A Time, Benchmark, and Comparative Analysis of Apartment Efficiency

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Overview

The ensuing study of apartment efficiency has the following three components:

A. Evaluating the efficiency of my apartment over the course of one year.
B. Conducting a cross-section of five apartments during May 2007.
C. Conducting a cross-section of three apartments over three different months.

The first component will utilize my PG&E utility bills to understand my monthly energy consumption patterns for household use of electricity (KwH) and natural gas (Therms). This data basis will serve as an empirical comparison to the results of the Lawrence Berkeley National Laboratory's "Home Energy Saver" (HES) in-depth self-audit.[1]

The second component will utilize the May 2007 PG&E utility bills (covering meter dates 5/4/2007 – 6/4/2007) for the five dwellings in my small apartment complex. These five rental apartments are comprised of the following:

- One 150-200 m^2 (measured vs. manager), 1-story, single occupancy apartment
- Two 260 m^2, 2-story, double occupancy, 1-bedroom apartments
- Two 290 m^2, 1-story, double occupancy, 2-bedroom apartments (duplex)

The third component will utilize the November 2006, January 2007, and May 2007 PG&E utility bills for three of the five apartments listed above (one from each floor plan). While this study is set-up partially due to significant data constraints (access to utility bills), the month selection is also partially intended to give a variety of climate conditions. Please note: A summer month bill is not yet available for this cross-section.

In addition to comparative analysis and the inferring of reasons for the contrasts in energy consumption, the goal of this is two-fold:

- Outline steps for me to take in maximizing my rental apartment efficiency.
- Provide energy efficiency education and comparatives for the other apartments.

This paper will proceed by outlining the methods of data collection, communicating the constraints and limitations encountered in the data collected, explaining the excel spreadsheet used for compiling and analyzing the data from each of the three studies mentioned above, and analyzing each study's results. It will finish by making concrete recommendations for energy efficiency steps that I personally can take in order to realistically minimize my own rental apartment's energy consumption. It is also worth mentioning that I have provided, and will continue to provide, feedback to my neighbors on the lessons learned within and suggestions for their own efficiency actions to consider.

[1] LBL, "Home Energy Saver", http://hes.lbl.gov/

Data Collection Methods

This study includes a number of different sources for collecting empirical data of energy consumption, information about the physical efficiency characteristics of the subject apartments, and occupant behavior. These sources are comprised of the following:

1. Utility Bills

   In addition to my own 11 months worth of PG&E utility bills, I also acquired the most recent PG&E bills (Meter Read Date: 6/4/2007) for the other four apartments, the online history for Apartment 'B' from time of occupancy (mid-October 2006), and sporadic utility bills for Apartment 'D'. The paper bills provided consistent range of dates and days covered by the period, changes in KwH and Therms for each period covered, and energy prices/unit[2] and allotted base quantities[3] for each apartment. The online print-out package provided by one tenant also listed average daily temperature and "number of heating and cooling degree days" for each period covered.[4] All other columns in the spreadsheet were calculated by me with information provided by the bills. I included notes in the spreadsheet cells where appropriate.

2. Equipment & Appliance Research

   A number of the more influential pieces of equipment and appliances I researched for various efficiency-related statistics. These include the following:

   - *Water Heater*: Inspection and online research[5] for age, fuel, energy factor, recovery efficiency, rated input, tank size, temperature setting, & location.
   - *Refrigerator*: Inspection and direct measurements complimented by online research for age, size, & type. Information alluded to relative efficiency.[6]
   - *A/C Unit*: Inspection of both neighboring units' methods (central air) and my unit's (room air conditioner) method and specifics.[7]

3. Property Manager

   The property manager's office is adjacent to my unit (and covers the North-facing wall, while the South-facing wall is covered by a garage and a tall green hedge covers much of the East-facing one…). Hence, I acquired information from her

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[2] Please note: I directly calculated monthly totals where possible. The online print-out for one tenant only provided cost totals for each type of energy, however. The small different would not impact analysis.

[3] Base Quantity: "The maximum usage that can be billed at the lowest price, for a particular rate schedule. The Baseline Quantity varies by season, climate zone and your heat source." PG&E, http://www.pge.com/res/understanding_bill/standard/page1.html

[4] Please note: Via PG&E phone call, "heating/cooling degree days" refers to general levels per zip code, not tenant usage specific.

[5] Gas Appliance Manufacturers Association, online search tool, http://www.gamanet.org

[6] Miller & Pratt, "Estimates on Refrigerator Loads in Public Housing Based on Metered Consumption Data", App. E, pp. 81-86, 10/98

[7] As I have yet to use my A/C unit (I prefer fans), I did not devote much time to comparing unit models. As I began having troubles with the power meter at this point, the inspection did reveal estimated power consumption for the unit – 1330 Watts vs. 35-70 for fans.

regarding square footage (converted to meters), heating/cooling systems, weather stripping within the past 2 years, and access to the water heating equipment.

4. City Records

   City Hall on Russell Blvd provided records for this address that allowed me to learn that my apartment dates to at least 1960 and the neighboring units date until the early 1970s. This information was used within the HES self-audit.

5. "Watt Man" Power Meter

   This power meter measured the power (standby and varied levels of use) of most appliances in my apartment – including, but not limited to, stereos, a laptop, a TV, a microwave, fans, a halogen lamp, a George Foreman Grill, coffee maker, answering machine, DVD player, phone charger, power strip, printer, etc. I used this information both to supplement the HES self-audit and to customize my efficiency recommendations below.

6. LBL Home Energy Saver Self-Audit Tool

   The LBL HES yielded the following benefits:

   - Focused my research and analysis efforts.
   - Validated my empirical results were fairly on target with its benchmark.
   - Provided instruction and efficiency knowledge.
   - Provided a fairly standard analysis for my apartment.
   - Provided fairly standard suggestions for improvement.

   It is important to note that while this tool allows some decent customization, complete customization is not feasible and, thus, additional interpretation is necessary using inputs such behavioral knowledge, power measurements, etc.

7. Subject Occupant Interviews

   I composed a standard questionnaire and used it to drive tenant interviews. This questionnaire was meant to supplement the energy bills and manager-based empirical knowledge about their units with behavioral and appliance specifics.

8. Miscellaneous Websites

   In addition to the LBL website and other sources that have been previously mentioned in the text and footnotes, I also utilized the Energy Star website with regard to lighting technology information, the Department of Energy's "Consumer's Guide for Energy Efficiency and Renewable Energy" regarding heating and cooling systems, and the AJ Madison website to gather measurement specifics for my refrigerator (to input into the LBL HES Self Audit Tool).

Data Collection Constraints

There were numerous constraints with regard to data collection that resulted in less-than-ideal data. First of all, record-keeping was sporadic or non-existent. While I had a complete set of my own utility bills, two households disposed of their bills immediately after payment and one paid everything online. The last apartment had sporadic bills over two years (thus leading to the 3 month cross-section survey).

As well, the online package given to me contained less data than the paper bills. Luckily, it became apparent that the data not included (such as base quantities and base prices) were consistent across the other apartments. Hence, it was easy to infer consistency for online apartment as well. Moreover, the online package included some useful input not included in the paper bills: Average daily temperature and number of degree heating and cooling days per period. Hence, this seeming data constraint ended up being a benefit.

A student's life was another difficulty to be overcome. First of all, data collection was more problematic since schedules were difficult to predict. Regarding the data, some students take vacations during breaks while others lounge at home consuming energy. Some choose to study at home while others prefer libraries. Finally, graduate students begin and end programs at different times and move around quite a bit, thus leading to renting instead of buying…and thus a lack of a lengthy utility history for certain addresses. Of the five tenants surveyed, only 1 had resided at their residence for over a year, thus leading to only one tenant having a 2006 comparison.

Regarding property attributes, estimating insulation proved to be the most difficult. As the buildings were built in the 60s and early 70s and the current owner took possession in the mid-90s, the property manager had no idea about the insulation level. She even doubted that property custodian would know. Hence, I went by what HES defaulted to for the age of my apartment in this location: R-11.

Finally, the LBL HES tool, while pretty comprehensive, did leave out certain energy consumption options and was confusing on others. For example, my George Foreman grill is used once/week for about 30 minutes with a power consumption of about 750 Watts. I had to include it under a separate item because I wasn't sure what the HES option "grill" referred to. How to properly count my shading situation was also problematic due surrounding plant-laden fences and non-standard building community layout. This forced me to use "6ft+ trees within 15 feet" as proxies. In addition, it was difficult to tell if the tool was making distinction between workstations and laptops. For example, there were two options regarding computers: "Computer" and "Laptop Charger". Since workstations consume quite a bit more than laptops, and chargers alone consumer much less, to be safe I had to jury rig by creating my own 20W Laptop under additional options. Finally, there was a strange question within the water heater section asking if an adult was home during the day. While I am, I never use hot water after my morning shower. I left the check-box unchecked, but wondered if I was short-changing my overall energy consumption as a result.

Data Compilation

Microsoft Excel proved to be the easiest way to display the results. One worksheet for each study listed in the Overview above was utilized and the tabs marked as follows:

A. Dan's Empirical "Year": 328 days of empirical data, corrected for "missing" days.
B. May 2007 Cross-Section: Five apartments compared during the same period.
C. 3 Multi-Month: Months between September 2006 and May 2007 for 3 apartments.

A brief description of the contents of each worksheet follows below. Please note, however, that interpretation of the data will occur in the next section.

A. My utility bills allowed for 328 days of empirical data. Not only were 37 calendar days not represented due to lack of duration at this apartment, but 33 of the counted days occurred over two lengthy vacations when I was absent from the apartment. Consequently, I corrected for these faults by finding my average daily KwH and Therm consumption during warmer months, multiplied them by 37 and added that to the total to create 365 calendar days. Regarding the vacation days, I did the same, except that 10 days occurred in cooler month so I corrected for that. Relevant information is called out in the Notes column.

   In the bottom portion of this worksheet, I compared my corrected "year" against the predictions of the LBL HES self-audit tool.

B. This worksheet captures much of the same data of the one above, but across five apartments (three different floor plans) and only for June 4th, 2007 Meter Read time period ("May"). It also captures the average of all five apartments so as to allow for comparisons, includes a column for efficiency-related property attributes, and summarizes the most pertinent results from the written survey under the last column "Interview Notes".

C. Three apartments with differing floor plans across months for which data is available for all. I used only the subset of previous data columns that proved beneficial for this multiple month cross-section survey. As well, only months which had data available for all three apartments are listed. Again, the Notes column calls out some relevant information related to the totals.

   In the lower section, I chose three months – November, January, and May (one from each season, excluding summer unfortunately) – and did a series of calculations and comparisons so as to shed some light on overall consumption patterns as well as call out the highs and lows for each apartment and energy unit.

Results Analysis

STUDY 'A'

The study of consumption habits over the previous year led to three main inferences:

1. I am relatively more electricity-efficient throughout the year.
2. I am relatively more gas-efficient during colder months.
3. Fan preference led to my increasing KwH consumption during darker months.

Regarding #1, I was significantly below the base quantity level on my utility bills, implying that I was not using as much energy as I was "allowed" at the lowest rate.

As well, the HES self-audit tool predicted the physical attributes of my apartment in combination with my behavior to lead to annual consumption of 2,278 KwH and 257 Therms. In reality, my utility bills over 12 months (corrected for absent days) yielded an empirical consumption of 1699.8 KwH and 233.8 Therms – 25.4% and 9% "better" than predicted (or less-consuming), respectively.

Analyzing the tool and my behavior, the following factors cause this discrepancy:

1. Efficient Lighting: While the HES tool captures that number of hours each light fixture is used per day, it does not request to know whether these light fixtures are efficient. In fact, I try to maximize the lighting I get from efficient sources (CFLs) and minimize the use of inefficient ones (incandescent and halogen).

2. Efficient Refrigerator: According to the Miller and Pratt refrigerator load article, my refrigerator (#26 on Table E.1 – Hot Point Model CTH14CYXLRWH) is by far one of the most efficient "Existing Refrigerators" by both DOE Rating Label (496 KwH) and Adjusted Consumption (373 KwH) listed on that 1998 survey. In fact, it is fairly competitive with the "New Refrigerators" listed in the table. Since the HES tool merely asks the year, volume, and whether it was Energy Star, but not brand or model, it likely assigned me an average or median quantity of KwH consumption when I would actually be on the lower end, empirically. Moreover, a search of Hot Point refrigerators on the Energy Star website revealed that the consumption listed on the table is fairly close the refrigerator in my apartment. Hence, the HES site likely added too many KwH to my self-audit for this.

3. Fan Use: The HES self-audit tool requests to know how many portable fans I have, but not how much I use them. In fact, I never use both at the same time (and, through the Watt Meter, learned that one is far more efficient than the other).

4. Overestimated Laptop Use: Perhaps, I over-estimated the number of hours for which I use my laptop (an "other" device listed at 20W power average), in light of class-time and my habit of "sleeping" my laptop when not in use.

Regarding #2, the utility bill results demonstrate that my natural gas consumption was only significantly below the base quantities during the colder months. This is consistent with my practice to set my thermostat fairly low…I even waited until late December to turn the heat on!

In contrast, my natural gas consumption is only a little bit below the base quantities during the more temperate months. Frankly, this is a little surprising considering I take relatively short showers, don't have a dish or clothes washer (and don't use hot water for washing dishes), and never cook with the oven. I do cook with the stove top, but that is only 1-2 times per week (for the whole week). My relatively high levels are even more surprising when it becomes apparent later that my rates of consumption during most months are not greatly different than one of the other apartments that cooks frequently and has two occupants. I'll address this further in the Results Analysis section below.

The most heartening revelation comes in the bottom portion of the spreadsheet where I compare my "year" against what the LBL HES predicts: My empirical use (233.8 Therms) is still a bit below the predicted natural gas consumption for my situation (257 Therms) – a level that is supposedly already as gas-efficient as possible.

Regarding #3, while one can expect most electricity consumption to increase in the summer time due to air conditioning, my peak electricity consumption occurs during the winter months. This is almost certainly due to the fact that since I prefer using a fan in the summer time, the additional lighting that is necessary for darker winter months outweighs the use of a fan in the summer months. This would not be the case if air conditioning were the preferred method of thermal cooling.

STUDY 'B'

Three broad conclusions can be drawn from "May 2007 Cross Section" study:

1. Residents in my complex are fairly energy conscious.
2. The electricity comparison easily synched up with subject attitudes.
3. The gas comparison did not synch up as easily with subject attitudes.

Regarding Conclusion #1, I interviewed five apartments (including myself), representing a total of 9 people. There was at least one inhabitant in each that was very energy conscious and concerned about energy efficiency. I evaluated this qualitatively and based upon their reaction to questions (horror at having the largest Therm consumption), their knowledge about energy efficiency technology (importance of minimizing A/C use and putting computers into sleep mode), and their listing of concrete steps they had taken regarding making their respective apartment more efficient (turning heat off at night, setting the thermostat lower in the winter, purchasing CFLs, etc), I judged them accordingly. Of the 9 people represented (all in their 20s), I would say 7 displayed concerns and/or behavior indicative of someone eager to behave in an energy efficient manner.

Regarding Conclusion #2, below are listed the subject apartments in order of descending KwH consumption. No inhabitants were absent for significant amounts of time during May and none had clothes dryers. Floor plans do differ, but since May was neither a heating nor cooling month (for us), I did not consider this as having a significant impact on energy costs. I will list out the traits – gleaned from the in-person survey – that demonstrated the relative adequacy of their ranking.

1. 104 – 641 'C': Very concerned about energy consumption. Inhabitants rarely at home during the day. When present, actively manage their lighting (space lighting) and never use the A/C (take measures to naturally cool the upper floor). They do not watch television, some laptop, and music through IPod stereo. No microwave oven.
2. 123 – 633: Very concerned about energy consumption. Only one inhabitant, but frequently studies from home. Utilizes energy efficient lighting, when possible. Does not use A/C, but listens to the radio most of the day and a couple hours of television. A little microwave cooking.
3. 200 – 641 'A': Somewhat concerned about energy consumption. Minimal A/C and rarely watches television or uses the computer, but the apartment is well-lit when they are home (though recently purchased CFLs). Music is always on. Some microwave cooking.
4. 221 – 641 'B': One is somewhat concerned about energy consumption, but the other does not seem to be and this one is around more of the day. Some efficient lighting is used and just recently turned on the A/C. Rarely watches T.V. or movies, but occasionally. 2 Desktop computers, one of which is typically on while the other frequently hibernates. Some microwave cooking.
5. 272 – 641 'D': One works from home (software engineer) while the other is around part of the day. The place is typically well-lit (though some efficient lighting) and T.V. is watched 3-4 hours a day and occasional movies. IPod music through computer. Due to working from home, one laptop is almost always on and the other for a few hours a day. A/C is preferred (but not much in May).

As is evident, KwH tends to increase depending on how many inhabitants reside at the apartment, how frequently they are present, and how actively they choose to manage their energy consumption and thermal comfort.

Note: as we get into the cooling months, this disparity will likely become more pronounced for the last two apartments due to thermal cooling methods (A/C). I may collect June's bills to verify…

Regarding Conclusion #3, below are listed the subject apartments in order of descending Therm consumption. As above, no inhabitants were absent for many days in May. Also, it was not a heating period. Hence, floor plan did not play a significant role in my analysis. All apartments have gas stoves and ovens and matching gas water heaters (all are set to a very high temperature, unfortunately). No apartments had dish or clothes washers. Frankly, the consumption pattern did not seem to synch up as well with subject attributes as the KwH consumption.

1. 12 (2) – 641 'A' & 'B': Both Duplex apartments used the least amount of natural gas during May. While this may make sense in light of significant maintenance to their heating system recently (a tuned-up system may likely have less inefficiency loss), the behavioral difference makes less sense – one frequently cooks with the stove and oven while the other two cook less frequently with the stove (oven not at all).
2. 14 – 633: 1 person, shorter showers, minimal cooking (no oven). However, this one is the only tenant with a non-central heating system and a new water heater. The wall furnace emits some heat occasionally even though it is "off".
3. 15 – 641 'D': This couple cooks 4-5 times per week, including with the oven. They also mentioned using hot water for dishes and taking 10 minute showers.
4. 18 – 641 'C': This couple cooks frequently as well (both stove and oven) and does not own a microwave to displace any of it. They do, however, minimize their shower time. At the same time, they did report getting scalding hot water out of their faucets fairly easily (almost certainly due to the high temperature setting on the water heater…which I advised them about).

From this study, it seems that natural gas use is a trickier energy source to manage. While behavior and beliefs seem to lead more naturally to lower electricity bills, this did not occur as readily in my study for natural gas (at least not during non-heating months…). For example, it is interesting to note that two of the most consuming three were very energy conscious subjects.

Side Note: My interpretation of the quantitative disparity is the following:

- A recently re-vamped heating system for apartments 'A' and 'B'. As the next study will demonstrate, the gas consumption was incredibly high during January for apartment 'B'. This combined with learning that the heating system died during January for apartment 'A' makes it easy to infer that an old, inefficient system existed prior to a replacement or significant overhaul. Either way, a much more efficient system may have resulted. Follow-up research is necessary to confirm this theory, however.
- A very old and inefficient wall furnace in 633. Heat has been noticeably observed emitting from the furnace despite being "off". Perhaps a pilot light.
- A lack of a microwave for some components of cooking by 641 'C'. This could be due to misunderstanding how efficient a cooking appliance it is (in comparison to stoves and ovens, which are the methods for apartment 'C').

STUDY 'C'

As mentioned earlier, this study was conducted only for certain apartments in certain months in which data was available. As such one apartment from each respective floor plan was covered for November, January, March, April and May. Frankly, this study was an afterthought to try to put all possible meaningful data to good use. In light of that, I added some additional metrics at the bottom of the worksheet

With the exception of the amount of gas burned by apartment 'D' in November (which I did inquire about but the subject could not explain), the results from this study made fairly good sense in light of subject behavior, appliance history, and tenant presence (vacations). Specifically, lessons learned included the following:

1. Electricity use followed a logical pattern for presence and habits.
2. 633's average gas consumption made no sense in light of behavior. The cause, however, may be due to a less efficient heating system (pilot light, old system).
3. January consuming the most gas was logical due to the month's temperature.
4. To be fair, November resulting in the highest KwH was hard to decipher.
5. The lowest Therms occurring in May makes sense, except for the '9' listed.
6. The lowest KwH occurring in May for 633 and 'B' makes sense since the lack of A/C compliments the additional sunlight. Meanwhile, since 'D' began using their A/C in May, this added electricity cost likely outweighed the savings from the additional daylight occurring one month after April.

Again, this study did not provide as much useful analysis knowledge as did Study's 'A' and 'B'; it would have been much more meaningful if I had a full year for each subject. That being said, the additional metrics of average and high/low consumption were interesting.

In summary, all the studies taken together and compared against the LBL HES self-audit were meant to paint a good picture of how efficient I have been, what areas I should target to improve, and what I can expect to obtain from those improvements (see next section for more details on this output). As well, it allows a method to pass on some knowledge to others around me – I know for a fact that Apartment 'C' will be aggressively looking to manage their gas consumption (perhaps by buying a microwave?) and they have learned that an efficient fan may be a good way to achieve thermal comfort with a sun-drenched bedroom and a dislike of air conditioning. Finally, the studies served as a good excuse to get to know the neighbors!

Recommendations & Target Savings

In light of the combination of recommendations provided by the HES self-audit and my own knowledge about the specifics of my apartment and general energy efficiency traits, I have listed out options I can take, in order of preference, first for electricity and then for natural gas. For each option, I have stated whether I will take the action and why.

Electricity:

1. Replace Incandescent Porch Light with CFL and Minimize Use

   Base (9pm – 7am): 10 hrs/day x 75 Watts = 750 wH x 30 d/m = 22.5 KwH/month
   Off (12am – 7am): -7 hrs/day x 75 Watts = -525 wH x 30 d/m = -15.8 KwH/month
   CFL Savings (9-12): -.75(3hrs * 75 Watts) = -170 wH x 30 d/m = -5.1 KwH/month
   New Porch Service: 22.5 – 15.8 – 5.1 = 1.6 KwH/month
   New Porch Service Savings: 20.9 KwH/month x $0.1143/KwH = $2.39/month

   Since I have a CFL in a light fixture that I do not use much, there would be no out of pocket expense and very little opportunity cost to switch the light bulbs. Even purchasing a new CFL (at $3.50) would yield a payback in less than two months. No service infringement would occur. **Hence, I will conduct this change**.

2. Dispose of Halogen Lamp and Replace with Efficient Option (existing lamp w/ CFL)

   Base (7am – 9am): 2hrs/day x 225 wH = 450 wH/d * 30d/m = 13.5 KwH/month
   New Lighting Service: 2hrs/day x 20 wH = 40 wH/d * 30d/m = 1.2 KwH/month
   New Lighting Service Savings: 12.3 KwH/month x $0.1143/KwH = $1.41/month

   I would need to purchase a CFL for an existing fixture, but it would pay back in under 3 months. No service infringement would occur. **Hence, I will conduct this change.**

3. Use Boom Box instead of Stereo component system for Radio

   Base: (2 hrs/day stereo NPR at 30 watts) + (5 hrs/day stereo music at 23 watts)
   Base: 60 wH + 115 wH = 175 wH/day x 30 days/month = 5.3 KwH/month
   New Radio Service: [(2hrs/day*15wH)+(5hrs/day*15wH)]x30d/m = 3.2 KwH/month
   New Radio Service Savings: 2.1 KwH/month x $0.1143/KwH = $0.24/month

   While the savings are minimal, the cost investment is nothing since I own the boom box and it not typically used for other services. **Hence, I will conduct this change.**

4. Replace Phone/Fax/Answering Machine with Standard Phone for Necessary Landline

   Base (Standby): (24 hrs/day) x 5 Watts = 120 wH/day = 3.6 KwH/m = $0.34/month
   Although this would yield some energy savings, even simply unplugging the phone when not in use would have insurmountable service costs (messages, incoming calls).

5. Unplug All Standby Devices when not in Use

   Per Watt Meter measurements, these devices' standby power ranged from a cell phone charger (0.2 Watts) to a computer power strip (5 Watts). When weighing service convenience, it makes sense to unplug some when not in use and others only on vacations.

   I attempted unplugging the 1.5 Watt Standby Microwave, but having to re-set a new Time every time I plugged it in to be allowed to cook food was annoying. At only 1.5 Watts, I figured it was worth the convenience. The same is true for the 5 Watt Power strip (due to occasional problems re-establishing the DSL connection), the Cell Phone charger (due only 0.2 Watts and awkward location of plug), and the Energy Star DVD Player (due to only 0.4 Watts Standby and the need to re-set stations). Hence, these items I only unplug when leaving town for a few days or longer.

   On the other hand, it made good sense to unplug the CD player (3 Watts Standby) and the T.V. (1.6 Watts Standby, but very convenient to unplug). As well, I am now much more careful about turning off the printer when not in use (1.75 Watts Standby) and hibernating my laptop whenever possible (0.55 Watts Hibernate vs. 0.9 Watts Sleep vs. 12 Watts on but inactive).

   One last lesson to squeeze in: I learned that my table fan uses about half the power that my standing fan uses. Hence, I now simply move my table fan to my bedroom at night rather using the standing fan.

Natural Gas:

Due to the lack of a proper measuring device, I will qualitatively rank my actions here.

1. Lower Water Heater Temperature Setting.

   It is currently set at the higher medium level. I will set it to a lower medium level to reduce the standby loss that comes with keeping water hotter than I need it.

2. Do a Gas Audit through PG&E

   It is troubling that I am using 14 Therms per month when I only cook 1-2 times per week and take relatively quick showers. Since the water heater is new, my instinct tells me that it is the old wall furnace system. PG&E can verify.

3. Replace Shower Head with Low Flow Option – Exhaust 1 & 2 first.

4. Shave with Cold Water & Shower in under 5 minutes – Costs outweighs benefits.

5. A final question: Should I boil cold water or warm-up water via faucet first?