



Knowledge Is Power:
Selling the Inconvenient Truth



presenter
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"STOP GLOBAL WARMING, YOU DUMBA__s!"

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**"STOP GLOBAL WARMING, YOU DUMBA__s!
 I really mean it!"**

The "good ole days" are fading ...

Allow Midair Email? GADGETS DB Sites Stack Up MOSSIER'S SOLUTION DB Nest eggs of 400K investors grow amid bull and bear markets... INVESTORS' CHOICE

Making the Best of \$78-a-Barrel Oil

Muzzling the Guzzlers: High Gas Prices Drive Effort to Remake SUVs
 By AMBERIAN WOLFE

SEVERAL TO BLAME for the image of sport-utility vehicles as vehicles in general, SUV makers are facing a number of pressures to boost fuel efficiency and reduce their emissions.

Investors Are Flocking To Slew of Offerings In Hot Energy Markets
 By RICHARD LANE

A one-month hot streak, however, has faded into the energy market's "normal" volatility. Investors are flocking to a slew of offerings in hot energy markets.

...and fading

THE WALL STREET JOURNAL
 WEDNESDAY, 20 FEBRUARY 2008 LEADING T

Oil's New Mark: \$100.01

Surge Defies Notion That Price Will Fall As Demand Softens

Past the Century Mark
 Price per barrel of crude oil on the New York Mercantile Exchange; front-month contract

Crude-oil prices finished just above \$100 a barrel for the first time yesterday despite signs the world's petroleum thirst may be subsiding.

The world's daily needs, running at about 86 million barrels a day. Yesterday, the Energy Department's Energy Information Administration reiterated its call for OPEC to increase production.

OPEC "would like to cut output, but they can't possibly do that at \$100 a barrel," said Roger Diwan, a partner at PFC Energy, a Washington consulting firm. Some market speculators

And, of course, we're at war



So, now what?



Values finally come around

Utilities & governments are becoming convinced:

- Society cannot build its way out of current energy crisis as in past
- Address demand-side of energy first
- Then, consider supply-side

"Less Power to the People" WSJ 16 October 2006

Energy end-use change
Todd Hoener, energy end-use specialist

25 June 2008

Energy end-use is choice

Knowledge + accountability = more usable power

Two energy resource choices in reducing consumption & increasing comfort, cleaning environment:

- Energy efficiency – use of technology, requiring less energy to perform same, or more, functions.
- Energy conservation – controls & behavior changes that result in using less energy.

Both considered substitutes for capital (\$).
Together, energy end-use management.

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Consider the obvious

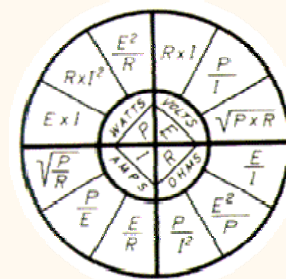
- Electricity generation – primary energy – consumes about 3X as much energy (BTUs) as it delivers to end user
- Reducing end use demand reduces primary energy consumption (BTUs) by a factor of 3

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101 Electric basics

- Watt
- Kilowatt
- Kilowatt-hour



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Watt = unit of power

Basic electric power unit is **watt**.

- One **kilowatt** = 1,000 watts
- Watts = Volts X Amps

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Kilowatt = unit of power


- One **kilowatt** = 1,000 watts
- Kilowatt (kW) measures capacity or load, i.e., power
- 1,000 watts (kW) = 1.34 horsepower

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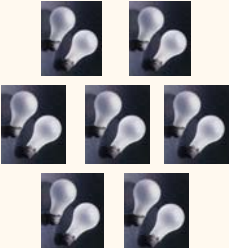
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1.4 kW example

One 1400-watt electric heater



Fourteen 100-watt incandescent lamps



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Kilowatt-hour = unit of energy

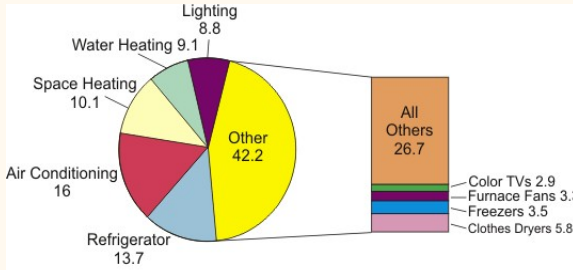
Kilowatt-hour (kWh): 1,000 watts, or 1 kilowatt, acting over a period of 1 hour

- Kilowatt-hour (kWh) = amount of electricity (energy) produced over time

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Residential end-use charted



Category	kWh
Lighting	8.8
Water Heating	9.1
Space Heating	10.1
Air Conditioning	16
Refrigerator	13.7
Other	42.2
All Others (Breakdown)	26.7
Color TVs	2.9
Furnace Fans	3.3
Freezers	3.5
Clothes Dryers	5.8

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U.S. residential electric use

- 10,656 kWh per year = annual average kWh use
- 29.2 kWh per day = daily average kWh use

(Residential Consumption of Electricity by End Use, 2002 survey, EAI, DoE)

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● ● ● "29.2 kWh / day" break down

- 16% air-conditioning = 4.7 kWh / day
- 14% refrigerator = 4.1 "
- 10% space heating = 2.9 "
- 09% water heating = 2.6 "
- 09% lighting = 2.6 "
- 06% clothes dryer = 1.8 "
- 04% freezer = 1.2 "
- 03% furnace fan = 0.9 "
- 03% electric range top = 0.9 "
- (26% "other" = 7.5 ")

(-- based on 10,656 kWh per year U.S. Energy Information Administration, 2002)

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● ● ● End-use percent of U.S. total

Most significant end uses

- Households central AC rose from 27% in 1980 to 55% in 2001
- Kitchen & laundry appliances, about 33% (includes refrigerators)

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● ● ● Low-income & energy use

Percent all average U.S. consumers spent on energy costs:

- 6.5%, 2008

Percent average LIHEAP recipient spent on energy costs:

- 20%, 2007

(AARP survey, American Gas Association survey)

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● ● ● Low-income energy use trends

Increased use of electricity as main heating fuel

- 10% in 1979
- 34% in 2001

(Natural gas remains dominant heating fuel)

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● ● ● "29.2 kWh / day" break down

- **16%** air-conditioning = **4.7 kWh / day**
- **14%** refrigerator = **4.1 "**
- **10%** space heating = **2.9 "**
- **09%** water heating = **2.6 "**
- **09%** lighting = **2.6 "**
- 06% clothes dryer = 1.8 "
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- 03% furnace fan = 0.9 "
- 03% electric range top = 0.9 "

(-- based on 10,656 kWh per year U.S. Energy Information Administration, 2002)

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● ● ● Average kWh use per day

- 16% air-conditioning = 4.7 kWh / day
- 14% refrigerator = 4.1 "
- 10% space heating = 2.9 "
- 09% water heating = 2.6 "
- 09% lighting = 2.6 "
- **48% Average = 3.4 "**

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Operation cost example

Average of top five appliances per day

- 3.4 kWh X \$0.15 (price of electricity per kWh)
- = \$0.51 per day
- X 365 days = \$186 per month per appliance
- X 5 appliances = \$931 per year for nearly 50% of electric use in top 5 users

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Operation cost example

Appliance specification plate states "1,400 watts"

- 1,400 watts ÷ 1,000 watts (1 kW) = 1.4 kW
- (1.4 kW) X 2 hours = 2.8 kWh
- 2.8 kWh X \$0.15 (price of electricity per kWh)
- = \$0.42 (operate for 2 hours)
- X 6 months per season = \$77 per season

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Baseload electric use

- Defined
- Quantified
- Audited
- Monitored
- Reduced by efficiency

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What is baseload electricity?

- Minimum amount of electric power delivered, or required, over given period of time at steady rate
- Generally, represents all energy used to operate house, *minus* heating & cooling (peaks)

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Determine baseload level

The "base" other electric fluctuations sit upon.
Multiply lowest kWh-per-month by 12 for an annual baseload use

- Total annual household use = 10,656 kWh per year
- Lowest average daily use in year (over a month period) = 20 kWh per day
- Annual baseload = 20 kWh X 365 days = 7,300 kWh per year (3,356 kWh "seasonal" or "peak")

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Baseload auditing


- Use monitoring measurement tool, read nameplate ratings (watts, amps) on equipment, devices
- Use bill (usage, not cost)
- Identify high electrical use
- Identify solutions to high-use problems
- Provide education & motivation

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Monitoring baseload



Electric usage monitor (baseload)

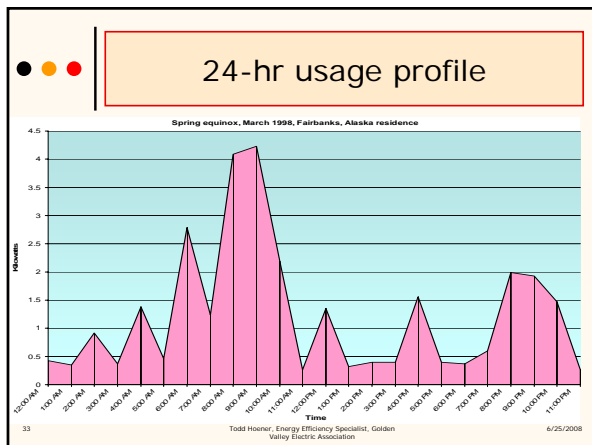
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Monitoring peak load



Electric usage monitor and Electric water heater timer (on)

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Monitoring electric use

- Tools
- Logging, recording, graphing
- Determining efficiency
- Analyzing the information & collected data

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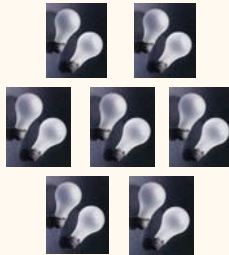
Monitoring electric use

One 1,400-watt electric heater




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Fourteen 100-watt incandescent lamps



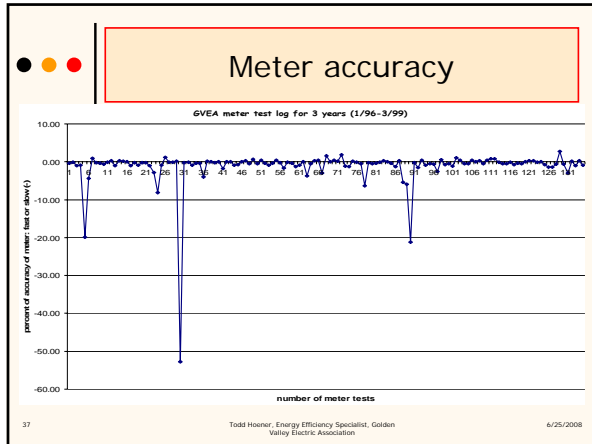
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Meter: a monitoring tool



- Meter measures usage (kWh)
- Difference between prior & present meter readings equals amount of kWh used – & purchased

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Monitoring with meter

Get sense of daily usage & activities

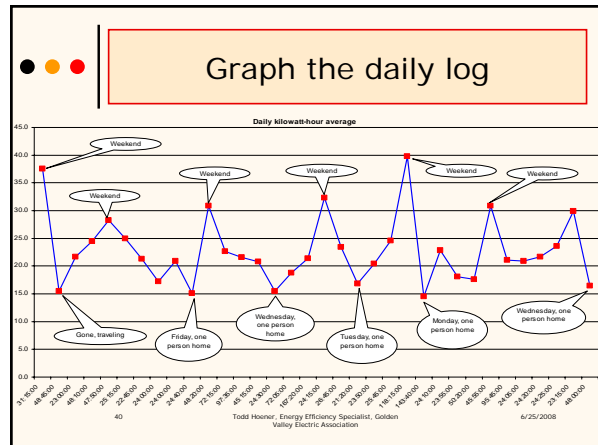
- Read meter same time each day
- Record reads & log activities (e.g., laundry, houseguests, construction, etc.)
- Electrical use = today's read subtract from tomorrow's read
 - = # of kWh used in 24-hr

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Daily log: 24-hr reads

Date	Day	Time	Days	kWh read	kWh usage	kWh daily ave	Activities
5-Oct-05	Wednesday	4:00 PM	0	16807	0	0.0	Two loads of wash and dried
6-Oct-05	Thursday	4:00 PM	1	16847	-40	40.0	
7-Oct-05	Friday	4:00 PM	2	16878	31	35.5	
8-Oct-05	Saturday	8:30 AM	2	16897	19	34.6	Turned off all but 2 circuit breakers
9-Oct-05	Saturday	6:00 PM	3	16900	3	30.0	Turned breakers back on. Used oven 4 hours, showers
9-Oct-05	Sunday	8:30 AM	3	16905	5	27.2	
10-Oct-05	Monday	8:30 AM	4	16970	65	35.4	Two loads laundry
11-Oct-05	Tuesday	8:30 AM	5	17004	34	35.2	No laundry, but stove, micro & grill
12-Oct-05	Wednesday	8:30 AM	6	17051	47	37.0	Turned all off but stove for a cup
13-Oct-05	Thursday	8:30 AM	7	17076	25	35.4	
13-Oct-05	Thursday	11:30 AM	7	17083	7	35.8	
13-Oct-05	Thursday	12:30 PM	7	17084	1	35.5	
13-Oct-05	Thursday	1:30 PM	7	17084	0	35.5	Turned just bedroom, frig, heater on; stove off
13-Oct-05	Thursday	2:30 PM	7	17085	1	35.2	Turned on what dried. Washer is water pump; took frig & heater on
13-Oct-05	Thursday	5:30 PM	8	17086	1	34.9	Turned on all but hot water & dryer
13-Oct-05	Thursday	8:00 PM	8	17090	4	34.9	Turned hot water on 7 pm, hot water off 8 pm
13-Oct-05	Thursday	9:00 PM	8				All in bed but Steve with computer on
14-Oct-05	Friday	9:45 AM	8	17096	6	34.0	Turned hot water on
14-Oct-05	Friday	9:45 AM	8	17105	9	36.3	Hot water off, wash one load, cold water
14-Oct-05	Friday	11:55 AM	8	17106	1	34.8	Wash one load, cold
14-Oct-05	Friday	12:55 PM	8	17107	1	34.5	Vacuum, dry one load for 20 min.
14-Oct-05	Friday	1:50 PM	8	17108	1	34.6	
14-Oct-05	Friday	4:50 PM	9	17109	1	33.6	Cooked on stove
14-Oct-05	Friday	6:50 PM	9	17111	2	33.4	Turn on oven
14-Oct-05	Friday	7:20 PM	9	17113	2	33.6	Churn off
14-Oct-05	Friday	9:30 PM	9	17114	1	33.4	Hot water heater on
15-Oct-05	Saturday	9:50 AM	9	17122	8	33.2	Hot water heater off
15-Oct-05	Saturday	7:20 AM	9	17126	6	33.4	Hot water heater off
16-Oct-05	Saturday	4:45 PM	10	17133	5	32.6	Hot water heater on
16-Oct-05	Sunday	7:00 AM	10	17140	7	32.2	Hot water heater on
16-Oct-05	Sunday	5:00 PM	11	17166	18	32.6	Hot water heater on
16-Oct-05	Sunday	9:15 PM	11	17172	6	32.9	Hot water heater off
17-Oct-05	Monday	6:00 AM	12	17182	7	31.0	Hot water heater on
17-Oct-05	Monday	9:30 AM	12	17194	12	31.5	Washed two loads, no dryer; hot water off
17-Oct-05	Monday			17195	1	31.5	

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Monitoring tools

Energy Usage Monitor (EML)

- Measures kWh consumed
 - Projects costs
- Measures kW load
 - Displays time monitored
 - Connects 120V or 240V
 - Cost: ~ \$ 295

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Monitoring tools

PowerCost Monitor

- Measures kWh
- Measures time
 - Displays kW
- Forecast costs
- Temperature
- Whole house

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Monitoring tools




- **Watts Up? PRO**
 - Measures projected costs
 - Measures kWhs
- Memory storage & ability to download data
 - Measures voltage & amp
 - Power factor: measures phase-shifted loads, such as motors
- Cost: ~ \$150

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Monitoring tools

- **P3 International KILL-A-WATT**
- Measures kWh
- Measures time
- Displays volts, amps, watts
- Forecast costs
- 0.2% accuracy
- Cost: ~ \$ 30




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Costs: replace refrigerator?

Annual operating cost of 1985 refrigerator	\$189.80
Annual operating cost of Energy Star Maytag bottom mount	\$48.80
Annual operating cost savings	\$141.00
Simple payback (yrs): Energy Star Maytag bottom mount (\$879 capital cost / \$141 annual operating cost savings)	6.4 yrs

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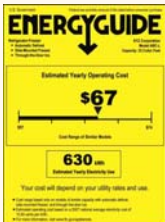
When efficiency matters



- Clothes washers
- Refrigerators & freezers
- Dishwashers
- Computers, monitors, printers
- energystar.gov for lots more

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Not Energy Star labeled?



DoE website purchasing guides & tips

- clothes dryers, water heaters, more

EnergyGuide label provides

- Energy consumption, usage estimates
- Yearly operating cost estimates

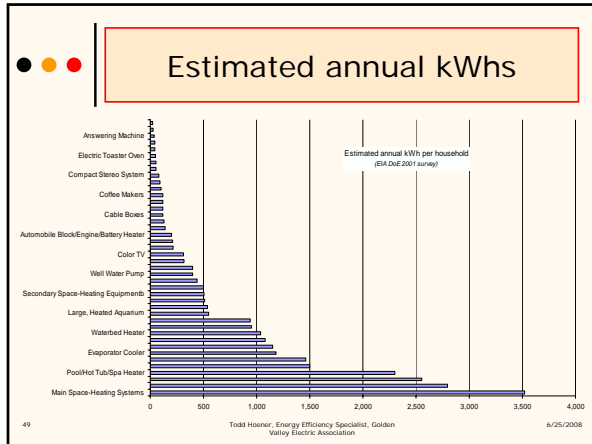
ACEEE's: *Consumer Guide to Home Energy Savings*

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Comparing kWh estimates

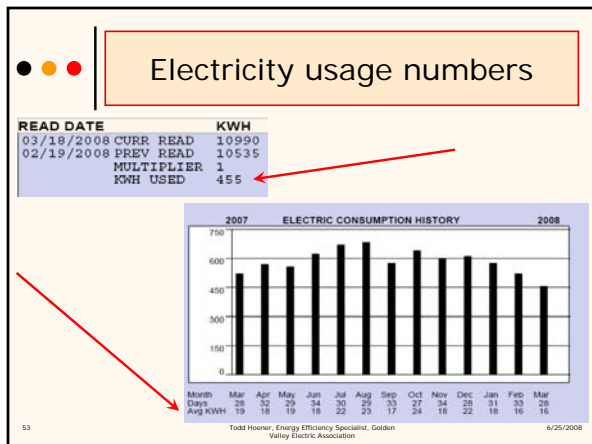
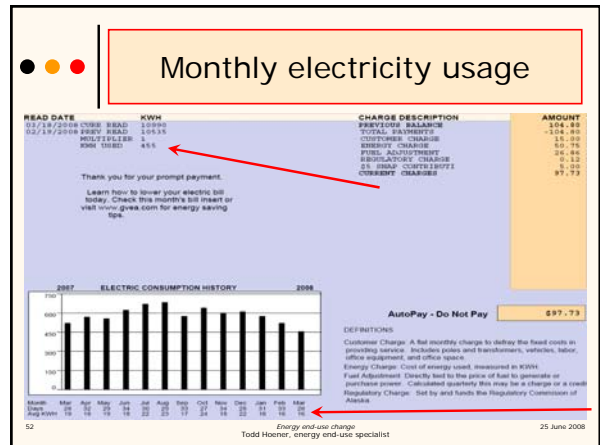
Appliances	Time in use	kilowatt-hours used per year	average kilowatt-hours per day	based on seasonal rates
Central air conditioning	2700 hrs/yr	2700	7.4	per 120 days per 12 hours per day
Water heater (40 gallon electric)	2 hrs/day	2,180	6.00	
Refrigerator	3 hours/day, 120 days/yr	440	1.22	per 120 days per 3 hrs per day
Fan (Refrigerator)	12 hrs/day, 120 days/yr	432	1.20	per 120 days per 12 hrs per day
Blower fan (ice chest)	12 hrs/day, 180 days/yr	420	1.17	per 180 days
Fan (tabletop)	4hrs/day, 120 days/yr	370	1.03	per 180 days per 4 hrs per day
Water pump (deep well)	2 hrs/day	730	2.00	
Refrigerator	24 hours/day	700	1.92	
Dishwasher	12 hours/day	700	1.92	
Refrigerator (freezer 18 cubic feet) - 1994	24 hours/day	680	1.87	
Refrigerator (freezer 16 cubic feet) - 1994	24 hours/day	642	1.76	
Electric fan/ceiling	8 hrs/day, 120 days/yr	175	0.48	
Computer	8 hours/day	320	0.89	per 120 days per 8 hrs per day
Dishwasher (does not include hot water)	1 hour/day	432	1.19	
Fan (ceiling)	4 hrs/day, 180 days/yr	144	0.39	per 180 days per 4 hrs per day
Television (cathode)	3 hours/day	264	0.73	
Coffee maker	30 minutes/day	120	0.33	
Hair dryer	15 minutes/day	100	0.27	
Microphone oven	2 hours/week	88	0.24	
Radio (cassette)	2 hours/day	72	0.20	
Toaster oven	1 hour/day	72	0.20	
Iron	1 hour/week	52	0.14	
Clock radio	24 hours/day	44	0.12	
Vacuum cleaner	1 hour/week	36	0.10	
Clock	24 hours/day	36	0.10	
Clothes washer (does not include hot water)	2 hours/week	31	0.08	
CDR	4 hours/day	30	0.08	

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- ## Determining load & usage
- Shortcut: Maximum amount of wattage load is imprinted on electrical devices or on attached labels (nameplate rating)
 - Watt-meter monitoring tool
 - Use residential service entry meter (isolate)
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- ## More tools: reading the bill
- Tells a lot
 - Typically underestimated, misunderstood
 - Audit helps understand energy use, provides client education
 - Bill, like meter: a tool & a friend (not necessarily "bad guy")
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- ## High-use assumptions
- Inaccurate meter (broken)
 - Misread (wrong)
 - Somebody else's meter read (confusion)
 - Mysterious, unannounced rate increase (conspire)
 - Leaking electricity (soaked ground)
 - "Not my fault" (after receiving statement)
 - Other people pay less & have/do more "things" (i.e., everything: house size, people, time home, lights on, appliances, toys, parties, etc.)
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High-use reality

Prolong use: inattention; unmonitored human activities, behaviors, habits: i.e., lack of control(s)

- Electricity constantly on, people or none
- People: cooking, laundry, lighting, fans, TV, entertainment center, computer, etc.
- Freezers, pumps, electric water heaters, "phantom" users (i.e., televisions, entertainment centers, etc. ~ 10%)
- Unknown high-use devices

Meter rarely inaccurate – accurate measuring device

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More high-use reasons

- Lifestyle changes, household dynamics
- Additional appliances
- Mechanical problems with electrical appliances, devices, equipment
- Seasonal temperatures, length of daylight
- Holidays, visitors, returning relatives
- Forgotten, hidden devices
- Staying at home (weekends, laundry day, etc.)

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Affordability budget planning

Example #1:

\$20,000 yearly household net income

- Electricity expense: 5% of net income
- = \$1,000 per year
- ÷ \$0.15 per kWh
- = 6,667 kWh per yr
- ÷ 365 days per yr
- = 18 kWh per day average over year

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Affordability budget planning 2

Example #2:

\$30,000 yearly household net income

- Electricity expense: 5% of net income
- = \$1,500 per year
- ÷ \$0.15 per kWh
- = 10,000 kWh per yr
- ÷ 365 days per yr
- = 27 kWh per day average over year

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Changing behavior

- Controlling use
- Demand response programs
- Home energy plans
- Education

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Control: automatic




Occupancy sensors (WattStopper)

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Control: automatic




Electric water heater electronic timer

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Control: automatic

Outdoor weatherproof timer




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Control: manual




Power strip - surge protector, control switch



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Kinda cool: KillAWatt PS



- Assesses efficiency
- Built-in surge protection
- Monitor voltage, line frequency, amperage, kWh, current "leakage"

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Demand response programs

Peak load reduction programs

- Provides incentives for demand reduction
- Load curtailment
- Sometimes offered for low-income residential users

End-use goals

- Improve reliability & save money
- Energy efficiency improvements
- Education & outreach
- Use advance metering to log end-use patterns

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Demand response programs

Smart meters

- Help manage energy use
- Time of use & critical pricing rates
- Provide capabilities such as outage detection and assessment
- Collect & store data on hourly basis
- Allows customers to see & react, making choices to reduce consumption & costs

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Home energy plan: *no cost*

No cost action – operating cost		
Monthly energy item	Action	Estimated savings each MONTH
Lighting	Off: three 75-w incandescent lights that operate 2 hrs per night.	2% of monthly energy usage
2nd refrigerator	Unplug & recycle second refrigerator	9% of monthly energy usage
Dishwasher	Open door & air dry dishes	1% of monthly energy usage
Refrigerator	Clean coils, provide circulation	1.7% of energy usage
Clothes washer	Only full loads (dryers, too), reduce washing 1/3 per month	.25% of monthly energy usage
Computers	Energy savings mode	1% of monthly energy usage

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Home energy plan : *low cost*

Low cost action – operating costs		
Monthly energy item	Action	Estimated savings each MONTH
Lighting	Replace four 100-w incandescent four 27-w CFLs	6% of monthly energy usage
Thermostat	Install ENERGY STAR®-labeled programmable thermostat	3% of monthly energy usage
Torchiere	Replace any halogen or incandescent torchiere with ENERGY STAR®	2% of monthly energy usage
Dimmers	Use dimmers, timers, & motion sensors on incandescent	7% of monthly energy usage
Water heater	Wrap older water heater with insulated blanket	30 kWhs
Faucets	Fix defective plumbing, leaks or dripping faucets	25 kWhs
Window shades	Install window shades, coverings	5% of monthly energy usage

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6/25/2008

Home energy plan: capital

Investment – capital costs		
Monthly energy item	Action	Estimated savings each MONTH
Refrigerator	Replace 10-year old or older refrigerator with ENERGY STAR®	8% of monthly energy usage
Central Air Conditioner	Replace 10-year old or older air conditioner with ENERGY STAR®	5% of monthly energy usage
Clothes Washer	Replace 10-year old or older clothes washer with ENERGY STAR®	5% of monthly energy usage
Hot Water Heater	Replace 10-year old or older water heater	76 kWhs
Windows	Replace old windows with new high performance ones	34 kWh (in cooling / heating season)

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Behavior change

- Over-communicate with clients: education
- Create action plan and how-to list for clients on saving & controlling electricity usage & money
- Develop an electricity-use budget
- Let clients know fixing problems quickly saves money

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Behavior change

- Offer seasonal tips to conserve energy (e.g., a calendar, periodic newsletter, etc.)
- Install sub-metering, if necessary (temporary)
- Launch electrical energy efficiency support campaign
- Offer some benefit, incentive

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Develop Home Energy Policy

- Efficiency important but only small part
- Accountability: it IS personal
- Affordability: income vs. energy costs
- It's not just "the lights on" – other factors
- Using monitoring tools, logging results
- Understand monthly statements & meter reads
- Develop usage budget plan
- Home energy planning
- Staying course, changing behavior, better habits

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Energy end-use change
Todd Hoener, energy end-use specialist

25 June 2008

Client education

Consumer communication campaign

Electric bill outrageous?

CLIC

unlock the power to lower your bill

- **Control**
- **Learn**
- **Install**
- **Change**

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Get people's attention

Consumer communication campaign

Control

the valuable electricity you purchase & use

- Motion detectors for lights
- Electric water heater blanket

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Get people to listen

Consumer communication campaign

Learn

how you use & spend

- Regularly read electric meter
 - Understand electric use
 - Know what electricity costs

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Get involved

Consumer communication campaign

Install

efficient, effective appliances, devices & equipment

- Energy Star products & appliances
- Compact fluorescent lamps

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Use social networks

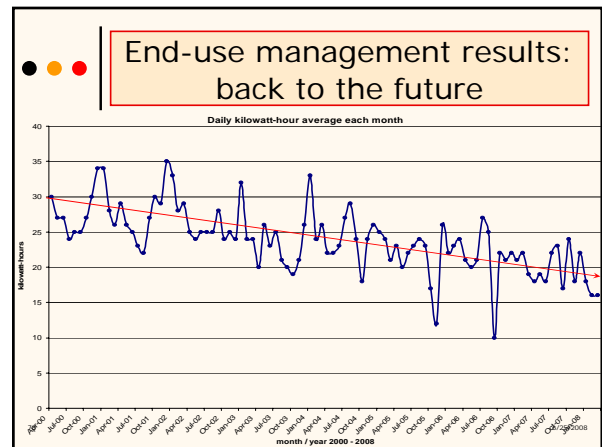
Consumer communication campaign

Change

your behaviors, habits, actions, activities

- Budget for electric consumption
- Prepare & follow your Home Energy Plan

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Useful resources

- www.energystar.gov – U.S. EPA ENERGY STAR
- <http://www.fypower.org> – California's energy efficiency & conservation information resource
- www.pathnet.org – Partnership for Advancing Technology in Housing (PATH), supported by U.S. HUD
- www.toolbase.org – PATH resource tools
- www.eere.energy.gov – U.S. DoE Energy Efficient & Renewable Energy

