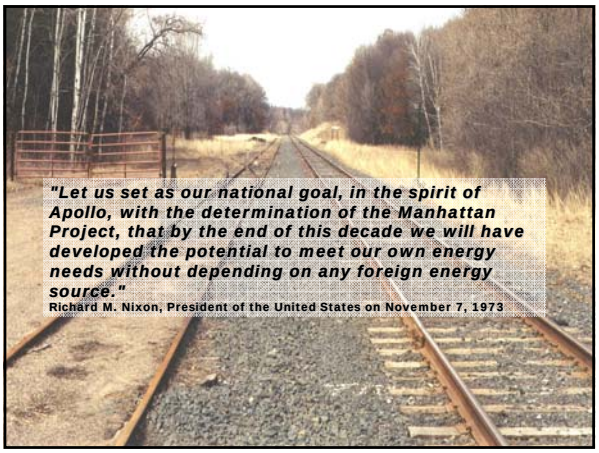


Utility Bill Analysis

Todd Hoener
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

$110 — Yesterday's settle: $100.01, up 4.7%

100

90

80

70

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

Analysis basics

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

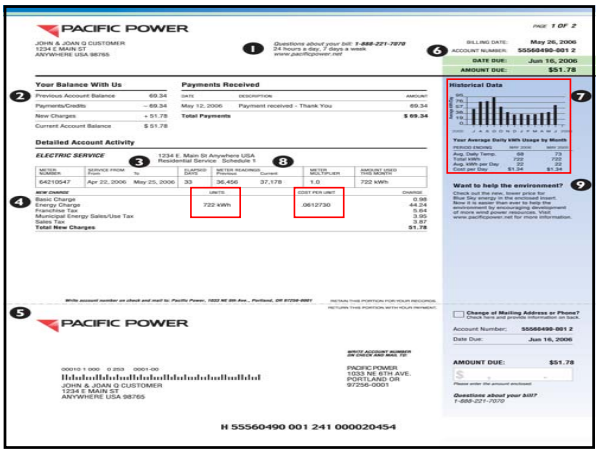
What is analyzed is purchased

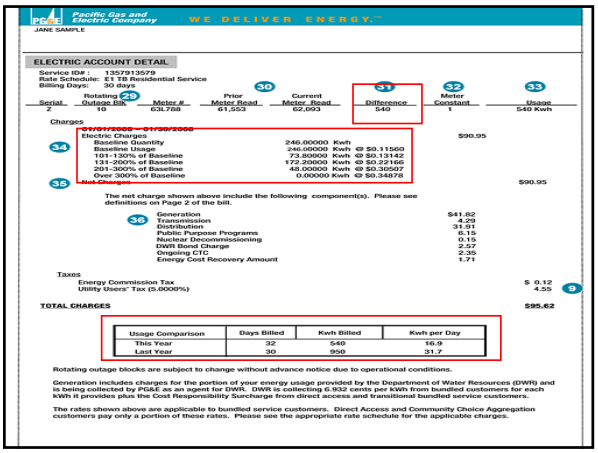
- Kilowatt-hour = unit of energy (consumed)
- Kilowatt-hour (kWh): 1,000 watts – or 1 kilowatt – acting over a period of 1 hour
- Kilowatt-hour (kWh) = amount of electricity (energy) produced or used over time

The hunt for data (kWh)

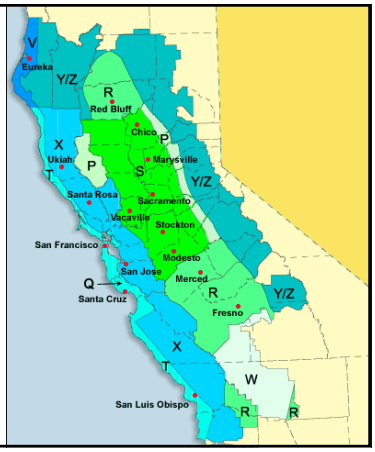
From utility to utility…

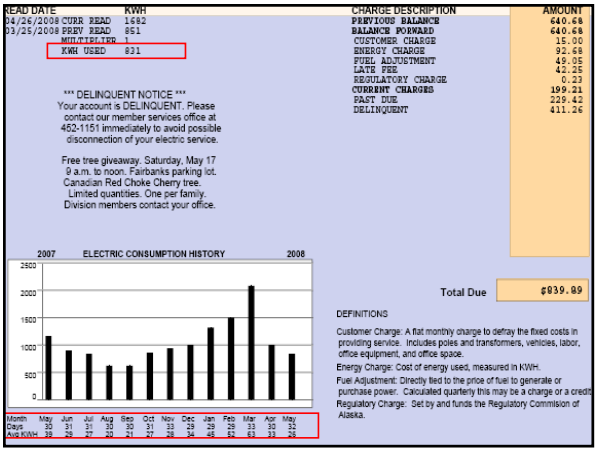
- Statements differ
- Rates differ
- Incentives to save energy differ





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





Spotting trends

- What is “normal”
- What is “baseload”
- Investigating peaks, trends, abnormalities

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)

"29.2 kWh/day" break down

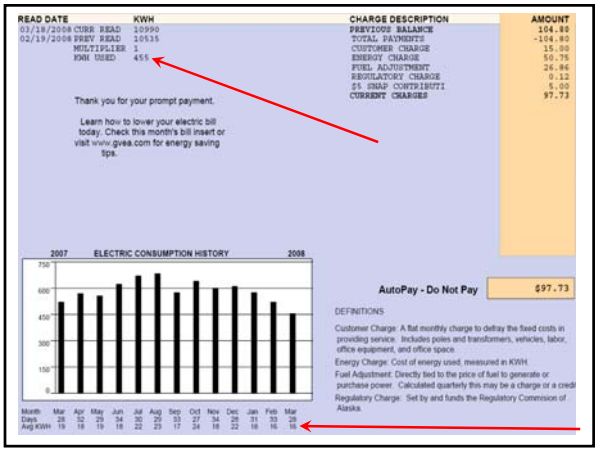
- 16% air-conditioning = 4.7 kWh / day
- 14% refrigerator = 4.1 "
- 10% space heating = 2.9 "
- 09% water heating = 2.6 "
- 09% lighting = 2.6 "
- 06% clothes dryer = 1.8 "
- 04% freezer = 1.2 "
- 03% furnace fan = 0.9 "
- 03% electric range top = 0.9 "
- *(26% "other" = 7.5 ")*

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

National average kWh use per day

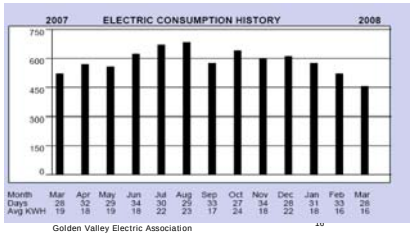
- 16% air-conditioning = 4.7 kWh / day
- 14% refrigerator = 4.1 "
- 10% space heating = 2.9 "
- 09% water heating = 2.6 "
- 09% lighting = 2.6 "

48% **Average = 3.4** "



Electricity usage numbers

READ DATE		KWH
03/18/2008	CURR READ	10990
02/19/2008	PREV READ	10535
	MULTIPLIER	1
	KWH USED	455

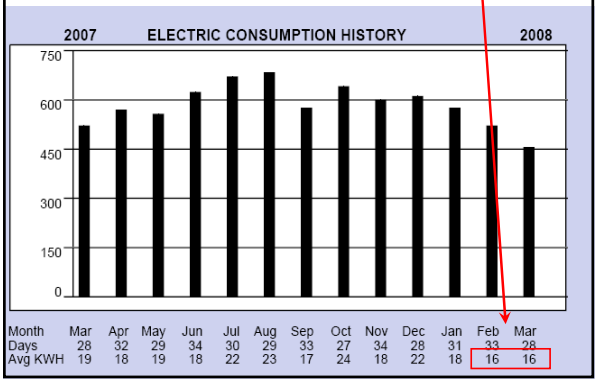


Baseload usage

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

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)

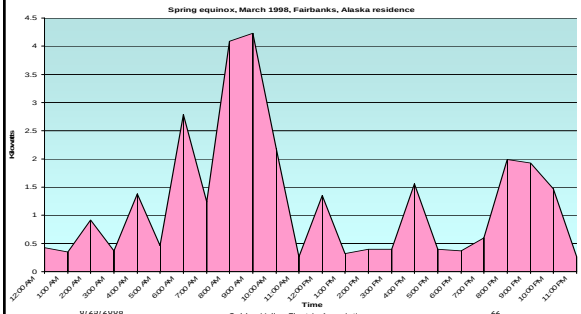
Monitoring peak load

- Electric usage monitor
- Baseload plus large load

Electric water heater load on (water heater timer on)

- 97.7 kWhs if left on 24 hrs

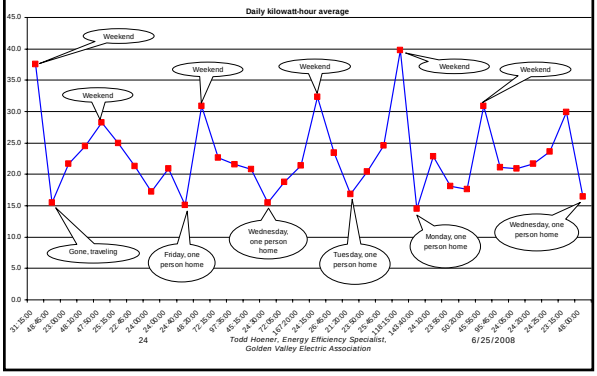
24-hr load profile:baseload & peaks

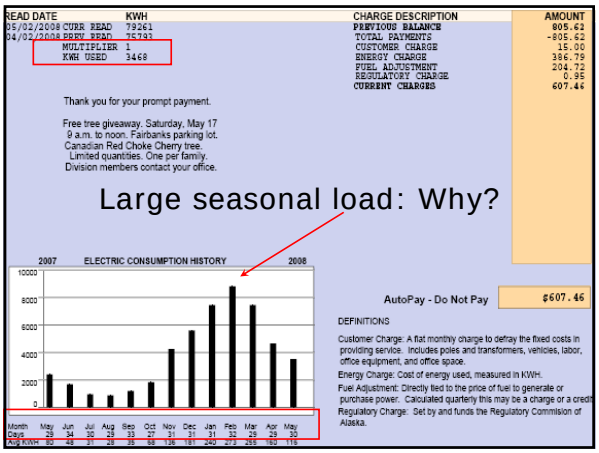


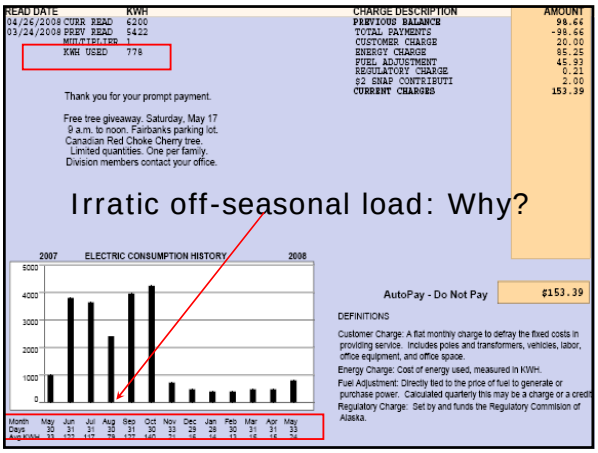
Monitoring 24-hr reads with log

Date	Day	Time	Days	kWh read	kWh usage	kWh daily avrg	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**	2.6	16897	**19**	34.6	Turned off all but 2 circuit breakers
9-Oct-05	**Saturday**	6:00 PM	3.1	16900	3	30.0	
9-Oct-05	**Sunday**	**8:30 AM**	3.6	16905	**5**	27.2	Turned breakers back on. Used oven 4 hours, showers
10-Oct-05	Monday	**8:30 AM**	4.6	16970	**65**	35.4	
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	No laundry, but stove, micro & grill
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	5:30 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	**5:45 AM**	8.5	17096	**6**	34.0	Turned hot water on
14-Oct-05	Friday	9:40 AM	8.2	17105	9	36.3	Hoter 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	Vacuum; 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	Oven 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
	Saturday	7:20 AM	9.6	17128	6	33.4	Hot water heater off
	Saturday	4:45 PM	10	17133	5	32.6	Hot water heater on
16-Oct-05	**Sunday**	**7:00 AM**	10.6	17148	**15**	32.2	Not home much: Saturday & Sun
	Sunday	5:00 PM	11	17166	18	32.6	
	Sunday	9:15 PM	11.2	17175	9	32.9	
17-Oct-05	Monday	**6:00 AM**	12.1	17182	7	31.0	
	Monday	9:30 AM	12.3	17194	12	31.5	Washed two loads; no dryer; hot water off
				17195	1	31.5	

Graphing the daily log for trends







Meter: a monitoring tool

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

Log daily electricity use: 2 month

Days	Date/Time	Time between reads	kilowatt-hour read	Delta kWh	Daily kWh average	Comments
0	1/21/06 11:00	0:00:00	0.00	0.00	0.0	
1	1/22/06 18:15	31:15:00	48.92	48.92	37.6	2X laundry
3	1/24/06 19:00	48:45:00	80.36	31.44	15.5	Gone for 2 days
4	1/25/06 18:00	23:00:00	101.10	20.74	21.6	Carey home, Todd work
6	1/27/06 18:10	48:10:00	150.30	49.20	24.5	Carey home, Todd work
8	1/29/06 18:00	47:50:00	206.60	56.30	28.2	Home all day, laundry
9	1/30/06 19:15	25:15:00	232.90	26.30	25.0	Gone all day, both
10	1/31/06 18:00	22:45:00	253.10	20.20	21.3	Gone all day, both
11	2/1/06 18:00	24:00:00	270.30	17.20	17.2	Carey home, Todd work
12	2/2/06 18:00	24:00:00	291.20	20.90	20.9	Gone all day, both
13	2/3/06 18:40	24:40:00	306.70	15.50	15.1	Carey home, Todd work
15	2/5/06 19:00	48:20:00	368.90	62.20	30.9	Weekend
18	2/8/06 19:15	72:15:00	437.20	68.30	22.7	Week days
22	2/12/06 20:50	97:35:00	525.10	87.90	21.6	Weekend
24	2/14/06 18:05	45:15:00	564.30	39.20	20.8	Carey home, Todd work
25	2/15/06 18:35	24:30:00	580.10	15.80	15.5	Carey home, Todd work
28	2/18/06 18:40	72:05:00	636.50	56.40	18.8	Saturday
35	2/25/06 18:00	167:20:00	785.40	148.90	21.4	Carey home, Todd work
36	2/26/06 18:15	24:15:00	818.10	32.70	32.4	Weekend
37	2/27/06 21:00	26:45:00	844.20	26.10	23.4	Monday
38	2/28/06 18:20	21:20:00	859.20	15.00	16.9	Gone all day, both
39	3/1/06 18:10	23:50:00	879.50	20.30	20.4	Carey home, Todd work
40	3/2/06 19:55	25:45:00	905.90	26.40	24.6	Carey home, Todd work
45	3/7/06 18:10	118:15:00	1102.00	196.10	39.8	Weekend
51	3/13/06 17:50	143:40:00	1189.00	87.00	14.5	Monday
52	3/14/06 18:00	24:10:00	1212.00	23.00	22.8	Carey home, Todd work
53	3/15/06 17:55	23:55:00	1230.00	18.00	18.1	Carey home, Todd work
55	3/17/06 20:15	50:20:00	1267.00	37.00	17.6	No laundry.
57	3/19/06 18:10	45:55:00	1326.00	59.00	30.8	Laundry, vacuum
61	3/23/06 17:55	95:45:00	1410.00	84.00	21.1	Home all day, both
62	3/24/06 18:00	24:05:00	1431.00	21.00	20.9	Saturday
63	3/25/06 18:20	24:20:00	1453.00	22.00	21.7	Before laundry
64	3/26/06 18:45	24:25:00	1477.00	24.00	23.6	Laundry
65	3/27/06 18:00	23:15:00	1506.00	29.00	29.9	Carey home, Todd work
67	3/29/06 18:00	48:00:00	1539.00	33.00	16.5	Carey home, Todd work

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

Whole house monitoring tools

The Energy Detective

- Whole-house electricity monitor

Whole house monitoring tools

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

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

More high-use reasons

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

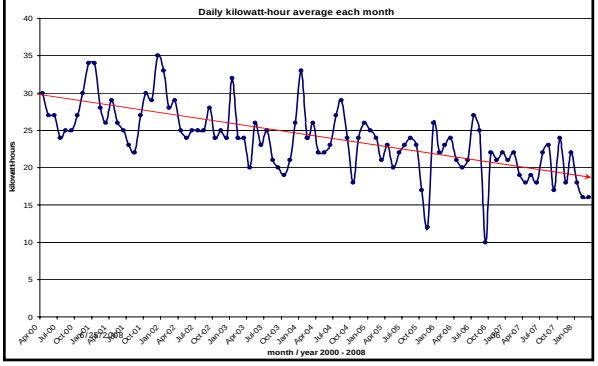
Single load monitoring tools

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

Kinda cool: **KillAWatt PS**

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

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