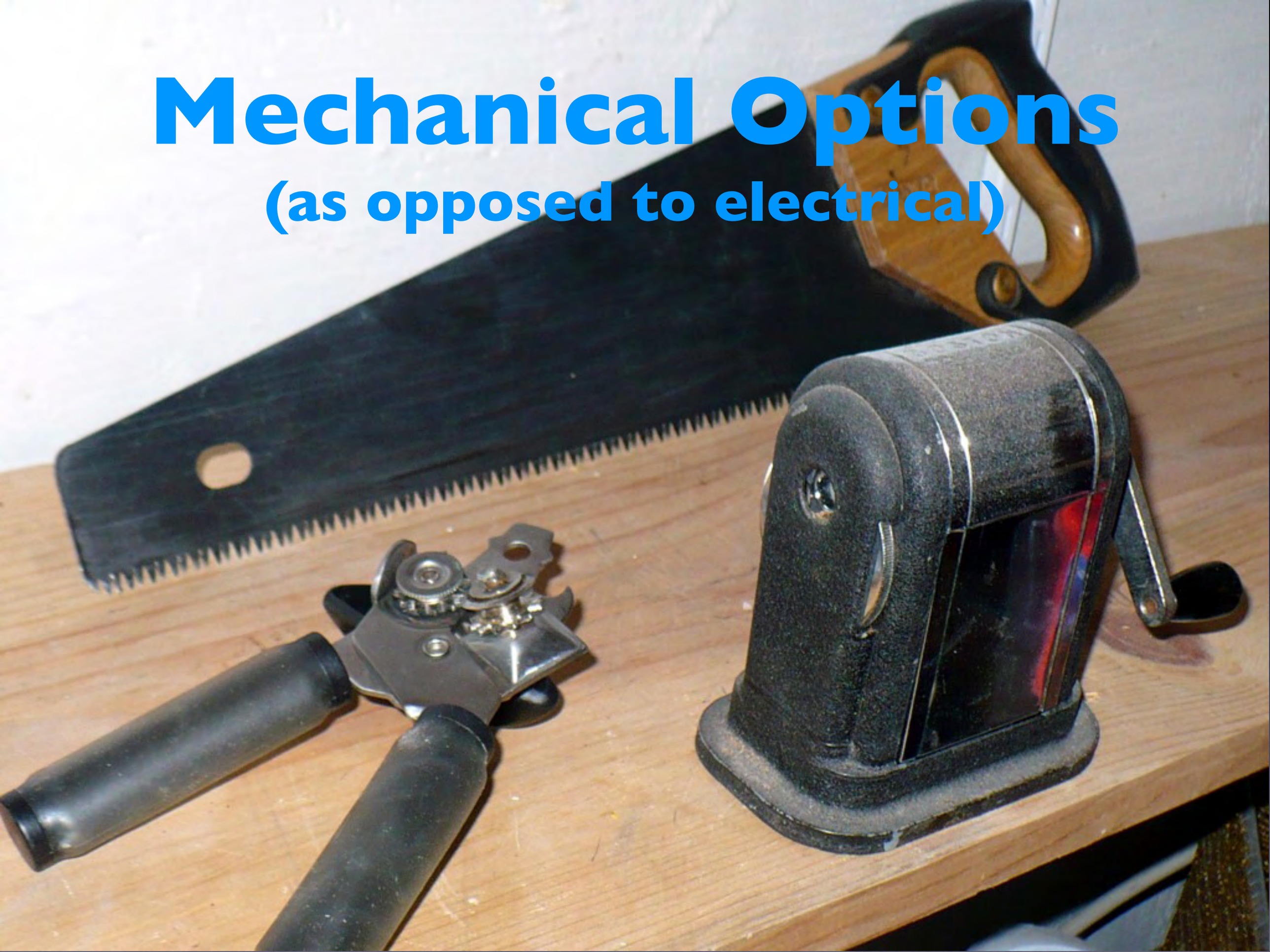
Microwave

10 watts constantly



Mechanical Options

(as opposed to electrical)



Washing Machine

0.2 kWh/load
8 loads = 1.6 kWh/month

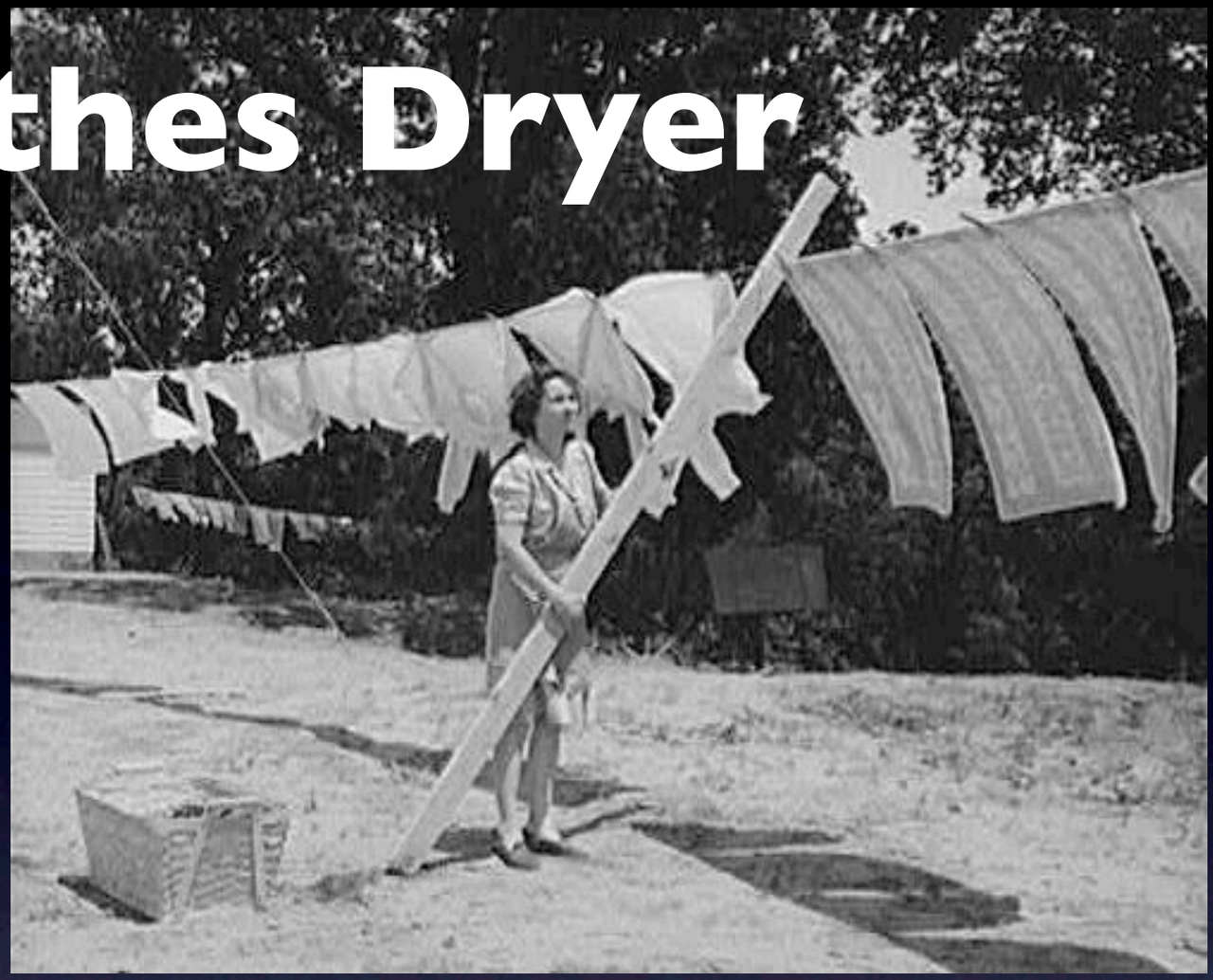
About the same monthly electrical usage as a clock radio.

Clothes Dryer

5 kWh/load
4 loads = 20 kWh/month

Uses twice as much electricity as all the lights in the house combined.

Solar Clothes Dryer



This is an Energy Star refrigerator.

While running, it uses 130 watts.

It's average monthly power usage is 45 kWh.

This is an Energy Star refrigerator.

While running, it uses 130 watts.

It's average monthly power usage is 45 kWh.

Even in January.

Put a plastic container of water outside overnight to freeze.

In the morning,
put it in the refrigerator.

This reduced energy use
by **37%**.

(1.39 down to 0.87 kWh/day)

Lighting: Past, Present, Future

Incandescent: 60 Watts
Efficiency: 17.5 lumens/Watt

Compact Fluorescent: 14 Watts
Efficiency: 72 lumens/Watt

LED (Light-Emitting Diode): 7 Watts
Efficiency: 79 lumens/Watt

Replaced 50-Watt halogens with 3-Watt LEDs

Over 10 Years at 8 hrs/day:

Halogens: $5/bulb x 10 + $146 power = $ 196

LED Bulbs: $15/bulb x 1 + $9 power = $ 24

www.ledlightbulb.net

MR16, 3x1W high power LED spotlight, Warm white

MR16, 3x1W, Using 3pcs 1W high power LEDs , Spotlight with 38~45 degree beam, Downlight bulbs, Warm White 3000K~3500K , 12VDC/12VAC Voltage...

$14.50

Add: 0

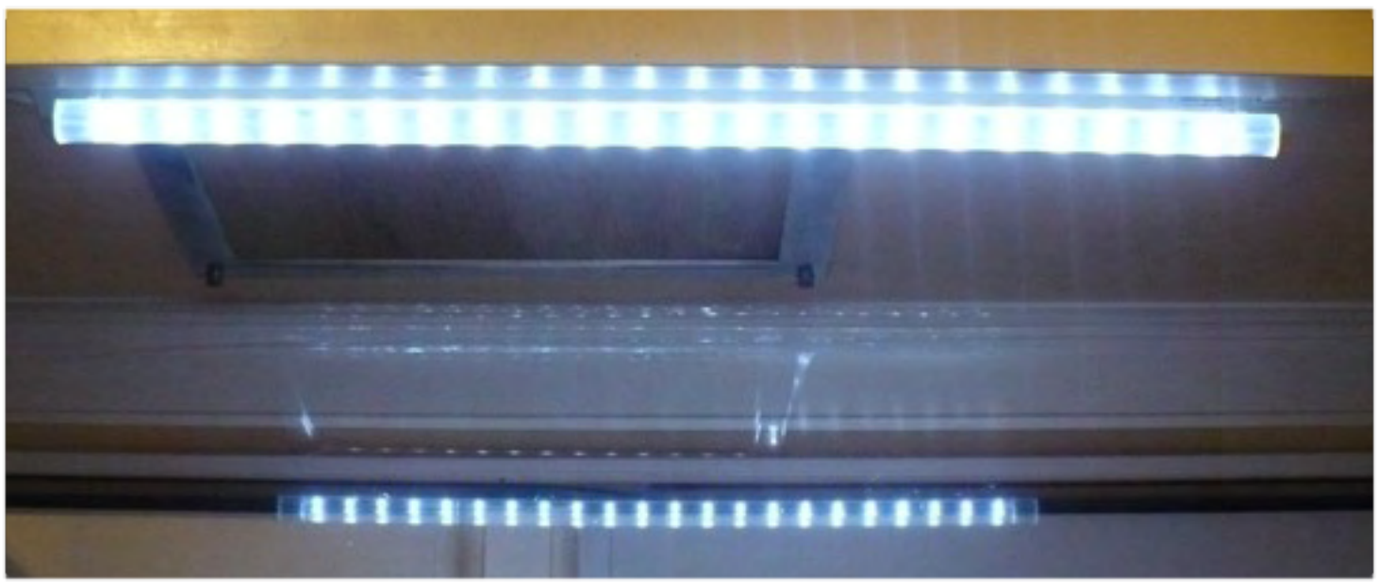
MR16, 3x1W high power LED spotlight, daylight white

MR16, 3x1W, Using 3pcs 1W high power LEDs , Spotlight with 38~45 degree beam, Downlight bulbs, Daylight White 5000K~6500K , 12VDC/12VAC Voltage...

$14.50

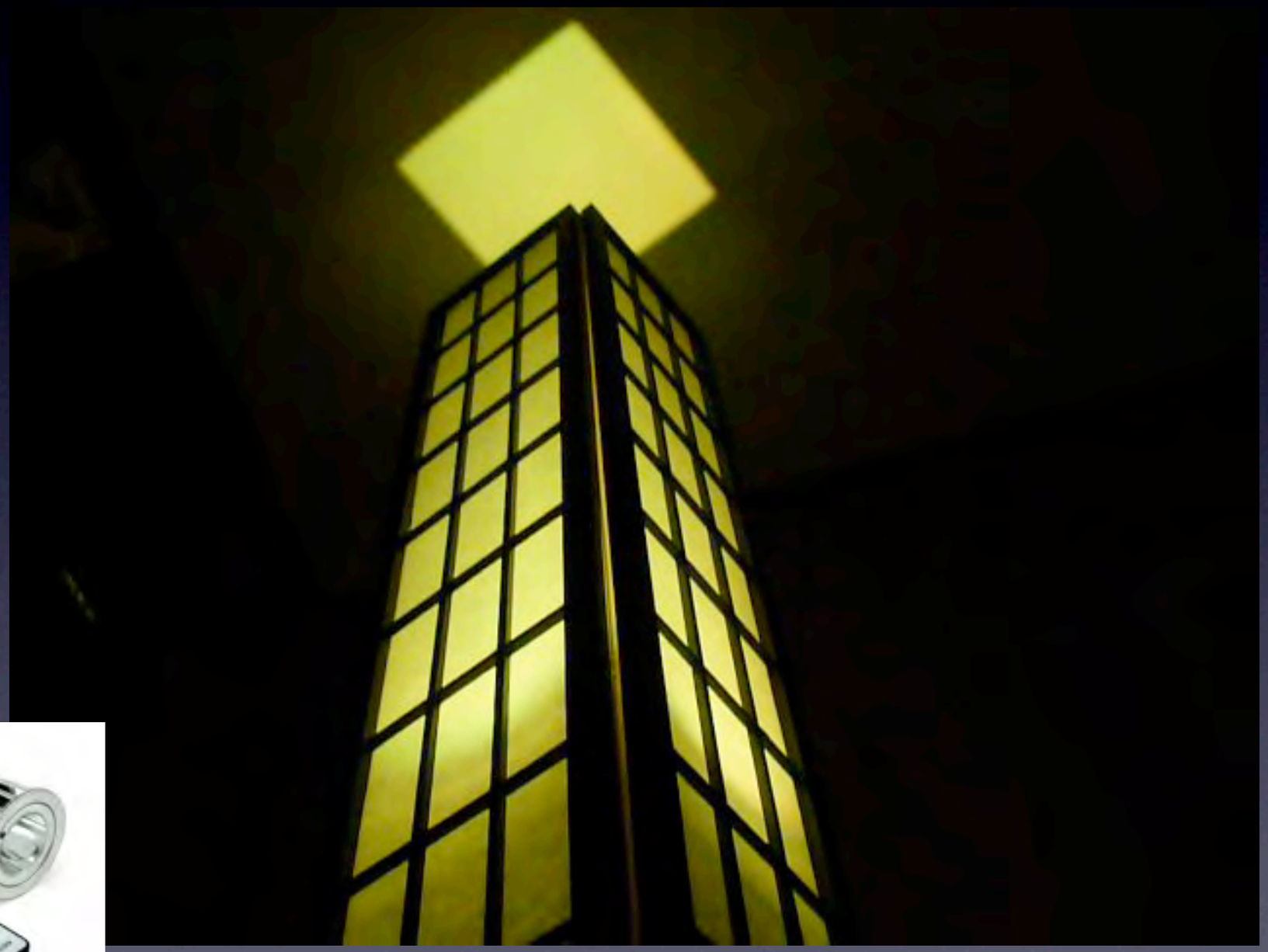
Add: 0

Under-counter LED strip lighting
$10 at Menard's
3 watts



LED Task Lighting

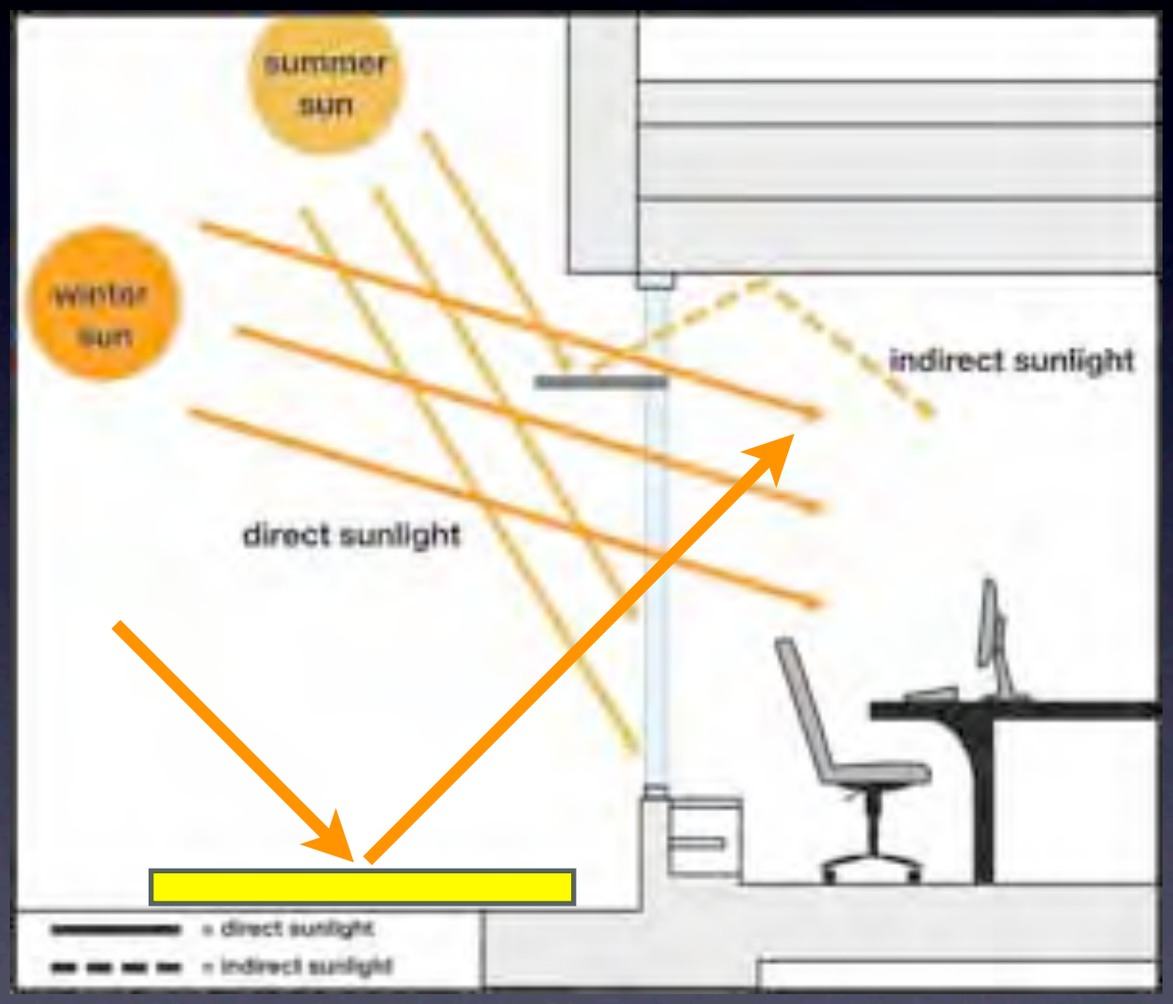
Color LED Bulb



$35 at eaglelight.com (w/remote)

Natural Light

Light Shelves



Extra Financial Incentives

Local:

GoColumbiaMO.com

State:

www.dsireusa.org (Database of State Incentives for Renewables and Efficiency)

www.dnr.mo.gov/transform/energizemissourirebate

- Gas Furnaces - $125
- Air Source Heat Pumps - $250
- Central Air Conditioning - $100
- Water Heaters-Gas Condensing - $150
- Water Heaters-Gas Storage - $100
- Water Heaters-Gas Tankless - $100
- Water Heaters-Solar (With Gas Backup) - $500
- Water Heaters-Electric Heat Pump - $150
- Water Heaters-Solar (With Electric Backup) - $500
- Clothes Washers - $75
- Dishwashers - $75

April 2010 until money runs out ($5.7 million)

Federal:

www.energy.gov/taxbreaks; www.energystar.gov

Tax Credit: 30% of cost up to $1,500
Expires: December 31, 2010
Details: Must be an existing home & your principal residence. New construction and rentals **do not** qualify.

- Biomass Stoves
- Heating, Ventilating, Air Conditioning (HVAC)
- Insulation
- Roofs (Metal & Asphalt)
- Water Heaters (non-solar)
- Windows & Doors

Tax Credit: 30% of cost with no upper limit
Expires: December 31, 2016
Details: Existing homes & new construction qualify. Both principal residences and second homes qualify. Rentals **do not** qualify.

- Geothermal Heat Pumps
- Small Wind Turbines (Residential)
- Solar Energy Systems

Tax Credit: Credit Details: 30% of the cost, up to $500 per .5 kW of power capacity
Expires: December 31, 2016
Details: Existing homes & new construction qualify. Must be your principal residence. Rentals and second homes **do not** qualify.

- Fuel Cells (Residential Fuel Cell and Microturbine System)

30% Federal Tax Credit

Extra Financial Incentives

The Gettin's Good

Above and Beyond

BUILD IT SOLAR

The Renewable Energy site for Do-It-Yourselfers

Search

Home | Getting Started | Projects Hundreds of DIY Projects | References Design Information | "Half" Program Cut Energy Use in Half | Experimental | Site Map

Welcome To Build-It-Solar

Plans, tools and information to do renewable energy and conservation projects.

Hundreds of projects -- from changing a light bulb to building a solar home.

Design information and tools for building renewable energy projects.

An Experimental section for backyard inventors.

Nothing For Sale here -- just free ideas, plans, and information.

Holy Solar Cow!

Our Solar Home Heater is Cover Story in Mother Earth News

Frugal Energy Saving Projects...

A collection of projects that cost little and save a lot -- 90 solid ideas from bubble wrap to sunspaces.

What's Here?

Getting Started

- Getting Started
- Why Solar?
- Solar Site Survey

Projects - *Hundreds of them*

Conservation

- Energy
- Water

Solar Homes

- Home
- Design
- Plans

The "Half" Program

Our family's program to cut our energy use, energy costs, and CO2 emissions in half.

Half

- Half Main
- Projects
- Progress
- Your Half Plan
- lessons

Design Information & Tools

General

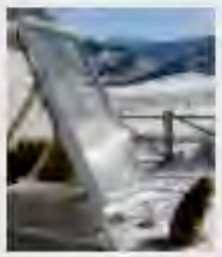
- Publications
- Web Sites

Some New Work

A $1000, cold climate, high performance, durable, Domestic Solar Water Heating System ...

Two new versions of solar water heating collectors:

A collector using PEX tubing instead of copper ($4/sqft)...



A low cost, high performance, copper/aluminum collector ($6/sqft)...

PHOTOVOLTAIC PANELS

Solar Panel Brand	Watt	Min. Quantity*	US$/Unit	US$/ Watt	Solar Panel Vendor NEW!! Complete Systems
Kaneka	60	25	$72.00	**$1.20**	Sun Electronics
Kaneka	60	25	$82.20	**$1.37**	Affordable Solar
Kaneka	60	4	$84.00	**$1.40**	Sun Electronics
Kaneka	60	25	$108.00	**$1.80**	AltE
EPV Solar	50	368	$92.50	**$1.85**	Aten Solar
EPV Solar	50	92	$109.00	**$2.18**	Aten Solar
BP Solar	165	2	$385.00	**$2.20**	Sun Electronics
EPV Solar	50	46	$112.00	**$2.24**	Aten Solar
EPV Solar	52	46	$116.48	**$2.24**	Aten Solar
BP Solar	170	60	$399.97	**$2.35**	The Solar BiZ
REC	225	60	$535.97	**$2.38**	The Solar BiZ
BP Solar	175	60	$423.97	**$2.42**	The Solar BiZ
REC	210	30	$509.97	**$2.43**	The Solar BiZ
REC	220	30	$533.97	**$2.43**	The Solar BiZ
Kyocera	210	2	$512.40	**$2.44**	Sun Electronics
Kyocera	185	2	$451.40	**$2.44**	Sun Electronics
REC	210	30	$512.40	**$2.44**	Beyond Oil Solar
REC	215	30	$524.60	**$2.44**	Beyond Oil Solar
REC	225	30	$549.00	**$2.44**	Beyond Oil Solar
REC	220	30	$536.80	**$2.44**	Beyond Oil Solar
REC	230	30	$561.20	**$2.44**	Beyond Oil Solar
DMSolar	120	2	$297.60	**$2.48**	DmSolar

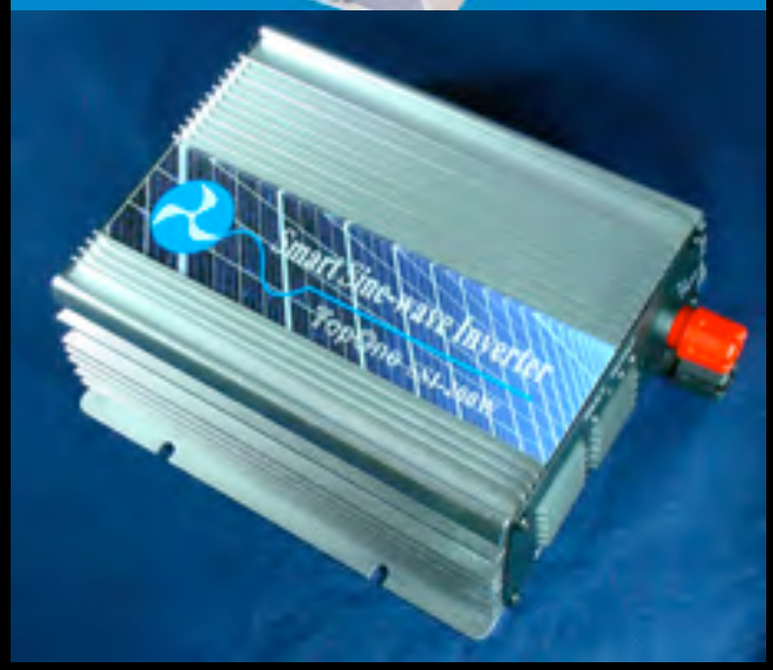
BATTERIES


BB BATTERY
BB BATTERY
Auto Display Backlig
OVER LOAD
LOW BATTERY
POWER
OUTPUT 110V AC

Small Grid-Tie Inverters

SWEA 250W
$229.99

SSI-200W
$259.95
buyerisland.net



Photovoltaic Economics

250 watts of PV	$600
Micro Inverter	$250
Produces about 1 kWh/day:	$34/year
Simple Payback:	25 years

Also:
- Government rebates and tax incentives
- Protection from increasing electricity costs

HACK: Halogen to CF

HACK: Halogen to CF

HACK: Ceiling Light to LEDs

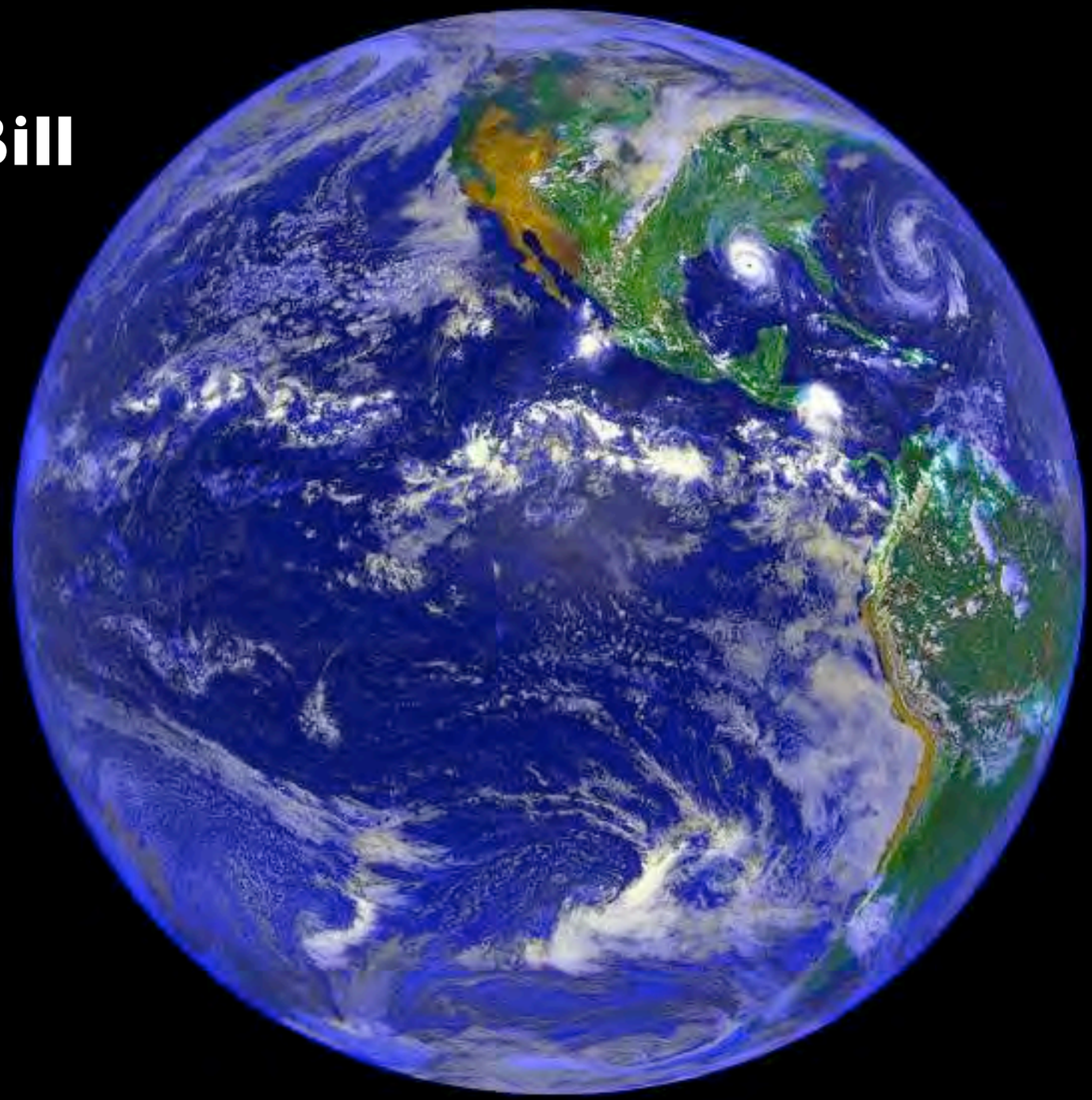
HACK: Incandescent to LEDs

HACK: Troll to Night Light

DC Adapter
to Night Light

HACK:

Monthly Electric Bill into Saved Planet



OR possibly divorce, fines, electrocution, legal fees, your house burning down...

be careful.

Household Electrical Energy Usage

Tom O'Connor, PE
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