

### Utility Bill Analysis

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End Use Energy Specialist  
Golden Valley Electric Association  
Fairbanks, Alaska  
Energy  
OutWest  
2008 06 06

### Ahh...the good ole days

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*

BY NEIL KING JR. AND ANA CAMPOY

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 latest surge surprised

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

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

Yesterday's settle: \$100.01, up 4.7%

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### Analysis basics

- Examining monthly statements
- Taking meter reads
- Using monitoring tools
- Logging & recording for baseloads and peaks

### What is analyzed is purchased

- Kilowatt-hour = unit of energy (consumed)
- Kilowatt-hour (kWh): 1,000 watts – or 1 Kilowatt – acting over a period of 1 hour
- Kilowatt-hour (kWh) = amount of electricity (energy) produced or used over time

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### The hunt for data (kWh)

From utility to utility...

- Statements differ
- Rates differ
- Incentives to save energy differ

**PACIFIC POWER**  
 JOHN A. MANN IS CUSTOMER  
 1234 E MAIN ST  
 ARKHYRE, USA 98765

1 Questions about your bill? 1-888-271-7070  
 24 hours a day, 7 days a week  
 www.pacificpower.net

BILLING DATE: May 26, 2008  
 ACCOUNT NUMBER: 5556490-001 2  
 METER: 63L708  
 AMOUNT DUE: \$51.78

**Your Balance With Us**  
 Previous Account Balance: \$9.34  
 Payments Received: \$9.34  
 New Charges: \$51.78  
 Current Account Balance: \$51.78

**Payments Received**  
 May 12, 2008: Payment received - Thank You: \$9.34  
 Total Payments: \$9.34

**Historical Data**  
 Year Average kWh Used by Month  
 May: 50, Jun: 50, Jul: 50, Aug: 50, Sep: 50, Oct: 50, Nov: 50, Dec: 50, Jan: 50, Feb: 50, Mar: 50, Apr: 50, May: 50

**Electric Service**  
 1234 E Main St, Arkhyre, USA  
 Residential Service - Schedule 1

**Electric Charges**  
 Meter: 63L708  
 Meter Read: 62,093  
 Difference: 540  
 Usage: 540 kWh

**Electric Charges**  
 Electric Charge: \$90.95  
 Baseline Usage: 240,000 kWh @ \$0.11560  
 101-100% of Baseline: 72,000 kWh @ \$0.11442  
 101-200% of Baseline: 172,000 kWh @ \$0.22146  
 201-300% of Baseline: 48,000 kWh @ \$0.36297  
 Over 300% of Baseline: 0.00000 kWh @ \$0.34878

**Taxes**  
 Energy Commission Tax: \$ 0.12  
 Utility Users' Tax (0.0000%): 4.25

**TOTAL CHARGES**: \$95.62

**Usage Comparison**  
 Days Billed: 32  
 kWh Billed: 540  
 kWh per Day: 16.9  
 This Year: 32, 540, 16.9  
 Last Year: 30, 996, 33.2

**PG&E Pacific Gas and Electric Company**  
 WE DELIVER ENERGY

JANE SAMPLE

Service ID# 1527913579  
 Rate Schedule: R 18 Residential Service  
 Billing Cycle: 30 days

**Electric Account Detail**  
 Meter: 63L708  
 Meter Read: 62,093  
 Difference: 540  
 Usage: 540 kWh

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PG& E has different baseline rate structures throughout its service territories

READ DATE: 04/26/2008  
 CURN READ: 1662  
 03/25/2008 ESTD: 831  
 kWh USED: 831

**CHARGE DESCRIPTION**  
 PREVIOUS BALANCE: \$40.68  
 BALANCE FORWARD: \$40.68  
 CUSTOMER CHARGE: 15.00  
 ENERGY CHARGE: 92.68  
 FUEL ADJUSTMENT: 49.05  
 LATE FEE: 42.25  
 REGULATORY CHARGE: 0.23  
 CURRENT CHARGES: 199.21  
 PAST DUE: 222.42  
 DELINQUENT: 411.26

**DELINQUENT NOTICE**  
 Your account is DELINQUENT. Please contact our member services office at 452-1151 immediately to avoid possible disconnection of your electric service.

Free tree giveaway, Saturday, May 17 9 a.m. to noon. Fairbanks parking lot. Canadian Red Choke Cherry tree. Limited quantities. One per family. Division members contact your office.

**2007 ELECTRIC CONSUMPTION HISTORY**  
 2007: Jan (1000), Feb (1000), Mar (1000), Apr (1000), May (1000), Jun (1000), Jul (1000), Aug (1000), Sep (1000), Oct (1000), Nov (1000), Dec (1000)  
 2008: Jan (1000), Feb (1000), Mar (1000), Apr (1000), May (1000), Jun (1000), Jul (1000), Aug (1000), Sep (1000), Oct (1000), Nov (1000), Dec (1000)

**DEFINITIONS**  
 Customer Charge: A flat monthly charge to defray the fixed costs in providing service. Includes poles and transformers, vehicles, labor, office equipment, and office space.  
 Energy Charge: Cost of energy used, measured in kWh.  
 Fuel Adjustment: Directly tied to the price of fuel to generate or purchase power. Calculated quarterly this may be a charge or a credit.  
 Regulatory Charge: Set by and funds the Regulatory Commission of Alaska.

Total Due: \$839.89

**Spotting trends**

- What is "normal"
- What is "baseload"
- Investigating peaks, trends, abnormalities

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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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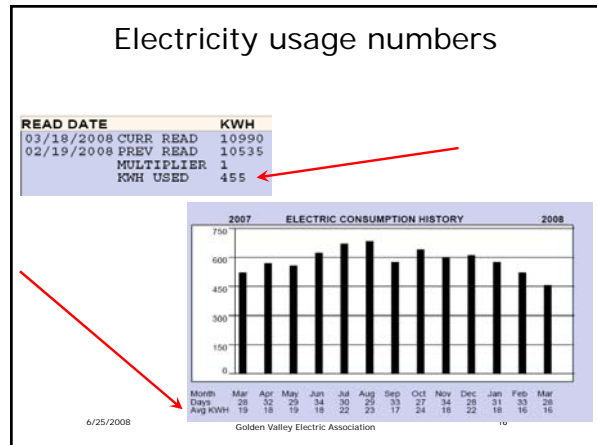
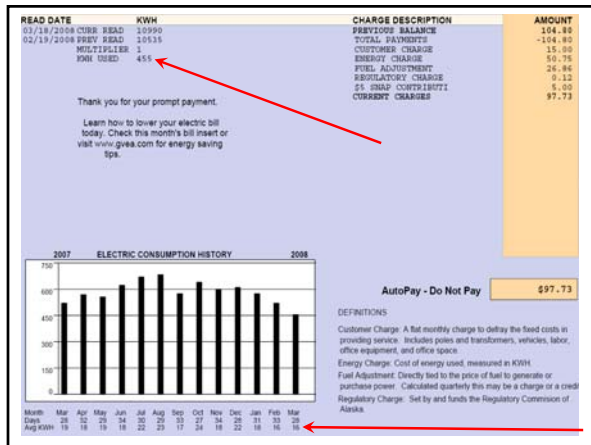
### National average kWh use per day

- 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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### Baseload usage

Starting point in data hunt & analyzing utility bill

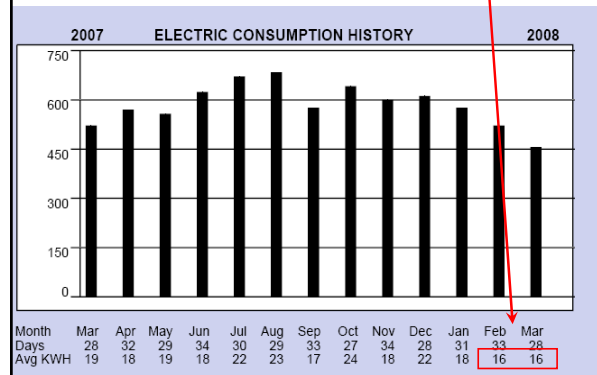
- Minimum amount of electric power delivered, or required, over given period of time at steady rate
- Generally, represents all energy used to operate house, *minus* heating & cooling (which are seasonal peaks sitting on top of the baseload)
- Controlled by efficiency or eliminating

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### Baseload daily average



### Baseload estimates

- 16 kWh average per day
  - 480 kWh average per month
  - 5,760 kWh average baseload per year (for that utility bill)
- That's the potential low usage of the house, annually

### Monitoring baseload



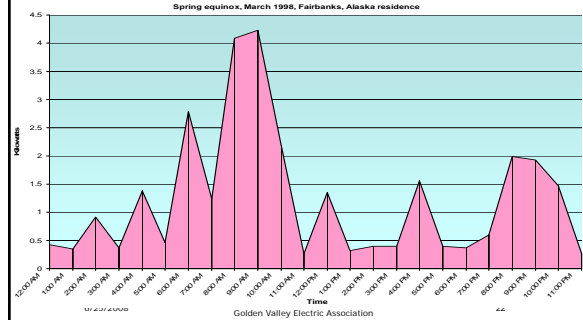
Electric usage monitor (baseload)  
 232 watts / 1000 watts = .232 kW X 24 hours = 5.6 kWh per day (potential)

### Monitoring peak load



- Electric usage monitor
  - Baseload plus large load
- Electric water heater load on (water heater timer on)
- 97.7 kWhs if left on 24 hrs

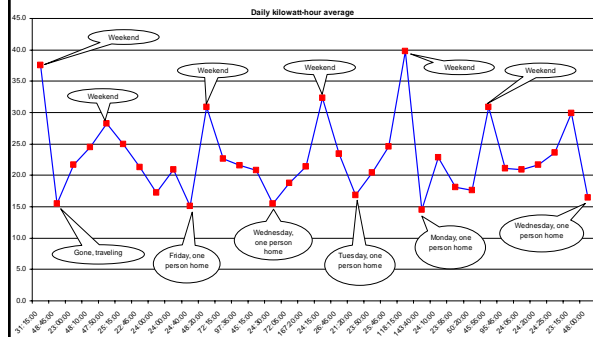
### 24-hr load profile: baseload & peaks



### Monitoring 24-hr reads with log

Date	Day	Time	Days	kWh read	kWh usage	kWh daily avg	Activities
6-Oct-05	Wednesday	4:00 PM	0	16807	0	0.0	Two loads of wash and dry
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	2,6	16897	19	34.6	Turned off all but 2 circuit breakers
9-Oct-05	Sunday	8:30 AM	3,1	16900	3	30.0	Turned breakers back on. Used oven 4 hours, showers
10-Oct-05	Monday	8:30 AM	3,6	16905	5	27.2	
10-Oct-05	Monday	8:30 AM	4,6	16970	65	35.4	No laundry, but stove, micro & grill
11-Oct-05	Tuesday	8:30 AM	5,6	17004	34	35.2	Two loads laundry
12-Oct-05	Wednesday	8:30 AM	6,6	17051	47	37.0	
13-Oct-05	Thursday	8:30 AM	7,6	17076	25	35.4	
13-Oct-05	Thursday	11:30 AM	7,7	17083	7	35.8	Turned all off but stove for soup
13-Oct-05	Thursday	12:30 PM	7,8	17084	1	35.5	
13-Oct-05	Thursday	1:30 PM	7,8	17084	0	35.5	Turned just bedroom, frig, heater on; stove off
13-Oct-05	Thursday	2:30 PM	7,9	17085	1	35.2	Turned on what (she) "thinks" is water pump; left frig & heater on
13-Oct-05	Thursday	3:30 PM	8	17086	1	34.9	Turned on all but hot water & dryer
13-Oct-05	Thursday	8:00 PM	8,1	17090	4	34.9	Turned hot water on 7 pm, hot water off 8 pm
13-Oct-05	Thursday	9:00 PM	8,2				All in bed but Steve with computer on
14-Oct-05	Friday	9:45 AM	8,6	17096	6	34.0	Turned hot water on
14-Oct-05	Friday	9:40 AM	8,2	17105	9	36.3	Hot water off, wash one load, cold water
14-Oct-05	Friday	11:55 AM	8,6	17106	1	34.8	Wash one load, cold
14-Oct-05	Friday	12:55 PM	8,7	17107	1	34.5	Wash dry one load for 20 min.
14-Oct-05	Friday	1:50 PM	8,7	17108	1	34.6	
14-Oct-05	Friday	4:50 PM	9	17109	1	33.6	Cooked on stove
14-Oct-05	Friday	6:00 PM	9,1	17111	2	33.4	Turn on oven
14-Oct-05	Friday	7:20 PM	9,1	17113	2	33.6	Open off
14-Oct-05	Friday	9:30 PM	9,2	17114	1	33.4	Hot water heater off
15-Oct-05	Saturday	5:50 AM	9,5	17122	8	33.2	Hot water heater on
15-Oct-05	Saturday	7:20 AM	9,6	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	7:50 AM	10,6	17146	15	32.2	Hot water heater off
16-Oct-05	Sunday	5:00 PM	11	17166	18	32.6	Not home much: Saturday & Sun
17-Oct-05	Sunday	9:15 PM	11,2	17175	9	32.8	
17-Oct-05	Monday	6:00 AM	12,1	17182	7	31.0	
17-Oct-05	Monday	9:30 AM	12,3	17194	12	31.5	Washed two loads; no dryer; hot water off
6/25/2008				17196	1	31.6	

### Graphing the daily log for trends



READ DATE	KWH	CHARGE DESCRIPTION	AMOUNT
05/02/2008 CURR READ	75261	PREVIOUS BALANCE	905.43
04/02/2008 PREV READ	75231	TOTAL PAYMENTS	-805.62
MULTIPLIER 1		CUSTOMER CHARGE	15.00
KWH USED 3468		ENERGY CHARGE	394.79
		FUEL ADJUSTMENT	204.72
		REGULATORY CHARGE	0.36
		CURRENT CHARGES	607.44

Thank you for your prompt payment.

Free tree giveaway. Saturday, May 17 9 a.m. to noon. Fairbanks parking lot. Canadian Red Choke Cherry tree. Limited quantities. One per family. Division members contact your office.

### Large seasonal load: Why?

AutoPay - Do Not Pay **\$607.46**

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 Regulatory Charge: Set by and funds the Regulatory Commission of Alaska.

READ DATE	KWH	CHARGE DESCRIPTION	AMOUNT
04/26/2008 CURR READ	6200	PREVIOUS BALANCE	98.44
03/24/2008 PREV READ	5422	TOTAL PAYMENTS	-98.46
MULTIPLIER 1		CUSTOMER CHARGE	20.00
KWH USED 778		ENERGY CHARGE	85.25
		FUEL ADJUSTMENT	45.29
		REGULATORY CHARGE	0.21
		82 SNAP CONTRIBUTION	2.00
		CURRENT CHARGES	153.39

Thank you for your prompt payment.

Free tree giveaway. Saturday, May 17 9 a.m. to noon. Fairbanks parking lot. Canadian Red Choke Cherry tree. Limited quantities. One per family. Division members contact your office.

### Irratic off-seasonal load: Why?

AutoPay - Do Not Pay **\$153.39**

**DEFINITIONS**  
 Customer Charge: A flat monthly charge to defray the fixed costs in providing service. Includes poles and transformers, vehicles, labor, office equipment, and office space.  
 Energy Charge: Cost of energy used, measured in KWH.  
 Fuel Adjustment: Directly tied to the price of fuel to generate or purchase power. Calculated quarterly this may be a charge or a credit.  
 Regulatory Charge: Set by and funds the Regulatory Commission of Alaska.

### Meter: a monitoring tool

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

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### Log daily electricity use: 2 month

Days	Date/Time	Time between reads	kilowatt-hour read	Delta kWh	Daily kWh average	Comments
0	1/23/08 11:00	0:00:00	0.00	0.00	0.0	
1	1/22/08 18:15	3:15:00	48.92	48.92	37.6	2x laundry
2	1/24/08 18:00	2:00:00	160.91	111.99	34.4	Done for 2 days
3	1/25/08 18:00	23:00:00	201.00	201.00	20.74	Carey home, Todd work
4	1/27/08 18:10	4:10:00	150.30	49.20	24.5	Carey home, Todd work
5	1/29/08 18:00	4:00:00	201.00	50.70	25.2	Home all day, laundry
6	1/30/08 18:15	2:15:00	232.90	26.30	26.0	Done all day, both
7	1/31/08 18:00	2:45:00	253.10	20.20	21.3	Done all day, both
8	2/1/08 18:00	24:00:00	270.30	17.20	17.2	Carey home, Todd work
9	2/2/08 18:00	24:00:00	291.20	20.90	20.9	Done all day, both
10	2/3/08 18:40	24:40:00	306.70	15.50	15.1	Carey home, Todd work
11	2/5/08 19:00	4:00:00	368.90	62.20	30.9	Weekend
12	2/6/08 18:15	7:15:00	437.20	68.30	29.7	Weekend
13	2/12/08 20:50	9:7:30:00	525.10	87.90	24.6	Weekend
14	2/14/08 18:05	4:15:00	564.20	39.20	20.6	Carey home, Todd work
15	2/15/08 18:35	24:30:00	580.10	15.90	15.5	Carey home, Todd work
16	2/18/08 18:40	7:00:00	636.20	56.10	16.8	Saturday
17	2/19/08 18:00	1:00:00	755.40	119.20	14.8	Carey home, Todd work
18	2/22/08 18:15	24:15:00	818.10	32.70	32.4	Weekend
19	2/27/08 21:00	2:45:00	844.20	26.10	21.4	Monday
20	2/28/08 18:20	21:20:00	859.20	15.00	16.0	Done all day, both
21	3/1/08 18:10	23:00:00	879.50	20.30	20.4	Carey home, Todd work
22	3/2/08 19:55	2:45:00	905.90	26.40	24.6	Carey home, Todd work
23	3/7/08 18:10	1:18:10:00	1122.00	186.10	39.8	Weekend
24	3/13/08 17:50	1:33:00:00	1189.00	67.00	14.5	Monday
25	3/14/08 18:00	24:10:00	1212.00	23.00	22.8	Carey home, Todd work
26	3/15/08 17:45	2:15:00	1230.00	18.00	18.1	Carey home, Todd work
27	3/17/08 20:15	5:00:00:00	1267.00	37.00	17.6	No laundry
28	3/19/08 18:10	4:00:00:00	1326.00	59.00	30.6	Saturday, vacuum
29	3/23/08 17:55	9:55:00:00	1410.00	84.00	21.1	Home all day, both
30	3/24/08 18:00	24:00:00	1431.00	21.00	20.9	Saturday
31	3/25/08 18:20	24:20:00	1433.00	2.00	21.7	Monday, laundry
32	3/26/08 18:45	24:25:00	1477.00	24.00	23.6	Laundry
33	3/27/08 18:00	23:15:00	1506.00	29.00	29.0	Carey home, Todd work
34	3/29/08 18:00	4:00:00:00	1539.00	33.00	16.6	Carey home, Todd work

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

### Whole house 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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### Whole house monitoring tools

**The Energy Detective**

- Whole-house electricity monitor

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 Energy end-use change  
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### Whole house monitoring tools



- **PowerCost Monitor**
- Measures kWh
- Measures time
  - Displays kW
- Forecast costs
- Temperature
- Whole house

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### High-use conditions

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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### Single load monitoring tools

- P3 International **KILL-A-WATT**
- Measures kWh
- Measures time



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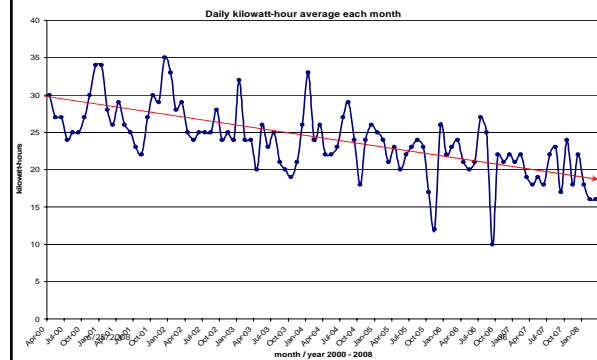
### Kinda cool: KillAWatt PS



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

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### End-use management results



## Ending points

### Analyzing utility bills

- More about usage than money
- Can reveals irregularities, anomalies, & provides clues
- Saving energy or increasing energy?
- Spotting unusual patterns & trends
- Useful with monitoring measuring tools
- Helps identify billing or meter errors
- Tells whether efforts are succeeding